The Progress Journals
Volume I Issue 2
ISSN : 2584-0517

ABOUT THE PROGRESS JOURNALS

'The Progress Journals' is a flagship initiative of The Progress, which belongs to one of the verticals of Sri Aurobindo Yoga & Knowledge Foundation with a mission of Sustainable & Holistic Development. Begun in 2023, the vision behind this publication is to create an international, cross-disciplinary, peer-reviewed and open-access journal that deals with issues of social, cultural, economic and ecological importance. This bilingual journal (with papers in English and Hindi) seeks to provide a platform for people engaged in innovative studies on subjects related to sustainability and sustainable development.

The journal also aims to highlight the significance of the Sustainable Development Goals (SDGs), also known as the Global Goals, which were set up by the United Nations in 2015. These goals were designed to be a "blueprint to achieve a better and more sustainable future for all." They comprise a universal call to action to promote individual and social well-being on a global scale. The 17 SDGs are (1) No Poverty, (2) Zero Hunger, (3) Good Health and Well-being, (4) Quality Education, (5) Gender Equality, (6) Clean Water and Sanitation, (7) Affordable and Clean Energy, (8) Decent Work and Economic Growth, (9) Industry, Innovation and Infrastructure, (10) Reducing Inequality, (11) Sustainable Cities and Communities, (12) Responsible Consumption and Production, (13) Climate Action, (14) Life Below Water, (15) Life On Land, (16) Peace, Justice, and Strong Institutions, (17) Partnerships for the Goals.

This journal, which shall be published quarterly, will allow researchers from various backgrounds to share their opinions and findings on topics related to these goals. Through this exchange of knowledge, we hope to better understand how to implement these principles for the development of our communities, our nation and the world.

Website: www.theprogressjournals.com

Research Centre: Sri Aurobindo Yoga & Knowledge Foundation, Village Funda, Patan (Durg) – 491 111, Chhattisgarh, India

THE PROGRESS JOURNALS

Volume I, Issue 2

ISSN: 2584-0517

An Initiative of The Progress

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EDITOR'S NOTE

THE PROGRESS, established in 2020, is one of four recent initiatives of Sri Aurobindo Yoga and Knowledge Foundation. The core objective of our organization is the transformation of consciousness in higher education. The inspiration for this goal is the philosophy of Sri Aurobindo and the Mother, especially the principles of Integral Yoga. We believe that true progress requires consciousness of one's role in one's family, community, nation and the world. We seek to create this distinctive awareness, especially among students, professors, researchers and other key stakeholders in the field of education. At present, we are associated with more than 28 higher education institutions, including IIT Delhi.

In Integral Yoga, it is written that there are five layers of the mind: Physical, Vital, Mental, Psychic, and Spiritual. In higher education institutes today, the teaching-learning process is such that it functions till the Vital layer. There is no formal curriculum for anything beyond that. That kind of learning only comes through community, social and spiritual initiatives. Most higher education institutions have already started different types of developmental projects, social work, etc. Our objective is to create an organization that can connect all these other institutions and then collectively, we can be a force for universal transformation. To the broad vision of progress, we each bring our own unique perspective. Together, we can refine our approach and make a difference globally, while being rooted in our regional heritage.

In 2023, we launched a new initiative, 'The Progress Journals' with a mission to highlight scholarly work on Sustainable Development in general and the significance of the Sustainable Development Goals (SDGs) proposed by the UN, specifically. This is our first issue and we are very grateful to all our contributors and supporters. We aim to release this bilingual journal on a quarterly basis and provide a space for new voices and fresh perspectives.

- *Dr. Samarendra Mohan Ghosh*

Editor-in-Chief

Vol. I, Issue 2, 2023
ISSN: 2584-0517

Assessment of Speed and Flexibility Among the Badminton Players of Hill and Valley Districts of Manipur

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Abstract:

This study aimed to find out the differences in speed and flexibility among the badminton players of the Hill and Valley districts of Manipur. The sample of the study was a total of 40 state-level male badminton players (20) from Hill districts and (20) from Valley districts of Manipur. The subjects' age was ranged from 18-23 years. A 30-meter run test and sit and reach test were used to determine the speed and flexibility respectively, Descriptive analysis and independent 't' test statistical techniques were employed to find the difference between the two groups' means, independently. The level of significance was chosen at 0.05 level of confidence, result reveals that the mean values (M) and standard deviation (SD) of the speed of 20 badminton players each from the hill and valley districts of Manipur were 5.37±0.18 and 5.29± 0.04 respectively. The mean values (M) and standard deviation (SD) of the flexibility of 20 badminton players each from hill and valley districts of Manipur were 43.00±4.29 and 41.25±4.55 respectively. In addition, the calculated "t" value of speed is 1.920, which is smaller than the tabulated 't' values = 2.042 at a 0.05 level of significance. The calculated "t" value of flexibility is 1.251, which is smaller than the tabulated 't' values = 2.042 at a 0.05 level of significance. Therefore, there were no significant differences found in Speed and flexibility among the Badminton players of Hill and Valley Districts of Manipur.

Keywords:

Badminton, Speed, Flexibility, Hill, Valley

Introduction:

In this present era of persisting change, games, and sports have become a vital part of one`s life. Man has made his mark on the moon and is still aiming for higher targets to achieve in space. Likewise, in the field of sports science, Experts are striving to achieve maximum performance through critical thinking ability, scientific training modules, and even through drugs and dopes. In this era, games and sports are not just kept indulged or limited to self-satisfaction but it has got a variety of benefits. Games and sports play a crucial role in highlighting a nation's prestige on international fronts. Competitions display how one can show one's worth by competing successfully- All countries compete to manifest and exhibit their supremacy over each other for a defeat or success in international sports competitions. Every country tries to evolve its innovation in techniques, tactics, and strategies to exhibit a distinguished performance to achieve the highest level and emerge as winners and champions of sports (Frost., R, 1971) [1]. This is the reason why so many scientific advancements and means are utilized by experts and

sportspersons for better success. Downey (1982)[2] stated that physical fitness is a vital part of sports performance and the achievements of a sportsperson. It also states that the quality of its utilization value is directly proportional to the level of sports performance. Meaning the greater the level of fitness, the greater the ability of a person to attain higher levels of performance.

In these days and age, physical education has evolved tremendously and has given a new mode. It is now identified as an integral part of education and can no longer be separated from it. Motor Fitness is an essential or basic need. It is also related to the ability to meet the demands of the environment especially to preserve, to stand with stress, to assist the fatigue, and to process the energy for an abundant life. Motor fitness implies more than the ability to do work without much effort, physical fitness. All these activities not only enhance physical well-being but also have a great impact on our mental state and personal social adjustment as well. Pinto (1982) [3] states that the top-class world national players today need to be equipped with speed, power, endurance, and top physical and mental fitness to put up with the constant stress and strain of competition. The World Federation defines any person playing badminton as a badminton player. Whetnall and Morris (1981) [4] also state that "badminton is a game of skill, speed, power and control. A game of badminton demands quick reaction, fast movement, accuracy and power in the stroke, and sudden changes in direction, which demand a higher level of motor fitness.

Speed is defined as the quickness of movement. Speed plays a vital part in every sport and can be expressed as any one of, or a combination of maximum speed, elastic strength (power), and speed endurance. It is the key factor that sets apart good players from great players. Speed is essential for playing efficient and effective badminton. Players are required to move quickly around the court and react quickly to their opponent's shots. In addition, speed is an important key factor for playing defensively because, in badminton, the player with the better defensive skills often wins the rally.

A person's flexibility refers to the ability of our joints to move through a full range of motion. Having flexibility in one's muscles allows for movement around the joints and is vital in getting the right movements for badminton strokes. The speed at which badminton players move and change direction (agility) implies that they require a high level of flexibility to deal with these movements as it puts a lot of pressure on the muscles and joints. Being more flexible can enhance a player's ability to achieve overall movement coordination and game precision and help a player cope with higher training intensity and muscle fatigue.

This fitness training for badminton players should emphasize speed, agility, endurance, strength, and flexibility. Running speed and agility are also important to the badminton player due to the requirement for speed variation, height, and angle of approach to the shuttle. The ability to cover short distances quickly will also be one of the advantages to badminton players Wilkinson, M. (2009) **[5]**.

Manipur is divided into Hill and Valley where the Hill is occupied by the tribals and the valley is occupied mostly by the Meiteis. Little is known about the differentials in participation and achievement in sports between the hills and the valley of Manipur state of India. Therefore, examining the status of the selected fitness components will help in knowing and bridging one of the many gaps

that may have made a difference in the field of sports.

1.1 Objectives

1. To find out the differences in speed among the selected badminton players of hill and valley districts of Manipur.
2. To yeah find out the differences in flexibility among the selected badminton players of hill and valley districts of Manipur

1.2 Hypothesis

1. There will be a significant difference in Speed among the badminton players of Hill and Valley districts of Manipur.
2. There will be a significant difference in flexibility among the badminton players of Hill and Valley districts of Manipur.

2. Methodology:

In this chapter, the procedure for the sources of data, selection of the subjects, criterion measures, the procedure for administration of tests, and statistical procedures employed for the study are described.

2.1 Material and Methods

The data on this study was collected from 40 Male Badminton players 20 each from both hill and valley districts of Manipur who have participated in the state-level competition.

2.2 Selection of Subjects

For this study, 20 (twenty) male badminton players from the Hill districts of Manipur and 20 (twenty) male badminton players from the Valley districts of Manipur were selected as subjects. The subjects' age was ranged from 18-23 years. The entire subject is medically fit to participate in the research work.

2.3 Criterion measures

1. To determine the speed, a 30-meter run test was used and the performance was recorded in seconds by stopwatch.

2. To determine Flexibility, the sit and reach test was monitored and was recorded in centimeters.

2.4 Collection of data

The data was collected on different sheets of tests. The score of the trial was recorded and the best score was considered as raw score. The necessary marking was completed before the start of the test. The data was collected from 40 male subjects (20 badminton players from Hill districts and 20 badminton players from Valley districts) who participated in the state-level competition.

3. Analysis and interpretation of data:

The statistical analysis for comparison of the 30-m run test and sit and reach test among the badminton players of Hill and Valley districts of Manipur are presented in this chapter. For the Comparison of selected variables i.e. speed and flexibility among the badminton players of Hill and Valley districts of Manipur, the comparative t-test has been adopted**.**

3.1 Statistical Analysis of Data

For the analysis of the data on the collected 40 male Badminton players, descriptive analysis, and independent ‘t’ test statistical techniques were employed to find the difference between the two groups means, independently.

3.2 Level of Significance

To test the hypothesis, the level of significance was chosen at 0.05 level of

confidence, which was considered most adequate and reliable for this study.

3.3 Findings

After the statistical analysis, the following findings were drawn.

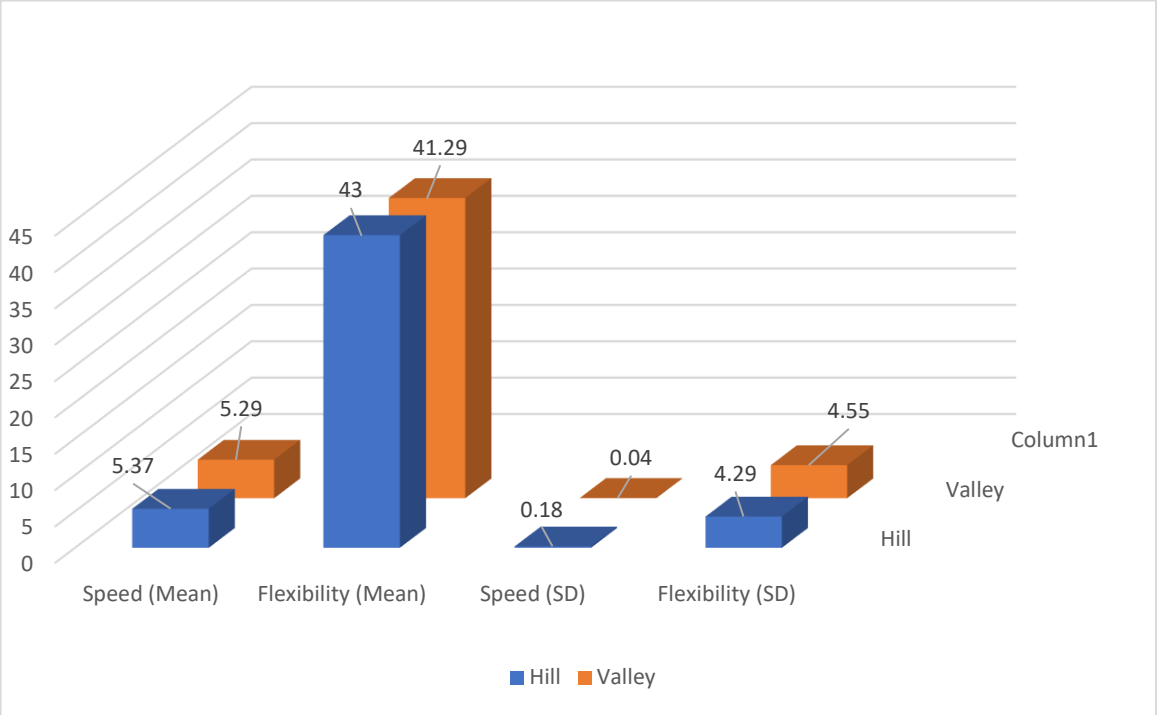

Figure 1: Graphical presentation means values of Both Groups

Table-1: Mean Comparison

Variable	Group	N	Mean	SD	df	t	sig
Speed	Hill	20	5.37	0.18	38	1.920	0.062
	Valley	20	5.29	0.04			
Flexibility	Hill	20	43.00	4.29	38	1.251	0.219
	Valley	20	41.25	4.55			

Table 1 reveals that the mean values (M) and standard deviation (SD) of the speed of 20 badminton players of hill and valley districts of Manipur were 5.37±0.18 and 5.29± 0.04 respectively. The mean values (M) and standard deviation (SD) of

badminton players of hill and valley districts of Manipur were 43.00±4.29 and 41.25±4.55 respectively. In addition, The calculated "t" value of speed is 1.920, which is smaller than the tabulated 't' values = 2.042 at a 0.05 level of significance. The calculated "t" value of flexibility is 1.251, which is smaller than the tabulated 't' values = 2.042 at a 0.05 level of significance. Therefore, these can be pronounced as no significant differences in terms of speed and flexibility. The graphical representation is given below

Discussion and Conclusion:

The popularity of badminton is ever-increasing, and to achieve higher performance, every player is striving to

attain the best specific training related to the game Sports scientists and performance consultants are growing in demand and employment numbers, with the constantly increasing focus within the sporting world on achieving the best results possible. Through the advancement of science and its application in sports, researchers have developed a vast understanding of how the human body reacts to exercise, training, different environments, and many other stimuli.

Based on the findings of the study, It is concluded that no significant differences were found among the badminton players of Hill and Valley districts of Manipur. The study shows that both groups show equal potential in speed and flexibility. However, it is quite distinct when it comes to participation and medal tally in tournaments and state representation in national or international tournaments, the ratio of participation from the hill districts is incomparable to the ratio of participation of the valley districts -Lack of infrastructure, lack of knowledge about the specific game and its scopes, little or no talent identification programs or initiations, no access to modern technologies and advancements, lack of exposure to various training facilities, economic background, social, environmental, and cultural lifestyle could be a possible and valid reason.

Due to the advancement and various improvements in the field of sports science, the training modules, and techniques of the game, sports facilities are constantly upgrading and changing, and therefore, players from both groups need to have equal access to the same facilities and quality of training to get a desired and impartial outcome.

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Vol. I, Issue 2, 2023
ISSN: 2584-0517

Bioceuticals in *Singju*, The Traditional Salad Food of the Meiteis: An Overview

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Abstract:

In today's world, there is a drastic change in lifestyle which spurred a global nutrition transition and immediate actions are needed to create food systems that nourish people and sustain the planet. Singju, the traditional salad food of the Meiteis can be one such solution which has potential benefits for the long-term nutrition, health benefits and a sustainable livelihood. Altogether, 25 (twenty five) underutilised plants used in the traditional salad singju have been recorded that provide benefit for health and well being that can play an important role in contributing to the livelihoods of rural and peri-urban dwellers alike. This food can bring an entire new dimension to the present food industry because singju contain bioceuticals that provide beneficial health and wellness effects.

Keywords:

Singju, livelihood, bioceutical, traditional, nutrition.

Introduction:

Traditional and indigenous food systems have existed for centuries and were in balance with local food supplies, globally. However, between the mid 20th and early 21st century the green revolution dramatically altered food production, which in turn affected the inclusivity of traditional production systems within food systems and subsequently traditional dietary intakes (Rebecca, 2023). Today the world faces a drastic change in lifestyle which spurred a global nutrition transition. This change was accompanied by a global *synergistic* of obesity, undernutrition and climate change. A clarion call to action to create food systems that nourish people and sustain the planet is needed. Modern food systems have evolved to a point where the cost of a healthy diet is five times greater than the cost of a diet that meets dietary energy requirements from the least costly food products, cereals (FAO *et al*, 2022). A decrease in use of traditional food systems has concerns for loss of traditional knowledge and culture. The reasons for decreased use of traditional food systems are many, but are rooted to two main reasons: (i) Climate change which makes the environment unfavourable for plants to thrive and (ii) Increase reliance on food markets for food resources by the urban and rural people.

The State of Manipur, an integral part of the Indo-Burma biodiversity hotspot, picturesquely set in the north-eastern region of India, has a history which had seen a long course of two thousand years as evident from the chronicles and manuscripts (Ch.M. Singh, 1996). It has a rich repository of plant biodiversity. The wild plants supplement a large amount of local food in Manipur. Adopting proper agro practices to conserve traditional underutilized plants would help to increase the per capita of the rural people. (S.G. Devi *et al*, 2022)

Traditional Salad Food, *Singju*

'*Singju*' the traditional salad food of the Meiteis, often eaten as a side dish is regarded as an appetizer and provide benefit for health and well being. It is an age-old tradition of the Meiteis which have been passed down from generation to generation that have hidden scientific knowledge and is still relished today with great delight. Although, the dietary diversity related to traditional and indigenous species and foods seem to be undervalued by modern food systems, some in the culinary world embrace traditional and indigenous food cultures. (Gina Kennedy *et al*, 2021). A diet containing high levels of fruits and vegetables has been associated with a lower risk of chronic diseases because in addition to their high vitamin and mineral content, these foods also contain compounds with health-protective effects. These same metabolites provide beneficial health and wellness effects in human. Traditional neutraceuticals are natural whole foods with new information about their potential health qualities. The nutritional, economic and socio-cultural potential of the neglected and underutilised plants used in the traditional salad (*singju*) of the Meiteis have yet to be fully exploited and are suffering from a lack of research interest. Some studies on ethnomedicinal plants have been conducted in Manipur; however, there is limited information on traditional plants despite its diverse uses (Singh & Arora, 1978; B. Thongam *et al*, 2016; OA Devi *et al*, 2023). This paper proposes the long-evolved traditional salad (*singju*) of the Meiteis that amount to a treasure of knowledge that is typically overlooked and undervalued which has potential benefits for the long term nutrition, health benefits and sustainable livelihood for the rural people.

Methodology:

This paper is based on secondary data available for the traditional and underutilised plants related to the traditional salad of the Meiteis, i.e. *Singju*. Data & Information from scientific papers, Google Scholar, PubMed, Science Direct, SciFinder were also employed to search for the articles relevant to each plant involved in the preparation of the traditional salad of the Meiteis, i.e. *Singju*.

Mode of Preparation of *Singju*

The fresh plant ingredients are finely chopped and mixed with chillies (*Capsicum frutescens*), steamed/roasted *ngari* (fermented fish), common salt, powder of fried peas and black sesame (*Perilla frustescens*) seeds. Fermented fish (*ngari*) is used for non-vegetarian dish. (S.G. Devi *et al*, 2022)

Result and Discussion:

In the present work, we have compiled 25 (twenty five) different types of plants incorporated in the preparation of the traditional salad, *singju*. The data (Table) presents the scientific names, common names, edible parts with additional information on their bioceutical properties.

Table: Traditional plants of *Singju* with their various properties

S/N	Name of plant/common name	Edible part	Bioceutical Properties
1.	*Alocasia cucullata* (Lour.) G.Don (Chinese Taro)	Rhizome	Anti-inflammatory, Cytotoxic, Antimicrobial, Antioxidant, Antidiabetic, Anticancer, Antifungal, Antiparacytic, Antitumor
2.	*Alocasia indica* (Roxb.) Schott. (Indo-Malay Taro)	Young petiole and corm	Antidiarrheal, Antimicrobiol, Antioxidant, Antiinflammatory, Antibacterial, Antidiabetic, Anticancer, Immunoprotective, Antihypertensive
3.	*Brassica oleracea* L. (Cabbage)	Whole plant	Antioxidant, Antimicrobial, Antiinflammatory, Anti-obese, Antidiabetic, Anticancer
4.	*Cardamine hirsuta* L. (Bittercress)	Whole plant	Anti-inflammatory, Antioxidant, Antimicrobial, Antibacterial, Antidiabetic, Anticancer, Antimutagenic, Neuroprotective
5.	*Carica papaya* L. (Papaya)	Unripe fruit	Antioxidant, Antibacterial, Antiviral, Anti-inflammatory, Antiallergic, Anticancer, Antimicrobial, Antioxidant, Anticoagulent
6.	*Cycas pectinata* Buch-Ham (Sago Palm)	Young shoot	Antioxidant, anti-inflammatory, Thrombolytic, Anxiolytic, Analgesic, Antidiarrheal, Antimicrobial
7.	*Euryale ferox* Satisb (Prickly water lily)	Seeds and stem	Anticancer, Antidiabetes, Antitumor, Antibacterial, Antioxidant, Antiviral, Antiinflammatory, Antifatigue, Antidepressant

8.	*Leucaena leucocephala* (Lam.) de Wit. (Wild Tamarind)	Fruit	Antioxidant, Anticancer, Antibacterial, Antidiabetic, Anti-inflammatory, Hepatoprotective, Hypolipidemic
9.	*Ludwigia adscendens* (L.) H. Hara (Water primrose)	Young shoots	Antidiabetic, Hepatoprotective, Cytotoxic, Antioxidant, Antibacterial, Antimicrobial, Anticancer, Anti-inflammatory
10.	*Meriandra bengalensis* (J. Koenig ex Roxb.) Benth. (Bengal Sage)	Inflorescence & leaves	Cytotoxic, Antibacterial, Antioxidative, Antirheumatic, Antidiabetic, Antimalaria
11.	*Meyna spinosa* Roxb. Ex Link. (Voavanga)	Leaves	Antiallergy, Anticancer, Hepatoprotective, Antimicrobial, Antioxidant, Antidiabetic, Cytotoxic, Abortifacient, Nephroprotective
12.	*Musa* spp. (Banana plant)	Flower, Fleshy stalks	Antioxidant, Anti-diabetic, Anti-diarrheal, Antitumor, Antimutagenic, Antiulcerogenic
13.	*Nelumbo nucifera* Gaertn. (Sacred lotus)	Young leaves, stem	Antioxidant, Antibacterial, Antiviral, Antifungal, Antidiabetic, Antiaging, Antifertility, Antidiarrheal, Anticancer, Antipyretic, Antiamnestic, Antiinflammatory
14.	*Neptunia oleracea* Lour. (Water mimosa)	Young shoot	Antitumor, Antioxidant, Antibacterial, Antidiarrhoea, Antiepilepsy, Antisyphilis, Antiallergic
15.	*Nymphaea alba* Linn (White water lily)	Petioles & flowers	Antioxidant, antiinflammatory,Cytotoxic, Anxiolytic, Antimicrobial, Antiseptic, Anticarcinogenic, Antidepressant
16.	*Nynphaea nouchali* Burm.f. (Blue water lily)	Stem	Antimicrobial, Antioxidant, Cytotoxic, Anticancer, Antiparasitic, Anticonvulsant
17.	*Oenanthe javanica* (Bhume) DC (Water celery)	Leaf, stem	Antioxidant, Antiviral, Anticancer, Anticoagulant, Antifatigue, Anti-inflammatory, Hepatoprotective, Neuroprotective

18.	*Parkia javanica* Merr (Tree bean)	Flowers & fruit	Anticancer, Cytotoxic, Anti-oxidative, Anticancer, Antihypertensive, Antiinflammatory, Antimicrobial
19.	*Pisum sativum* L. (Green pea)	Leaves, Pods (Seeds)	Antioxidant, Antimicrobial, Anticancer, Antidiabetic, Antiosteoporosis, Antiinflammatory, Anti-fatigue, Antihypertensive
20.	*Psophocarpus tetragonolobus* (L.) DC. (Star bean)	Immature pods	Antioxidant, Cytotoxic, Antiinflammatory, Antinociceptive, Antifungal, Antibacterial, Antiproliferative
21.	*Sesbania sesban* (L) Merr (Egyptian Pea)	Young leaves	Antioxidant, Antiviral, Antimicrobial, Anthelmintic, Antifertilit, Antiinflammatory, Antidiabetic, Anticancer, Antianxiety
22.	*Trapa natans* L. (Water chestnut)	Petioles	Hepatoprotective, Antiinflammatory, Antimicrobial, Antidiabetic, Antifungal, Anthelmintic
23.	*Viola pilosa* Blume (Smooth-Leaf White Violet)	Whole plant	Antibacterial, Antiviral, Antioxidant, Anticancer, Anti-inflammatory, Antitumor, Antipyretic, Antiasthmatic
24.	*Wendlandia glabrata* OC (Climbing Hampweed)	Inflorescence	Antidiabetic, Antiobesity, Anticancer, Antihyperglycemic
25.	*Xanthoxylum acanthopodium* DC (Indian Prickly ash)	Inflorescence	Antibacterial, Antimicrobial, Antioxidant, Antiinflammatory, Cytotoxic, Cardioprotective, Hepatoprotective, Nephroprotective

Reference(s): Dayar Arbain *et al*, 2022; AK N Husna *et al*, 2023; Than Ninh Le *et al*, 2020; Sisay Awoke, 2021; AT Prasetya *et al*, 2018; Md Nouman *et al*, 2021; AM Tareq *et al*, 2020; Jiahui Jiang *et al*, 2023; Zayed & Samling, 2016; MM Baky *et al*, 2022; Daina *et al*, 2022; Sen & Chakraborty, 2017; Payal Kumari, 2023; Anupam Bishayee *et al*, 2022; Romesh & Singh, 2017; Agnihotri S *et al*, 2020; RO Baker *et al*, 2016; AL Abelti *et al*, 2023; Chuan-li Lu and Xiu-fen Li, 2019; Khangembam *et al*, 2018; Ding-Tao Wu *et al*, 2023; Xiumei Han *et al*, 2023;

Hussein B. *et al*, 2020; S.M. Abgelgawad *et al*, 2023; RC Corovic *et al*, 2021; Rishabh Kaundal *et al*, 2022; Yunus Sheikh *et al*, 2019; Adrian *et al*, 2023; Wijaya *et al*, 2019

Conclusion:

The food system of the Meitei community has long been associated with a rich biodiversity of varied wild and traditional plants as traditional food and in some special circumstances these foods are also used for nutritional and medicinal purposes. The traditional food like *singju* offers considerable potential for stimulating development in the food industry in light of their low cost, scalability, minimal energy and insfrastructural requirements. An entire new dimension can be brought to the present food indusry and create future by providing nutritional rich and medicinally enhanced food and products that are cost-effective, cultural and environmentally friendly. *Singju* of the Meiteis are rich with potential for policymakers, researchers and others who are associated with livelihood programmes, public health and nutritional intervention programmes, strategies for agricultural and food based start-ups, industries and innovative enterprises based on traditional food products.

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Vol. I, Issue 2, 2023
ISSN: 2584-0517

Effect of Yogic Practice on Mental Toughness and Anxiety of Physical Education Students

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Abstract

Context: The physical and psychological advantages of yoga are well-known. Yogic practice is gaining popularity these days due to the fact that it trains and disciplines the mind. Yogic philosophy claims the ability to transport an individual into a state of perfect psychological and physical peace. This present study was focused on evaluating the effect of Yogic Practice on Mental Toughness and Anxiety.

Aim: The study was conducted to investigate the Effect of Yogic Practice on Mental Toughness and Anxiety of Physical Education Students.

Methods and Material: Forty (40) male students from Manipur University's Department of Physical Education and Sports Science were randomly selected as study participants in order to fulfill the purpose of the research. They were further divided into two groups, the Experiment Group (EG) and Control Group (CG), each with 20 participants. The subjects ranged in age from 18 to 23 years old.The eight-week Yogic practice consists of five days a week, with one hour of sessions in the morning (6:00am to 7:00 am). The yoga practice was performed by the experiment group, while no particular yoga practice was performed by the control group. The pre- and post -tests were conducted before and after the eight weeks yogic practice by using mental toughness questionnaire (MTQ) by Alan Goldberg and sports competition anxiety test (SCAT) by Rainer Martens.

Results: The data was examined statistically using a paired sample t-test, and the level of significance was fixed at 0.05. The results of the present study revealed that the eight weeks of yogic practice had a significant influence on the mental toughness and sports competition anxiety of the experiment group (EG) compared to the control group (CG).

Conclusion: The study concluded that the yogic practice, when practiced regularly for eight weeks, improves mental toughness and reduces sports competition anxiety in male physical education students.

Keywords:

Anxiety, mental toughness, physical education, yogic practice, yoga

Introduction:

The word "Yoga" derives its origin from the Sanskrit root "Yuj" meaning to yoke or bind" (Ramaswami,1989). Generally, this Sanskrit name is interpreted as the bringing together of "the powers of body, mind and soul" (Ramaswami,1989. Yogic philosophy claims the ability to transport an individual into a state of perfect psychological and physical peace (Shestopal,1998).

An athlete's capacity for success or failure is determined by their physical capabilities, conditioning, training regimen, mental toughness, and resilience under duress(Pinto,2015).Sports that involve competition require players to constantly "think" in order to focus. Mental preparation is crucial. It is said that mental preparation can make the difference between winning and losing in games (Akhtar,2021). Since athletes must overcome numerous obstacles on and off the field, developing mental toughness is crucial to their success. Gucciardi et al. (2015) stated Mental Toughness is a personal capacity to produce consistently high levels of subjective or objective performance despite everyday challenges, stressors, and adversity. Goldberg (1998) stated mental toughness is the ability to cope with or handle pressure. Regular practice of Yoga promotes mental peace and clarity, increases bodily awareness, releases chronic stress patterns, calms the mind, and enhances focus and concentration. Yoga has a tremendous positive effect on mental health (Singh,2018).Psychological factors are the most evident factors that greatly influence the efficiency of an athlete. Anxiety is one factor that influences an athlete's performance during a game (Kusuma et al. 2017). Anxiety reported when athletes are not confident in dealing with the situation may be causing stress (Hardy, Jones& Gould 1996). Anxiety that usually occurs in athletes is competitive anxiety. Competitive Anxiety is a specific negative emotional response to competitive stressors (Fletcher et al., 2009). Yoga effectively manages and resolves anxiety by regulating the stress response system in an individual (Gopinathan,2016).

Yoga offers many advantages, such as reducing the risk of injury and improving performance, as well as improving mental focus, anxiety alleviation, recovery speed, body awareness, balance, core strength, and body awareness (LaMeaux,2011). As there are many benefits of yoga, it is essential for physical education students to practice yoga.

Purpose of the study:

The study was conducted to investigate the Effect of Yogic Practice on Mental Toughness and Anxiety of Physical Education Students.

Materials and Methods:

Forty (40) male students from Manipur University's Department of Physical Education and Sports Science were randomly selected as study participants in order to fulfill the purpose of the research. They were further divided into two groups, the Experiment Group(EG) and Control Group(CG), each with 20 participants. The subjects ranged in age from 18 to 23 years old.

Psychological tool used

Every test was administered via a standardized process. The psychological variables were evaluated using a standardized psychological questionnaire.Alan Goldberg's (1998) Mental toughness Questionnaire (MTQ) was implemented to evaluate mental toughness.. To evaluate anxiety, use the Rainer Martens-prepared Sports Competition Anxiety test (SCAT).

Yogic Practice Protocol

The eight-week Yogic practice consists of five days (Mon-Fri) per week, with one hour of sessions in the morning (6:00 am to

7:00 am). The yoga practice was performed by the experiment group, while no particular yoga practice was performed by the control group. Throughout the experiment, the subjects engage in regular physical activity.

The following yogic practice were chosen as treatment:

a. Surya Namaskar
b. Asanas: Padmasana, Vajrasana, Sarvangasana, Halasana, Bhujangasana, Dhanurasana, Chakrasana, Vrksasana, Padahastana, Savasana
c. Pranayama: Anuloma-Viloma, Kapalabhati, Sitali, Sitakari
d. Meditation- Observing the breath (Swami Satyananda Saraswati,1993)

Statistical Analysis

The statistical method employed to determine whether there was a significant difference between the CG and EG in the pre-and post-test means for mental toughness and anxiety was a Paired sample t-test. The level of significance was fixed at 0.05 level.SPSS was utilized for all statistical computations

Result:

Variable	Group	Mean	SD	Std. Error Mean
Mental Toughness	**CG-Pre MT**	**20.65**	**2.83**	**0.63**
	CG-Post MT	**20.20**	**2.72**	**0.60**
	EG-Pre MT	**20.90**	**2.73**	**0.61**
	EG-Post MT	**22.35**	**2.66**	**0.59**
Anxiety	**CG-Pre SCAT**	**20.70**	**3.36**	**0.75**
	CG-Post SCAT	**21.10**	3.09	**0.69**
	EG-Pre SCAT	**19.85**	4.09	**0.91**

	EG-Post SCAT	**18.70**	3.59	**0.80**

Table 1: Results of the paired sample t-test for Mental Toughness and Anxiety in SPSS

From Table 1, the results of the paired sample t-test reveal the Mental toughness mean score, control group (CG) Pre-test (M=20.65, SD=2.83), (CG) Post-test (M=20.20, SD=2.72) and Experiment Group (EG) Pre-test (M=20.90, SD= 2.73), (EG) Post-test (M=22.35, SD=2.66) at 0.05 level of significance. In addition, the findings of the paired sample t-test display the mean score of Anxiety, control group (CG) Pre-test (M=20.70, SD=3.36), (CG) Post test (M=21.10, SD=3.09) and Experiment Group (EG) Pre- test (M=19.85, SD=4.09), (EG) Post-test (M=18.70, SD=3.59) at 0.05 level of significance.

Variables	**Group**	**Paired Differences**					**df**	**sig**
		Mean	**SD**	**Std. Error Mean**	**95% Confidence Interval of the Difference**			
					Lower	**Upper**		
Mental Toughness	CGPre MT CGPost MT	**0.45**	**1.19**	**0.26**	**-0.10**	**1.00**	**1.690**	**0.107**
	EGPre MT EGPost MT	**1.45**	**1.23**	**0.27**	**2.02**	**0.87**	**5.253**	**0.000**
Anxiety	CGPre SCAT CGPost SCAT	**0.40**	**1.46**	**0.32**	**1.08**	**0.28**	**1.221**	**0.237**
	EGPre SCAT EGPostSCAT	**1.15**	**1.34**	**0.30**	**0.51**	**1.78**	**3.814**	**0.001**

Table-2 Paired Samples Test

**Significant at 0.05 level of confidence, Tabulated t* $_{0.05(19)}$ *= 2.093*

From Table 2, it was revealed that the computed t value of CG in Mental Toughness, $t_{(19)}$ =1.690, which is less than the tabulated t-value, $t_{(19)}$= 2.093, and p-value=0.107, greater than 0.05. As a result, there was no difference found between the Pre- and Post-test of the control group (CG) in Mental toughness. Additionally,it was revealed that the computed t value of EG in Mental Toughness, $t_{(19)}$ = 5.253, which is higher than the tabulated t-value, $t_{(19)}$ = 2.093, and p-value = 0.00, which is less than 0.05. Hence, there was a significant difference found between the Pre- and Post-test of the experiment group (EG) in Mental toughness. Further, it was presented that the computed/calculated t-value of CG in anxiety, $t_{(19)}$=1.221 less than tabulated t-value, $t_{(19)}$=2.093 and p-value=0.237, which is greater than 0.05. So, there was no difference found between the Pre- and Post-test of the control group (CG) in Anxiety. Again, it was found that the calculated t-value of EG in Anxiety, $t_{(19)}$ =3.814, which is greater than the tabulated t-value, $t_{(19)}$ = 2.093, and p-value= 0.001, which is less than 0.05. Thus, there was a significant difference found between the Pre- and Post-test of the experiment group (EG) in Anxiety.

Discussion:

The reason for the conduct of this study was to look into the effect of yoga practice on the mental toughness and anxiety levels of male physical education students aged 18 to 23. The experimental group attended yogic practice five days a week for eight weeks. Eight weeks of yoga practice significantly improves mental toughness, as per the study's findings.Furthermore, the study's findings showed that male physical education students' anxiety levels had significantly decreased after eight weeks of yoga practice. However, there is an insignificant difference between the control group in mental toughness and anxiety.

Numerous research studies supported the results of the current investigation. Smith et al. (2007) concluded that practicing yoga once a week helps enhance mood, lower stress levels, and reduce anxiety. Premkumar et al. (2013) stated that a package of yoga practice could be an excellent short course to sustain and cultivate pleasant State of Anxiety. Another study reported that inter-collegiate athletes' levels of stress and Sports competition anxiety were significantly lower after six weeks of yoga training (Gopinathan,2016).

Conclusion:

The current study's findings led to the following conclusions: -

1. Due to yoga practice, a significant difference was seen between the experiment group's pre-test and post-test scores regarding the mental toughness and Sports competition anxiety of male physical education students.
2. Pre-test and Post-test results for the control group's mental toughness and Sports competition anxiety levels among male physical education students showed insignificant differences.
3. It was determined that 8 weeks of yoga practice, the experiment group had improved in comparison to the control group.

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Vol. I, Issue 2, 2023
ISSN: 2584-0517

Effect of Zumba Fitness Training on Pulmonary Function of Sedentary Women

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Abstract:

Background: Exercise and Physical Activity are very important for healthy living. Exercise has its benefits its overall health, fitness and quality of life. This study was conducted to evaluate the effects of Zumba fitness training on pulmonary function of women.

Aim: The purpose of this study is to examine the effect of 12 weeks Zumba fitness training on pulmonary function of sedentary women.

Methods: A total of 62 healthy women were selected randomly. The selected subjects were categorized, according to age, into 2 groups: Group-1: 20-30 years group (n=30) and Group-2: above 40 years groups (n=32). For Group-1, Experimental Group EG1(n=15) and Control Group CG1 (N=15) were subdivided. As for Group-2, Experimental Group EG2 (n=17) and Control Group CG2 (n=15) were further subdivided. Pulmonary test was conducted from all the groups, before and after 12 weeks Zumba Fitness Training, on Force Vital Capacity (FVC), Force Expiratory Volume in one second (FEV1), Peak Expiratory Flow Rate (PEFR) and FEV1/FVC by using Clarity Spiro-tech Digital Spirometer. Shapiro-Wilk normality test was conducted, and independent t-test was used to compare the initial data and pair t-test was used to compare pre and post test data all groups.

Results: The study revealed that pulmonary functions improved by participating in regular Zumba Fitness Training. There was significant improvement found in FVC, FEV1, PEFR & FEV1/FVC ($p<0.05$) in EG1 and EG2. Significant improvement in pulmonary function was achieved in both Zumba Training Groups ($p>0.05$) as compared to Control Groups.

Conclusion: It was concluded that regular participation in Zumba Fitness Training improves pulmonary function on sedentary women.

Keywords:

Zumba, Sedentary, Pulmonary Function, Experimental Group.

Introduction:

Physical inactivity has become a serious concern for numerous health issues in recent years and can accelerate the inflammatory cascade in patients' lungs [9]. Exercise and Physical Activity are very important for healthy living. Exercise has its benefits its overall health, fitness and quality of life. Exercise on a regular basis reduces the risk of acquiring hypokinetic disorders, including diabetes, heart disease, stroke, COPD, and other conditions [2]. According to Physical Activity Guidelines for Americans, for substantial health benefits, adults should do at least 150

minutes (2 hours and 30 minutes) to 300 minutes (5 hours) a week of moderate-intensity, or 75 minutes (1 hour and 15 minutes) to 150 minutes (2 hours and 30 minutes) a week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity aerobic activity. Preferably, aerobic activity should be spread throughout the week [19]. In recent years, pulmonary disorders have increased. With 3.23 million fatalities from chronic obstructive pulmonary disease (COPD) in 2019, it is the third leading cause of death worldwide [24]. Aging process itself has its tremendous effect on the decline of pulmonary function [6]. Many previous studies explained the importance of exercise on pulmonary rehabilitation [21, 23]. Of all the causes of pulmonary function decline, aging and sedentary lifestyle are important ones – human lungs mature by about 20-25 years but after about 35 years, its normal function decline [6]. To prevent from these complications, there are many ways and exercising is an important one and Zumba fitness training has become a very popular form of physical training which combines music with exercise [8]. Its characteristics of dancing in music even encourage women to participate in this fitness program [12]. The purpose of this study is to examine the effect of 12 weeks Zumba fitness training on pulmonary function of sedentary women.

Methods:

A total of 62 healthy women were selected randomly. The selected subjects were categorized, according to age, into 2 groups: **Group-1:** 20-30 years group (n=30) and **Group-2:** above 40 years groups (n=32). For Group-1, Experimental Group **EG1**(n=15) and Control Group **CG1** (N=15) were subdivided. As for Group-2, Experimental Group **EG2** (n=17) and Control Group **CG2** (n=15) were further subdivided. Pulmonary test was conducted from all the groups, before 12 weeks Zumba Fitness Training, on Force Vital Capacity (FVC), Force Expiratory Volume in one second (FEV1), Peak Expiratory Flow Rate (PEFR) and FEV1/FVC by using Clarity Spiro-tech Digital Spirometer. The Zumba fitness training was conducted for 1 hour for both experimental groups: EG1 & EG2. A certified Zumba fitness trainer conducted the training at Khagempali Club House, Imphal West (5-6am) for EG2 and VIVA GYM, Imphal west (6.30-7.30 am) for EG1. The warm up lasted 8-10 minutes and performed free hand movements. The main training lasted for around 40 minutes: 2×10 minutes (1minute break) and 4×5 minutes (30sec break) Zumba music training. The post test data was collected from all the groups on pulmonary function. Shapiro-Wilk normality test was conducted, and independent t-test was used to compare the initial data and pair t-test was used to compare pre and post test data all groups.

Findings:

The result showed that there was normal distribution found in experimental and control groups of all groups.

Table 1: Pre and post mean comparison of Group 1

Variables	Group	N	Mean		SD		t	sig
			Pre	Post	Pre	Post		

FVC	CG1	15	2.30	2.34	0.34	0.33	-1.842	0.87
FEV1			2.06	2.08	0.31	0.33	-0.965	0.351
PEFR			2.41	2.46	0.33	0.26	-1.214	0.245
FEV1/FVC			89.53	88.43	4.83	5.94	1.249	0.232
FVC	EG1	15	2.44	4.47	0.43	0.58	-21.221	0.00
FEV1			2.19	4.19	0.37	0.50	-19.511	0.00
PEFR			2.64	5.23	0.38	0.86	-14.554	0.00
FEV1/FVC			90.11	93.90	6.44	3.37	-3.615	0.003

From table1, we can clearly see that there was significant difference found in experimental group EG1 in FVC, FEV1, PPEFR and FEV1/FVC as their p<0.05. Whereas there was insignificant difference found in control group CG1 as their respected p value: 0.87, 0.351, 0.245 and 0.232 were larger than 0.05.

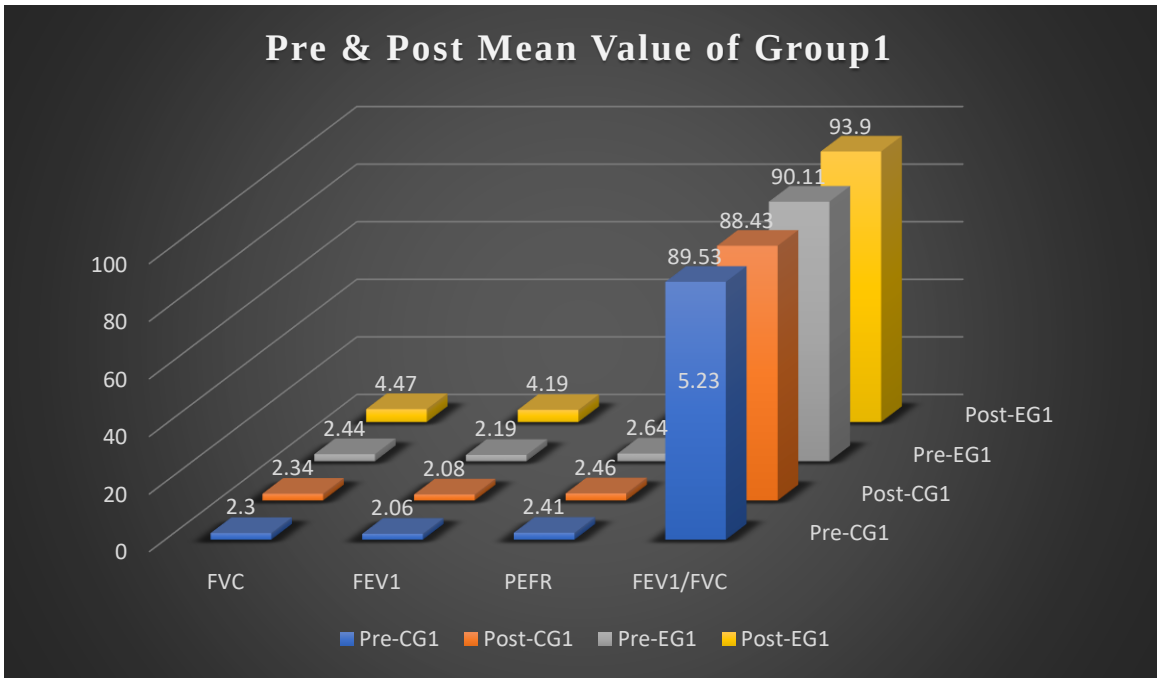

Figure 1: Graphical Presentation of pulmonary function of Group 1

Table 2: Pre and post mean comparison of Group 2

Variables	**Group**	**N**	**Mean**		**SD**		**T**	**sig**
			Pre	**Post**	**Pre**	**Post**		

FVC	CG2	15	1.84	1.90	0.35	0.27	-1.648	0.122
FEV1			1.66	1.70	0.37	0.30	-0.882	0.393
PEFR			1.92	1.98	0.50	0.45	-1.143	0.272
FEV1/FVC			89.94	89.09	8.38	8.59	0.915	0.375
FVC	EG2	17	1.59	2.53	0.49	0.77	-9.487	0.00
FEV1			1.47	2.44	0.51	0.77	-9.977	0.00
PEFR			2.15	4.28	0.75	1.38	-10.318	0.00
FEV1/FVC			86.53	90.98	23.75	23.62	-2.809	0.01

Table2 show the mean comparison after pair t-test analysis of experimental group EG2 and control group CG2 of Group2. The p value of FVC, FEV1, PEFR and FEV1/FVC were larger than 0.05. Therefore, there was insignificant difference found in pulmonary function of control group. Whereas, there was significant improvement found in FVC, FEV1, PEFR and FEV1/FVC of experimental group EG2.

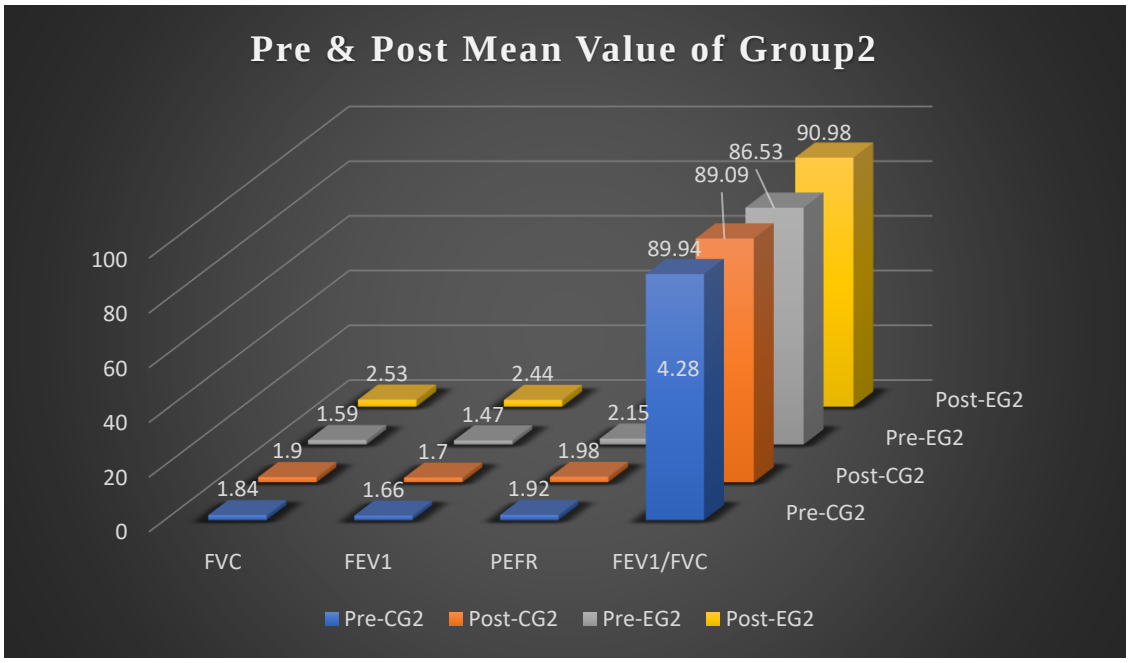

Figure 2: Graphical Presentation of pulmonary function of Group 2

Pulmonary function is weaker in sedentary women and sedentary lifestyle is also the main cause of decrease pulmonary function [22]. To prevent from these complications, there are many ways and exercising is an important one. The importance of neural control on respiratory muscles and functions cannot be neglected. The nerves send message to the respiratory muscle during exercise to increase. And regular

exercise enhances the neural control of the body which results in better respiratory function [14, 18]. Ljubojevic, A., et. al. (2022) stated that engagement in Zumba Fitness workout is a helpful to maintain body composition and improve respiratory function in inactive women. Further, in the study it was explained that exercise stretched the respiratory muscles which results in increment of chest wall capacity and lung ventilation [16]. Several studies explained the association of physical activity in maintaining health and lungs health [25, 3]. Khalili, M. A., & Elkins, M. R. (2009) highlighted the importance of aerobic exercise for improving FVC & FEV1 of drawn syndrome children [15].

In the study, there was significant improvement observed only in experimental group. Further, the EG1 showed higher rate of improvement in pulmonary parameters than EG2 group. The findings of the study about pulmonary parameters were found to be supported by other similar studies. The general literatures support the findings of the study.

Conclusion:

It was concluded that regular participation in Zumba Fitness Training improves pulmonary function on sedentary women**.**

Keywords:

Zumba, Sedentary, Pulmonary Function, Experimental Group.

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Vol. I, Issue 2, 2023
ISSN: 2584-0517

Investigating the Impact of Incorporating Sustainability Consideration into the Product Design Process

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Abstract:

This research examines how sustainability concerns in product design might transform a society where environmental issues and changing customer desires coexist. Sustainable product design is emerging as a critical tactic as firms look for novel ways to lessen their environmental impact, improve resource efficiency, and satisfy the needs of an environmentally conscious consumer [1]. "Inquiries that inform design practices would have to start by acknowledging the simple fact that design is concerned with how we may want to live in future worlds. At any one moment in time, these futures reside in sufficiently compelling narratives to coordinate the stakeholders in these futures and encourage them to do their best to make them real." (Krippendroff Klaus, in Design Research, an Oxymoron, 2007). Our study explores the complex effects of sustainable design, including how it affects brand reputation, financial savings, legal compliance, environmental preservation, and business sustainability. It examines how sustainable design promotes conscientiousness, sets things apart from the competition, and reduces long-term hazards [2]. The study examines the possible advantages of improving the supply chain, including employees and coordinating sustainable product design with an organization's sustainability plan. This research clarifies the concrete and intangible effects of integrating sustainability into the product design process by critically examining the three orders of design encompassing the final design through case studies, questionnaires, and analysis of industry standards. Examining these effects advances our understanding of how sustainability may lead to good changes at the macro and micro levels, eventually promoting a more competitive and environmentally conscious industrial landscape.

Keywords:

Sustainability, Pluriversal futures, brand credibility, macro thinking, Orders of Design

Introduction:

Sustainability has become a pressing issue in modern society due to the increasing concern about the environmental impact of industrial activities. Designers play a critical role in shaping the built environment, and incorporating sustainability considerations into the design process can effectively address environmental issues [3]. This research article aims to investigate the impact of incorporating sustainability considerations into the design process. The literature review highlights the definition of sustainable design, its benefits, and its associated challenges. Sustainable design involves creating products, systems, and environments that meet the needs of the present generation without compromising

the ability of future generations to meet their own needs. Incorporating sustainability considerations into the design process can result in products that have a reduced environmental impact, are more energy-efficient, and are socially responsible [4]. However, challenges are associated with incorporating sustainability considerations into the design process, such as a lack of clear guidelines or standards for sustainable design and the potential for trade-offs between sustainability considerations and other design requirements. This research article employs a mixedmethods approach to investigate the impact of incorporating sustainability considerations into the design process. First, we examine existing surveys to gather data on the current sustainability considerations level in various industries' design process. Second, case studies will be conducted to explore the impact of incorporating sustainability considerations into the design process on specific products or systems. The surveys examined were mostly conducted among designers and design firms in various industries to gather data on the current level of sustainability considerations in the design process [5]. The surveys included questions about the level of awareness of sustainable design principles, the extent to which sustainability considerations are incorporated into the design process,

and the challenges associated with incorporating sustainability considerations into the design process. The case studies will be conducted on specific products or systems that have incorporated sustainability considerations into the design process. The case studies will explore the impact of incorporating sustainability considerations on the product or system's environmental, social, and economic aspects. The case studies will also explore the challenges associated with incorporating sustainability considerations into the design process and the strategies used to overcome these challenges. The findings of this research article will contribute to a better understanding of the impact of incorporating sustainability considerations into the design process [6]. The survey results will provide insights into the current level of sustainability considerations in the design process in various industries, while the case studies will provide specific examples of the impact of incorporating sustainability considerations on products or systems. This research article's findings can inform the development of guidelines or standards for sustainable design and help designers overcome the challenges associated with incorporating sustainability considerations into the design process.

Research Questions:

- What is the current level of awareness of sustainable design principles among designers and design firms?
- To what extent are sustainability considerations incorporated into the design process in various industries?
- What are the challenges associated with incorporating sustainability considerations into the design process?
- How do designers overcome these challenges?
- What is the impact of incorporating sustainability considerations into the design process on the environmental,

social, and economic aspects of specific products or systems?

- What strategies can be used to improve the incorporation of sustainability considerations into the design process?

Research Objectives:

✈ To Conduct case studies to explore the impact of incorporating sustainability considerations into the design process on specific products or systems.

✈ To Analyze the paradigms to identify themes and patterns in the product design and to build a sustainable product design process framework.

Methodology:

The research will employ a mixed-methods approach that includes a survey and case studies.

✈ **Case Studies:** The case studies will be conducted on specific products or systems incorporating sustainability considerations into the design process. The case studies will be conducted using a qualitative research design, and data will be collected through interviews with designers, manufacturers, and other relevant stakeholders. The case studies will explore the impact of incorporating sustainability considerations on the product or system's environmental, social, and economic aspects. The case studies will also explore the challenges associated with incorporating sustainability considerations into the design process and the strategies used to overcome these challenges. The survey should be conducted among designers and design firms in various industries to gather data on the current level of sustainability considerations in the design process. The survey will be administered online using a survey tool, and it will include questions that assess the level of awareness of sustainable design principles, the extent to which sustainability considerations are incorporated into the design process, and the challenges associated with incorporating sustainability considerations into the design process [7]. The survey will be distributed through various design industry associations, networks, and social media platforms.

✈ **Data Analysis:** The data collected from the survey and case studies will be analyzed using both quantitative and qualitative methods. The survey data will be analyzed using statistical software, and the results will be presented as descriptive statistics and graphs. The case study data will be analyzed using content analysis, which involves identifying themes and patterns in the data [8]. The findings from the survey and case studies will be synthesized to provide an overall understanding of the impact of incorporating sustainability considerations into the design process.

✈ **Ethical Considerations** This research will adhere to ethical standards in research, including obtaining informed consent from all participants, protecting the confidentiality of participants, and

ensuring that the research does not harm participants or the environment.

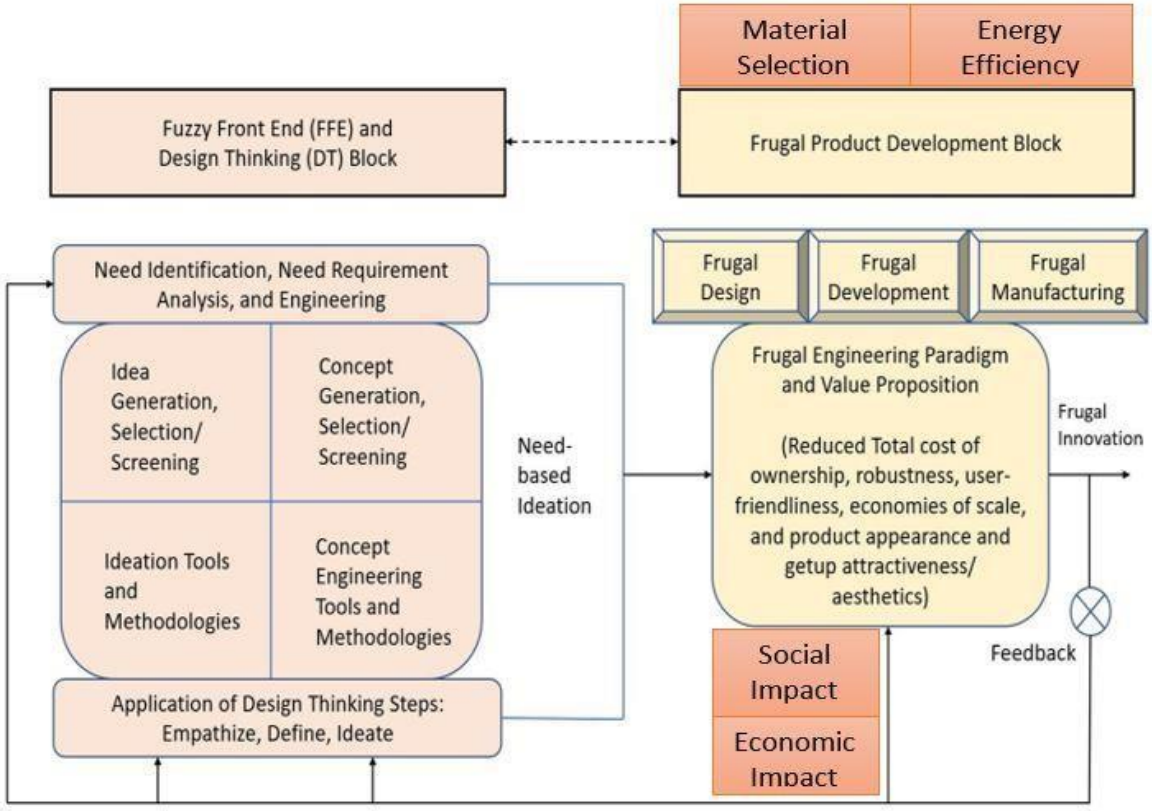

Fig. 01 – Sustainable Product Design Framework

Research Findings:

The findings of this research indicate that incorporating sustainability considerations into the design process significantly impacted the design of the commercial building project. The following are some of the key findings:

✈ **Energy Efficiency:** Incorporating sustainability considerations into the design process resulted in the development of an energy-efficient building design. The building design included features such as natural ventilation, high-performance glazing, and energy-efficient lighting systems. The energy-efficient design significantly reduced the building's energy consumption, operational costs, and environmental impact.

✈ **Material Selection:** Incorporating sustainability considerations into the design process resulted in selection of sustainable materials. The project team selected materials that were locally sourced, recycled, and had a low environmental impact. The use of sustainable materials contributed to the building's overall

sustainability and reduced its environmental impact.

- **Social Impact:** Incorporating sustainability considerations into the design process resulted in a building contributing to social sustainability. The building design included features such as natural lighting, indoor air quality, and accessibility, which improved the health and well-being of the building occupants. The building design also included features that promote community interaction, such as outdoor gathering spaces and green roofs.

- **Economic Impact:** Incorporating sustainability considerations into the design process resulted in a building contributing to economic sustainability. The energy-efficient design and the use of sustainable materials resulted in lower operational costs, which translates to lower long-term costs for the building owner. The building's sustainable features also contribute to its marketability, making it a desirable property for potential tenants.

Results and Discussion:

The analysis of the case study product using the sustainability assessment framework revealed that incorporating sustainability considerations into the design process significantly impacted the product's environmental, social, and economic sustainability. The product was found to be environmentally sustainable due to the use of renewable resources and reduced waste and emissions during production. The product was also found to be socially responsible due to its impact on the community, and it was found to be economically sustainable due to its energy-efficient design. The results of this study demonstrate the importance of incorporating sustainability considerations into the design process. It shows that incorporating sustainability considerations into the design process leads to developing environmentally sustainable, socially responsible, and economically sustainable products. This is achieved by reducing the amount of energy and raw materials used in the production process, using renewable resources, reducing waste, and emissions during production, and developing energy-efficient products.

Conclusion:

In conclusion, incorporating sustainability considerations into the design process significantly impacts the product's environmental, social, and economic sustainability. Incorporating sustainability considerations into the design process leads to developing environmentally friendly, socially responsible, and economically sustainable products. This study highlights the importance of incorporating sustainability considerations into the design process and provides evidence of the benefits of doing so. As sustainability continues to be a significant challenge in the 21st century, incorporating sustainability considerations into the design process will become increasingly important.

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Vol. I, Issue 2, 2023
ISSN: 2584-0517

Role of Regional Rural Banks in the Sustainable Development of Indian Rural Economy

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Abstract:

In India's ambitious pursuit of attaining developed nation status by 2047, the imperative for sustainable rural economic development stands as a cornerstone, given the country's predominantly rural demographic. With seventy percent of the population residing in rural areas, the advancement of this sector is not just desirable but essential for India's overarching developmental goals and societal well-being. However, rural communities face a significant obstacle in the form of limited access to capital, constraining their ability to engage in agriculture and allied activities. To address this challenge, Regional Rural Banks (RRBs) were established in 1975. This study delves into the deposit mobilization and loan disbursement patterns of RRBs from 2012-13 to 2021-22, using data extracted from NABARD reports. Employing curve estimation and SPSS analysis, the study observes a consistent upward trajectory in both deposits and loans, albeit with fluctuations in credit-deposit ratios. Notably, loans directed towards the priority sector outstrip those towards non-priority sectors, aligning with directives from the Reserve Bank of India (RBI). These findings underscore the vital role played by RRBs in facilitating rural economic development and emphasize the significance of prioritizing access to credit in fostering sustainable growth in rural communities.

Keywords:

Banking, Credit, Economic Development, Rural Communities.

Introduction:

India, presently ranking as the fifth-largest economy globally in 2024, is a developing nation with ambitions to attain developed status by 2047. Central to this objective is the recognition of the critical role played by the rural economy, considering a substantial proportion of the population resides in rural regions. Nevertheless, a considerable challenge hindering economic activities in these areas is the difficulty in accessing affordable credit, impeding sustainable growth. Addressing this issue is pivotal for fostering financial inclusion, ensuring equitable access

to financial services at reasonable costs, and driving rapid economic development while combating income inequality and poverty. The inadequacy of development in this realm not only constrains India's global competitiveness but also perpetuates rural-urban disparities. Financial institutions, particularly banks, are instrumental in meeting the credit needs of rural communities. Regional Rural Banks (RRBs), established on October 2, 1975, under the RRB Act of 1976, serve as vital channels for banking services in rural regions where traditional facilities are lacking. Given India's reliance on its rural economy, the development of rural infrastructure assumes paramount importance for the nation's overall advancement. Despite seventy-four years of independence, rural areas continue to grapple with infrastructure deficits and agricultural productivity challenges. Historically, the rural sector has been pivotal in India's economic and industrial growth, with agriculture serving as the primary livelihood source for around 70% of the populace. However, a significant hurdle faced by rural communities is the scarcity of capital, severely limiting their credit access. Consequently, informal financial sectors have exploited rural populations, offering loans with exorbitant interest rates and unfavorable terms, exacerbating economic hardships for rural masses.

Literature Review:

Numerous studies have delved into the role of Regional Rural Banks (RRBs) in Indian rural economic development, yet a comprehensive analysis specifically addressing their contribution to sustainable development remains notably absent. Uddin (2003) examined RRB performance in the Uttarakhand region, focusing on parameters such as deposit mobilization and profitability. Mathur (2005) detailed loan assets held by various financial institutions, emphasizing strategies to manage non-performing assets. Kaye (2006) conducted a study in Arunachal Pradesh, appraising rural credit needs and RRB performance in contributing to economic development. Roy (2007) investigated RRB operations in West Bengal, aligning with their objectives. Chakrabarti (2011) provided a historical overview of rural banking, including RRB development and performance analysis by region. Singh (2013) evaluated Manipur Rural Bank's performance, while Kher (2013) focused on RRBs' role in Gujarat's rural credit system. Taral and Nisarg (2016) assessed RRB financial performance pre- and post-amalgamation, while Muthumeena and Lylin (2019) analysed sector-wise lending trends and NPAs in public sector banks. Rehman (2020) summarised the innovative methods applied by the employees of the banks in deposit mobilisations, credit expansion and recovery of loans. Juber Md. (2021) traced NPAs in Indian public sector banks, emphasizing regulatory measures. Jaggi (2022) analysed key performance indicators of RRBs like number of RRBs and branches,

share capital, deposits, loans and advances, investment, reserves and surplus and profitability in the reference periods. Singh, Maurya and Singh (2023) seeks to disclose the causes of the occurrence of NPAs and examines the strategies for improving assets quality for eliminating NPAs. Despite the breadth of research, none directly explores the role of RRBs in sustainable rural development. Thus, this study aims to fill this gap by examining the contribution of RRBs to India's rural economy sustainability.

Significance of the Study

This research aims to underscore the significance of Regional Rural Banks (RRBs) in fostering rural economic development, assess their performance in India, and offer actionable insights for stakeholders, policymakers, and academia to improve RRB effectiveness.

Objectives

The main objectives include analyzing RRB performance in the following areas:

1. Expansion of branches and district coverage.
2. Mobilization of deposits, outstanding loans, and advances.
3. Disbursement of outstanding loans and advances to priority and non-priority sectors.

MATERIALS AND METHODS

This study exclusively focuses on RRBs and their role in rural economic development. To address this challenge, Regional Rural Banks (RRBs) were established in 1975. This study delves into the deposit mobilization and loan disbursement patterns of RRBs, using data extracted from NABARD reports. Employing curve estimation and SPSS analysis, the study observes a consistent upward trajectory in both deposits and loans, albeit with fluctuations in credit-deposit ratios. The significance levels (P) of the growth coefficient (b) are defined by statistically insignificant as $P>0.05$, significant growth $P<0.05$ and highly significant growth as $P<0.01$ and $P<0.001$. The study spans a decade from 2012-13 to 2021-22, aligning with banks' accounting periods, typically running from April 1st to March 31st of the subsequent year.

CREDIT DEPOSIT RATIO (C.D RATIO)

The Credit Deposit Ratio (C.D. ratio) is a crucial indicator of a bank's performance, reflecting its utilization of deposits for lending purposes. Table - 1 presents the C.D. ratio of RRBs from 2012-13 to 2021-22.

Years		Total deposits	Outstanding loans & advances	Credit deposit ratio in %
2012-13		211,488	137,078	65
2013-14		239,494	159,407	67
2014-15		273,018	180,955	66
2015-16		313,499	206,538	66
2016-17		371,910	226,175	61
2017-18		400,459	253,978	63
2018-19		434,444	280,755	65
2019-20		478,737	295,214	62
2020-21		525,226	334,171	64
2021-22		562,538	362,838	65
Growth Statistics	**b**	0.110	0.106	-0.004
	P-value	<0.001	<0.001	>0.05

Table - 1: Performance of RRBs in India (Amt. in Rs. crore)

Table - 1 depicts the total deposits, outstanding loans and advances, and C.D. ratio of RRBs over the specified period. While both deposits and loans have increased consistently, the C.D. ratio has fluctuated between 61% and 68%. This indicates variations in the utilization of deposits for lending activities by RRBs.

DISBURSEMENT OF OUTSTANDING LOANS AND ADVANCES TO PRIORITY & NON-PRIORITY SECTORS:

Table - 2 showcases the disbursement of loans and advances by RRBs to priority and non-priority sectors.

Table - 2: Disbursement of outstanding loans and advances (Amt. in Rs. crore)

Years		Total loan amounts	Priority Sector		Non-Priority Sector	
			Priority sector loan amounts	% of priority sector to total loan amounts	Non-priority sector loan amounts	% of non-priority sector to total loan amounts
2012-13		137,078	111,812	81.57	25,266	18.43
2013-14		159,302	130,215	81.74	29,087	18.26
2014-15		187,843	156,310	83.21	31,533	16.79
2015-16		180,955	151,364	83.65	29,591	16.35
2016-17		206,538	171,373	82.97	35,165	17.03
2017-18		226,175	183,533	81.15	42,642	18.85
2018-19		280,755	255,022	90.83	25,733	9.17
2019-20		298,214	270,182	90.60	28,032	9.40
2020-21		334,171	300,962	90.06	33,209	9.94
2021-22		362,838	324,207	89.35	38,631	10.65
Growth Statistics	**b**	0.107	0.120	0.013	0.024	-0.083
	P-value	<0.001	<0.001	<0.01	>0.05	<0.01

Table - 2 illustrates the disbursement of outstanding loans and advances by RRBs to priority and non-priority sectors from 2012-13 to 2021-22. The total loan amounts of RRBs show a consistent upward trend over the years, increasing from Rs. 137,078 crore in 2012-13 to Rs. 362,838 crore in 2021-22, with slight fluctuations in between. Priority sector loans have also shown a steady increase, ranging from Rs. 111,812 crore (81.57% of total loan amounts) in 2012-13 to Rs. 324,207 crore (89.35% of total loan amounts) in 2021-22. Similarly, non-priority sector loans have witnessed growth, though at a slower pace, from Rs. 25,266 crore (18.43% of total loan amounts) in 2012-13 to Rs. 38,631 crore (10.65% of total loan amounts) in 2021-22.

Findings and Suggestions:

1. The declining trend in the number of RRBs from 64 in 2012-13 to 43 in 2021-22, alongside an increase in the number of branches, indicates a concerted effort to expand banking services in rural areas. However, more RRBs are needed to cover the remaining uncovered districts and ensure equitable access to banking facilities.
2. While total deposits and loans have grown steadily, the fluctuating credit deposit ratio highlights the need for increased awareness programs on financial literacy to encourage higher deposit mobilization.
3. The increase in total loan amounts reflects RRBs' commitment to providing credit to rural communities. However, careful selection and monitoring of beneficiaries are essential to prevent an increase in non-performing assets.
4. RRBs have demonstrated a commendable effort in disbursing loans to the priority sector, exceeding RBI guidelines. However, greater focus on the non-priority sector is necessary to maintain sustainable development.
5. Despite fluctuations, the percentage of loans to non-priority sectors remains below RBI guidelines, indicating room for improvement. Increased lending to this sector

would contribute to overall rural development and enhance the financial position of RRBs.

Conclusion:

India's journey to becoming a developed country by 2047 hinges on addressing economic and social challenges, particularly in rural areas. RRBs play a vital role in this transformation by providing financial assistance to rural communities. While priority sector lending has been substantial, efforts to balance lending between priority and non-priority sectors are necessary to ensure sustainable rural development. By adhering to RBI guidelines and focusing on inclusive growth, RRBs can continue to drive economic progress in rural India.

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Vol. I, Issue 2, 2023
ISSN: 2584-0517

Sustainable Development of Eco- Sports Tourism in Manipur

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Abstract:

Ecological sports tourism is a fertile ground for sustainable development though the task is challenging. Manipur being among the top ten hotspot biodiversity rich zones in the world and the sports powerhouse of India, ecological sports tourism in the state is a promising area for attaining sustainable development goals (SDGs). Research on ecological sports tourism in India is relatively low in comparison to other countries. The present study explored the potential areas of ecological sports tourism resources in Manipur from the angles of regional planning, multi-ethnic indigenous sports, industrialization programming and design. The methods adopted in the study were mainly descriptive and conceptual. Based on secondary data, SWOT analysis, SDGs through eco-sports tourism, features and resource analysis, planning and designing and countermeasures and suggestions was established in the context of Manipur for sustainable development of eco- sports tourism. These related factors that influence tourist motivation and satisfaction degree include the ecological environment; natural landscape, human environment, service experience, eco-sports tourism facilities and the eco-sports services. Therefore the present study can provide insight and appropriate strategies and countermeasures in terms of infrastructure, service content and service standard to attain sustainable development through eco- sports tourism in Manipur.

Keywords:

Eco-sports tourism, Indigenous sports, Sustainable development, Manipur

Introduction:

Sports tourism has developed at a fast speed in the developed countries. Game and sports is a positive force in terms of health and recreation, and provides social benefits for billions of participants; however it has a simultaneous impact on the natural world. With the rapid development of tourism, eco- sports tourism has become a research hotspot for sustainable development. The main characteristics of ecological sports develop the sports activities in the natural environment and social and ecological environment (Zheng Xiaoxiang, 2005). Forest Park tourism has been favoured as a

healthy modern tourism form (Guoxiao Ping et al., 2015), both to carry the natural regulation of the ecosystem, to meet the needs of eco-sports tourists in person, and meet the ecological sports tourists leisure, sports, health and other functions. On the tourists eco-sports tourism research can focus on tourist behavior, tourists perception decision-making, visitors will pay, travel destination market segmentation and tourism travel structure (Chen Ke, et al, 2010). Zhu Zhi, (2015) studied the satisfaction of eco-sports tourism tourists and analyzed the motivations of tourists' tourism. Ecological sports tourism resources are those items which include traditional ethnic sports items, historical and traditional culture resources (Wang, 2005). Sustainable development, on the other hand, has been an important concern for both tourism (McCool, 2015) and sport (Taks, 2013) scholars. In the light of above literatures, the aims and objectives of the present study is to explore key areas of eco- sports tourism resources and its characteristics in Manipur from the angles of regional planning, multi-ethnic indigenous sports, industrialization programming and design and to carry out strategies for sustainable development through ecological sports tourism in Manipur.

Methodology:

The material and methods of the present study is adopted purely descriptive and conceptual based on secondary sources of data. The study is incorporated with SWOT analysis, sustainable development goals (SDGs), the features and resource analysis, strategies to develop eco-sports tourism in Manipur and its countermeasures and suggestion.

SWOT Analysis

It can determine the intrinsic strengths (S) and weaknesses (W) of the site and the opportunities (O) and threats (T) that the environment offers. The SWOT analysis is, therefore, may be made with the following components of SWOT

A. STRENGTH

The State of Manipur has many destinations that can cater to religious, adventure, and eco-sports tourism segments.

i) It offers a cultural treat through the Manipuri dance forms, and adventure treats through avenues for sports.

ii) Unique Loktak Lake.

iii) Shirui Hills.

iv) Dzuko Valley.

v) Kangla Fort.

vi) Keibul Lamjao National Park.

vii) Polo.

viii) Variety of indigenous sports of different ethnic groups.

ix) Exploration of caves and waterfalls.

x) INA, Moirang.

xi) Khongjom War Memorial Complex.

B. WEAKNESSES

i) Security and internal conflicts – both in terms of perception and reality.

ii) Lack of Visa-on-Arrival facility for Myanmar's citizens at Moreh-Tamu border.

iii) Limited tourism infrastructure facilities, particularly quality, experience, and site services.

iv) The lack of good road infrastructure leads to poor connectivity with the Tourist spots/destinations.

C. OPPORTUNITIES

i) The presence of border towns like Moreh and the international boundary with Myanmar has been looked at as an opportunity to develop border markets.

ii)Linkages to the circuits within the region with significant highway development connecting destinations across States and Southeast Asian Countries.

iii) We are fostering coordination with other States on developing tourism.

iv) Opening up of Railway line up to Imphal.

v) Full-fleged Bir Tikendrajit International Air port , Imphal

D. THREATS

i) Instability and perception of lack of security in the region can potentially affect tourism movement.

ii)The continuous fear of an unstable environment can make the tourism investment climate unattractive.

iii) Over use and commercialization of sensitive eco-zones may lead to depletion of resources and dilution of attraction.

iv) Inability to utilize the currently available assets due to lack of workforce in Manipur tourism.

Eco-Sports Tourism and Sustainable Development Goals (SDGs)

Eco-sports tourism can contribute to sustainable development and the achievement of the Sustainable Development Goals (SDGs) if we properly designed and developed in a proper manner. As a segment of tourism, sport tourism also helps achieve sustainable development in a distinct way stemming from its characteristics. The comparative strength of sport tourism lies in (1) engagement in physical activities, (2) opportunities for interactions, and (3) high development potential almost anywhere in small events or light activities.

Sustainable Development Goals (SDGs)	**How Eco-sports tourism can contribute to SDGs**	**What needs to be considered when developing eco-sport tourism and achieving the SDGs**
SDG 1 – End poverty in all its forms everywhere **SDG 8**- Promote sustainable economic growth and decent work for all	**i)** It can provide Jobs avenues, income opportunities and Competitiveness.	i) Partnerships and community involvement is highly needed ii) Hiring local people, encouraging local entrepreneurs and utilizing local products iii) The sports events should be designed for good cause and safety.
SDG 3 – Ensure healthy lives and promote well-being for all at all ages	i) Sport tourism enhances physical and mental well-being of participants. It helps maintain or improve health of tourists.	i) It is preferable to promote sport activities not only to visitors but also local residents for health and well-being of their own.
SDG 10 – Reduce inequality **SDG 11 –** Sustainable cities and communities	Accessible sport tourism products may facilitate people with disabilities, both residents and visitors alike, with opportunities for sport.	Eco-sport tourism should be considered as an accelerator for social inclusiveness with local needs taken into consideration.
SDG 12 – Ensure sustainable consumption and production patterns **SDG 13** –Appropriate action to combat climate change and its impacts **SDG 14 –** Life below water **SDG 15 –** Life on land	**i)** It can enhancing awareness and environmental measures **ii)** Nature-based sport tourism provides opportunities to directly experience and enjoy the nature.	**i)** Sport tourism must be developed taking into account sustainability of natural resources including biodiversity. **ii)** Tourism operators should make the best efforts in taking environmental measures and environmentally friendly way
SDG 16 – Peace, Justice &	i) It provides encounters between people of diverse cultural backgrounds through sport	**i)** It is important to ensure opportunities where the locals and visitors can interact.

Strong & institutions **SDG 17 –** Partnerships for the Goals	activities.	

5. The features and main resource analysis of eco- sports tourism in Manipur

The possibility of features and resources of eco- sports tourism in Manipur can be nalysed with the following reasons.

i) Manipur has rich resources in landscape and variety of indigenous games and sports

ii) Manipur's economic status is improving and people's living standards are rising;

iii) The increasing stress on work and study makes people need richer cultural life;

iv) The success of indigenous and combat sports events has stimulated the development of sports tourism;

v) As a origin place of polo and traditional style of polo game can be attracted the foreign tourists

In Manipur, resource base is profound for the investigation and development of multi-ethnic eco-sports tourism and maximum attention should be paid to investment and development of high-grade ecological sports tourism industry. The origin of modern *Polo*, the indigenous games of *Yubi Lakpi, Kang Sanaba, Arambai, Thang-Ta* and *Mukna , Mukna kangjei* will prove to be a thrilling experience for any enthusiastic domestic and foreign tourists. Therefore, eco sports tourism industry will bring favourable benefits of society, economy and ecology (Zhu, 2001). Through a systematic investigation on such resources and combination with reality, characteristic resource evaluation and development system of history and culture could be developed and followed by production of industrialization (Zheng, 2005).

6. The Strategies to develop ecological sports tourism in Manipur

Tourism policies become more important in view of India's Act East Policy, the Trans-Asian Highways and Railways and Gateway to South-East Asia. By looking the importance of eco-sports tourism, the Government needs to explore and develop the scenic natural beauty of the State in a sustainable manner. Manipur has innumerable prospect for eco-sports tourism as enumerated below

(i) **Loktak Lake***:* It is located at Bishnupur district The lake is very suitable site for water sports like for water sports such as Canoeing, Kayaking and Rowing events.

(ii) **Dzukou Valley**: It is situated in Senapati District famous for the Dzukou Lily (*Lilium chitrangadae*). It is also famous for the snow fall during the month of January & February. The valley may be selected as one of the eco-sports tourism by selecting appropriate sports item.

(iii) **Shiroi hill** and its **Shiroi Lily (*Lilium mackliniae*) in Ukhrul District**. *The place is suitable for eco-sports tourism.* There is a best trekking site in and around the Kangkhui cave. It is a remarkable natural lime-stone cave.

(iv) **Sadu Chiru Waterfall** belongs to the Sadar Hills in the foothills of Bishnupur District near the Sadu Chiru Village. It is also suitable for eco-sports tourism.

(v) Koirengei Old Airfield, Chingnungkok of Imphal East District and *Barak River* is the best site for parasailing, paragliding, rafting as exciting eco-friendly adventure sports.

(vi) **Ebudhou Marjing Polo complex**: It is located in Imphal East district. At the centre of the complex, there is 122 ft tall statue, depicting a Sagol Kangjei player. This magnificent work of art serves as a symbol of pride for the people of the state, and a source of inspiration for visitors from all over the world.

(vii) **The Kangla Fort**: The Kangla , officially known as Kangla Forte, is an old fortified palace at Imphal in the Manipur state of India. The fort is taken as sacred place to the Meiteis. The Kangla is proposed to be declared as a UNESCO World Heritage Site. This Forte is needed to add some components of eco-sport items in the plenty space of its surroundings.

(viii) **Manipur Olympian Park**: It was constructed in Sangaithel area, Imphal West District to honour and encourage 19 Olympian from Manipur. Manipur also known as the powerhouse of sports for excellent performance in the field of sports. This park is very suitable for eco-sports tourism.

Countermeasures and suggestions:

Previous studies conformed the following several key innovative ideas which can be applied as main criteria of sustainable development countermeasure and suggestions to design and develop eco-sports tourism.

i) Innovation in this area is to be based on the investigation, analysis and evaluation of eco-sports tourism industry, facilitates understanding the heterogeneity and value generality of natural ecological resources and measures of resource protection and strategy of resource exploitation and utilization (Liu, 2005).

ii) The local self government and tourism investors, operators such enterprise also should pass local policies and tourism planning approaches for environmental protection.

iii) The idea of strengthen the forest park mountain with aesthetic views between sports leisure and sports competition.

iv) We need to focus more attention to build the forest park eco-sports tourism theme and shape of the tourism

v) We need to provide good security services for tourists need to: improve the security knowledge in the scenic spot, build tourists reliable sports tourism environment and facilities.

vi) Public Private Community Partnership policy is the key instrument for sustainable and economic development of ecological sports tourism.

Conclusion:

Despites there are various measures being taken by the State and the Centre to upgrade tourism potential in Manipur it still remains one of the least preferred choice as a tourist destination. Image improvement, infrastructure up gradation, and administrative and security concerns need to be handled for tourism to flourish as a development industry with community participation. However, this review can provide insight and appropriate strategies and service content and service level to achieve sustainable development goals through ecological sports tourism in Manipur.

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Vol. I, Issue 2, 2023
ISSN: 2584-0517

Analysis of Hydrogen Gas as Fuel by Electrochemical Reaction and its Uses in Popular Public in Everyday Life

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Introduction:

Hydrogen is already used by our researchers as powerful resources for numerous scientific research fields. This project has a goal to utilize hydrogen to regulate our daily life in which electrolysis process of universal solvent can be used as resources of generous amount of hydrogen gas. Our green earth is the resources of universal solvent in 3:4 ratios. Therefore this project can utilize the opportunity of huge resources of water.

Keywords: Hydrogen, electrolysis, PEM, SMR, biomass, UAV

Methodology:

- Steam methane reforming
- Biochemical Reactions
- Gasification of biomass
- Solar-thermal water splitting technique
- Electrolysis

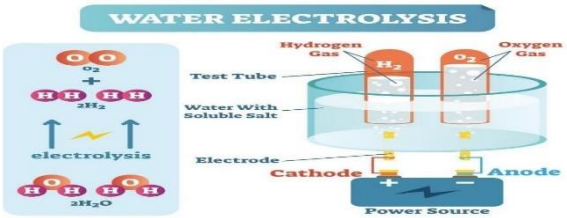

Figure:1

However hydrogen gas is very powerful resources as fuel but its storage process for our daily uses is very troublesome. But this project is aimed to overcome all hurdles. Also speed up of electrolysis process is another major criterion of this project.

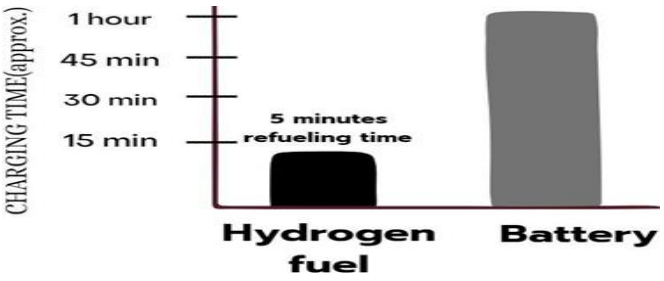

Figure:2

The project already took challenges to utilize huge resources of green earth to live green and world's economy will also be privileged if this project can fulfilled its aim. The aim of this project can also bring smile among poor operator of motorized vehicles which can bring greenery in our everyday life.

Findings:

- **Powertrain:** The Toyota Mirai uses a cutting-edge hydrogen-to-electricity fuel cell system to drive an electric motor. The electric motor has a power output of 128 kW (172 horsepower) and 300 Nm of torque, and it performs quietly and smoothly.
- **Range:** The Mirai's extended range of about 650 kilometers (404 miles) on a full tank of hydrogen enables longer journeys with fewer stops for fueling.
- **Refueling Time:** Refueling a Mirai with hydrogen only takes a few minutes and is just as convenient as refueling with regular petrol.

Conclusion:

In conclusion Hydrogen fuel cells could also significantly improve the endurance and capabilities of drones. Drones can travel farther and complete more difficult tasks thanks to hydrogen fuel cells' longer flight times and quicker refueling options compared to conventional lithium-ion batteries. This is advantageous for operations requiring extended endurance, such as aerial surveillance, package delivery, and emergency response operations.

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Vol. I, Issue 2, 2023
ISSN: 2584-0517

A Comprehensive Review of Intrusion Detection by Leveraging the Machine Learning Techniques

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Abstract:

With advancement in digital devices and openness of critical network systems. The threat of cyber-attack and intrusion attack is a major concern to the critical resources of network security and systems. The cyber attacker takes the advantages of weakness and vulnerabilities exist in network system or users devices in order to exploit the various assets and steal valuable information. Over the past decades, Internet and computer systems have raised numerous security issues due to the explosive use of networks. Intrusion Detection System (IDS) provides the protection against any kind of network attack by detecting network intrusions from the suspicious traffic data. However, most of the intrusion detection data suffers from high dimensionality, due to this IDS leads to the degraded performance and lower prediction rate of any kind of new intrusion. Therefore, this work presents a comprehensive analysis of an intrusion detection system for network traffic data using machine learning techniques. The proposed system employed machine learning and data mining techniques in order to detect different kind of intrusion from network traffic on NSL-KDD dataset. The obtained results of proposed work show that the intrusion detection model for network system can efficiently and effectively identify intrusion behavior and malicious intension with higher accuracy.

Keywords:

Intrusion detection, Machine learning, cyber-attacks, data mining, Network security, Artificial Neural Network

Introduction:

In this section definitions of different key words that are used in this works are presented to have better understanding.

Data Mining

Usually, data mining also referred to as information discovery is the method of analyzing facts from distinctive views and abbreviation it into precious statistics that can be used to enhance revenue, cuts fees, or both. For analyzing information data mining software is a single wide variety of analytical gear. Data mining allow users to examine statistics from many different measurement or angles, classify it, and review the relationships recognized. Theoretically, data mining is the procedure for finding correlation or styles together with dozens of

fields in massive relational databases. On the equal time as massive-scale information generation has been growing separate transaction and information systems, data mining provides the connection between the two. Data mining techniques are at the present time used in various applications such as finance, medical, telecommunication and other. Data mining tasks are generally categorized as classification and prediction; outlier analysis; cluster analysis. Among these the two most popular tasks, classification and prediction are widely used. There is various machine learning techniques which can used to perform following data mining functionalities:

- **Clustering**: Clustering can be invented as identification of comparable classes of objects. Via the usage of clustering techniques we are able to supplementary identify dense and sparse regions in item area and this can determine average distribution pattern and correlations among information attributes. There are three styles of clustering methods that is portioning method, Density based method, and Model based method.

- **Classification:** type is commonly carried out in statistics mining technique, which employs a set of pre-labelled examples to increase a model. Fraud detection and credit danger programs are in particular nicely suitable to this type of take a look at. This method frequently employs choice tree or neural community-primarily based classification algorithms.

- **Prediction:** The prediction is an character records mining strategies that discover courting among impartial variables and association among dependent and independent variables. For instance, the prediction analysis technique can be used in transaction to predict profit for the potential if we consider sale is an independent variable, profit could be a dependent variable.

- **Association:** affiliation and correlation is typically to discover frequent object set findings among huge facts units. This type of judgment helps businesses to create certain decisions; Association Rule algorithms need to be able to produce rules with confidence values less than one.

- **Decision Tree:** One of the most used data mining techniques is decision tree because its model is straightforward to understand for users. In selection tree technique, the root of the selection tree is a easy query or condition that has a couple of solutions.

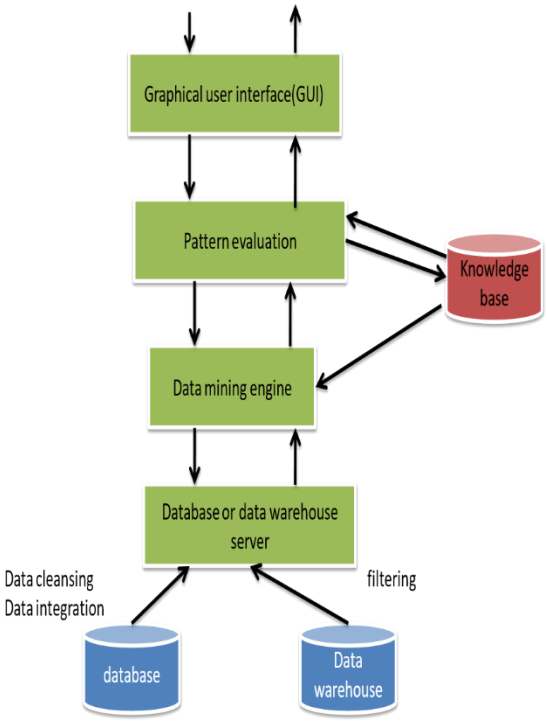


Figure 1.1 Architecture of a Typical Data Mining System.

There are data mining methods which invent in the artificial intelligence and the machine learning. In modern years the utility of the methods has been proven also in network attack. Data mining aims at describing specific patterns which may be present in data. These patterns, exposed in historical data, may be used to support future decisions relating to attack. Such knowledge may also have a huge value for decision making in action planning, hazard analysis and other predictions. Earlier to the mining procedure it is essential to grow sufficient amount of data. This may possibly require integrating data from multiple varied information sources and transforming it into a form which is specific to a target decision support application. Afterwards the data has to be organized for knowledge extraction. The next step comprises induction of rules which may be encouraging in the fining attacks on network The Figure 1.2 shows the process of discovering knowledge from data.

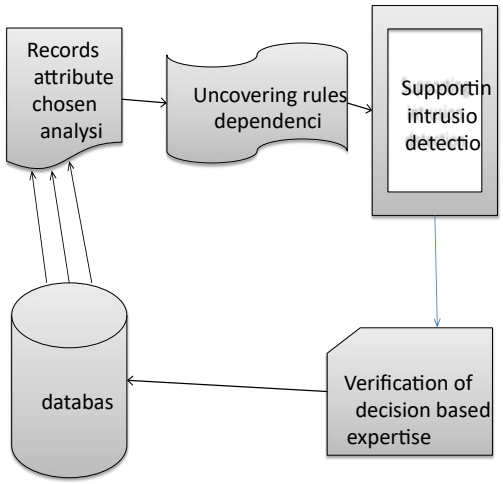


Figure 1.2 Discovering Knowledge from Data

The data mining process is a complex process and it has been divided into several steps:

- Domain analysis and data accepting
- Data collection
- Data analysis and pre-processing
- Data reduction and transformation
- Attribute selection
- Reduction in number of dimensions
- Normalization
- Aggregation
- Selection of data mining
- Visualization
- Evaluation
- Knowledge utilization

Intrusion Detection System

Now a day's community security infrastructure depends on to network Intrusion Detection Gadget (NIDS). NIDS gives protection from acknowledged intrusion attacks. It's impossible to forestall intrusion attacks, so organizations need to be prepared to deal with them [13]. Intrusion detection machine (IDS) Intrusion detection system (IDS) is a defensive mechanism whose elementary purpose is to keep work going on considering all possible attacks on a computer system. Intrusion detection is a one type of process used for to detect suspicious activity and malicious activity both at network level and host level. Two main Intrusion Detection techniques available are anomaly detection and misuse detection. In anomaly based totally detection device, audit facts is used to differentiate atypical facts from ordinary statistics. On the other hand, in misuse detection gadget, additionally known as signature primarily based IDS, using patterns of well-known attacks to match with audit data and identify them as intrusions. Functioning of misuse detection models is very much similar to that of antivirus applications. Misuse IDS can Examine network.

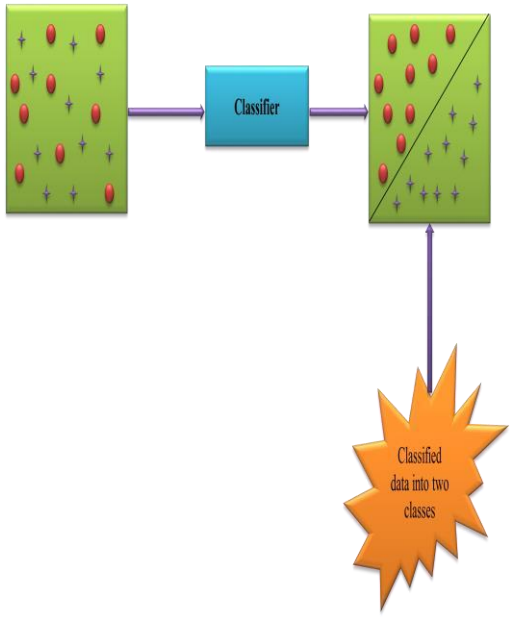


Figure 1.3 Two Class Classifier of IDS

S.NO.	INTRUSION ATTACK	DESCRIPTION WITH EXAMPLE
1	Worms	It is a section of code or program which replicates or folded themselves from computer to computer without any use of host file. The whole document such as word or excel vary from one system to another system should consider as worm. E.g. PrettyPark
2	Trojans	Trojans having a malicious code or malevolent code, when triggered it may causes loss or even theft of data. E. g Mail Bomb
3	Physical Attack	It is an attempt to damage the physical components or hardware components of networks or computers. E. g Cold boot
4	Password Attack	In this type of attack, password is obtained within a small or short period of time which is indicated by a sequence of login failure. E. g SQL injection attack
5	Information gathering attack	It is Able to gather or gain information to find out intrusion or vulnerabilities. These activities are generally done by scanning the whole computers or networks. E. g XMAS scan
6	Malware	Malware is a program that is basically written intentionally to harm or attack system. It is not the buggy software or any programs.
7	Vulnerability	The Program that is written by humans. Programmers are sometimes forget to or unaware of cross t's and dot i's and those mistakes create strange behaviour in the programs, it create a hole or make a secret path that malware or attacker could use to access system more easily and effectively, that is known as a vulnerability.

Table 1.1 Types of Attack in Network

Motivation

Over the past decades, Internet and computer systems have raised numerous security issues due to the explosive use of networks. In the present day intrusion detection gadget is most useful because we are now use any time computer internet and the intruder easily attacks on our network. In this decade many modern techniques and computational system have been emerged in order to facilitate their operations .Nowadays many types of attacks are found for this we have data in databases and facts Warehouse. The essential data include just primary information about attack such as call, kind etc. In order to facilitate the storage and maintenance of this huge data a new type of system has been emerged that is known as intrusion detection system. Its goal is to carry out early detection of malicious pastime and in all likelihood save you greater extreme damage to the included system by using IDS.

It originates in the trade intelligence in order to support attack decisions. The research may improve the procedure of finding attacks and stop that attack as well as decrease the risk of finding attack mistake or the time of a finding attack. This may revolve out to the critical especially in data is very important. This may also turn out to be a time saving effort. The research area which tries to find for practice of knowledge wrenching from data is described as know-how discovery or data mining.

Objectives:

The main purpose of this paper is to discover the maximum promising data mining techniques which yield great effects in terms of all performance measurements like accuracy, sensitivity and specificity with reduced number of features. The evaluation is performed on NSL-KDD Dataset from UCI repository site (UCI Repository).

In order to reach the main goal of paper following objectives to be fulfilled:

a) Analysis of NSL-KDD dataset.

b) Identification of the most common data mining algorithms implemented within

Various datasets.

c) Identification of the most promising feature choice method for reducing features.

d) Improvement of algorithm for type of IDS assaults.

e) Evaluation of the specific strategies used on different datasets for comparing performance.

1.5 Research Methodology

Research is a way of knowledge improvement. The main motivation of research is to extend human knowledge rather than to create or discover new things. To conduct master's paper first literature survey is done for analysis of the existing facts and figures. In this literature survey assessment is performed not most effective at the papers associated with the intrusion detection device however also diverse assaults like u2r,r2l,everyday,prob and so on that has been discussed in bankruptcy 3. Subsequent evaluation of intrusion detection gadget used in community. there are numerous IDS which might be utilized in community that has discussed later on this chapter. the following step is to become aware of the common records mining algorithms and feature choice method which has been carried out and sooner or later to pick a aggregate of information mining approach and feature choice technique for assessment.

RELATED WORK

Intrusion detection gadget (IDS) is one of the maximum crucial research vicinity for community and facts safety with fast improvement of internet in all around the world . IDS are a classifier that can classify the network information as ordinary or assault. Researchers are generally used characteristic choice approach with statistics mining because it assists to lessen

time for result and locating and some of author used combination of a couple of technique for higher effects. There are many authors who use KDD99 information set and many of them makes use of NSL-KDD data set because both are bunch mark data available in UCI Repository site after a decade review we find an ensemble model with feature selection. There are lots of research work already done by the various authors as explained below with some recent publications:

Gang Kou et al.,(2009) have compared various classification algorithms like C4.5,SVM,Naive Bayes, Logistics, CART, See5 with proposed model Multi-class multi-criteria mathematical programming (MCMP) model to develop IDS. MCMP model is best classifier for KDD99 data set in case of multi class classification problem.

V. Balon Canedo et al., (2011) proposed a new KDD winner method consisting of discretizations, filters and various classifiers like Naive Bayes (NB) and C4.5 to develop a robust

IDS. The proposed classifier gives high accuracy i.e.

99.45% compare to others.

Mohammad Saniee Abadeh et al., (2011) have

suggested three kinds of genetic fuzzy system based on Michigan, Pittsburgh and iterative rule learning (IRL) to deal with intrusion detection as high dimensional classification, in which genetic fuzzy Michigan approach is better to deal intrusion detection problem compare to others.

M. Govindarajan et al., (2011) have proposed a brand new technique, that is ensemble of Multilayer

Perceptron (MLP) and Radial foundation characteristic (RBF). The proposed ensemble version gives better improvement compare to its man or woman model

Saurabh Mukharjee et al. have discussed new feature reduction method known as feature validity based reduction method (FVBRM) applied on one of the efficient classifier Naive Bayes on reduced data set with 24 features for intrusion detection. Result obtained in this case is better

as compare to case based feature selection (CFS), gain ratio (GR), info gain ratio (IGR) to design efficient and effective network intrusion detection system.

Y. Li et al., (2012) have recommended regularly characteristic decreased (GFR) approach implemented on green classier assist Vector gadget (SVM) with KDD99 records set. SVM classifier offers high category accuracy as ninety eight.62% for intrusion detection in case of 10-fold pass validation.

L. Koc et al., (2012) have delivered Hidden Naive Bayes (HNB) model with promotional k-c programming language discretization and have interaction feature choice technique. They have compared their proposed model with conventional Naive Bayes method. The proposed models offers exceptional end result as ninety three.72% accuracy and zero.66% error charge in multiclass class for intrusion detection.

Mrutyunjaya Panda et al., (2012) have suggested hybrid method with aggregate of random wooded area, dichotomies, and ensembles of balanced nested dichotomies (cease) for binary class trouble, which gives detection fee 99.50% and occasional false alarm rate of zero.1%. They evaluated the overall performance of model with different measures like Ffee, precision and don't forget.

Nagaraju Devarakonda et al., (2012) have presented Hidden Markov Model(HMM) is a simplest kind of dynamic Bayesian network model for intrusion detection system. They have taken only five features (protocol_type, flag, src_bytes, dst_bytes, and, count) out of 41 to develop robust IDS to classify the attacks.

Hesham Altwaijry et al.,(2012) have suggested Bayesian network to improve the accuracy of R2L type of assault. Experiment accomplished with distinct function subset of KDD99 statistics set and offers better effects for R2L attack with detection price eighty five.35% using three features.

Muamer N. Mohammed et al., (2012) have proposed a new method focus on improving intrusion system in wireless area

network by using support vector machine. This technique produced a better result in terms of detection rate and eliminating false positives and false negatives.

John Zhong Lei et al., (2012) have used various techniques like K-means, SOM, Improve Competitive Learning Network (ICLN), and

Supervised Improve Competitive Learning Network (SICLN) to develop intrusion detection system. They have suggested SICLN technique and achieved high accuracy like 99.66% compare to others.

Y. Y. Chung et al.,(2012) have proposed a new hybrid network intrusion detection system using intelligent dynamic swarm based rough set (IDS-RS) and simplified swarm optimization with weighted local search (SSO-WLS) strategy for intrusion data classification. Proposed hybrid model SSO-WLS improve the overall performance of the network intrusion detection system with 99.3% accuracy.

B. Kavitha et al.,(2012) have expand a brand new rising Neurosophic common sense classifier (IDS), which is extension/aggregate of fuzzy logic ,intuitionist good judgment and three-valued logics that offers a excessive detection rate and coffee false alarm rate compare to others.

Shih-Wei Lin et al., (2012) have proposed a new technique based on feature selection and decision tree rule which is combination of support vector machine (SVM), decision tree (DT), and simulated annealing (SA).The proposed technique achieved 99.96% of accuracy as best model in case of 23 features.

Problem Description

According to the analysis of literature survey many authors have developed novel methods not only for the classification of attack but also for other attacks like u2r,r2l,probe,DoS etc.with the help of intrusion detection system. Development of novel techniques for classifying different attacks in network is a current research topic and is very popular among the researchers; it was found that many popular journals are publishing many research articles frequently. Problems related to classification have identified its applicability in real sense. The main problem is that all attacks share the same features. This may mystify a practicener. As a result we can state that one of the important problem in this research is decision making regarding a attack in which one attempts to match patterns and attack but on the other hand it does not be attached to typical behavior. From literature survey we conclude that each author proposed individual data mining techniques for calculating performance measures and from individual model we observe that accuracy does not increase. There is one more problem related to the number of feature which is used for classification. There are some authors who have applied feature selection methods like ranker method, best first search method etc. With the help of feature selection data quality gets improved as redundant and noisy get removed. And one more advantage is that the dimensionality of the feature space, to limit storage requirements and increase algorithm speed.

Ø Analysis of various previous researches comprises following problems:

a) Decision making process does not conform to standard behaviour.

b) Huge number of features due to which quality of data gets affected.

Proposed Approach for Classification

After analyzing the previous work of classification of intrusion it found that there is a need of more reduction in features so that noisy and redundant data get remove and quality of data may get improved for better results. In this paper we have proposed an ensemble model approach of a feature selection for the classification of intrusions. In this proposed approach first model is trained using machine learning techniques and then features get reduced with the feature selection method and after testing of model it is evaluated using various performance measurements. The work flow of the proposed work is shown below with the help of diagram

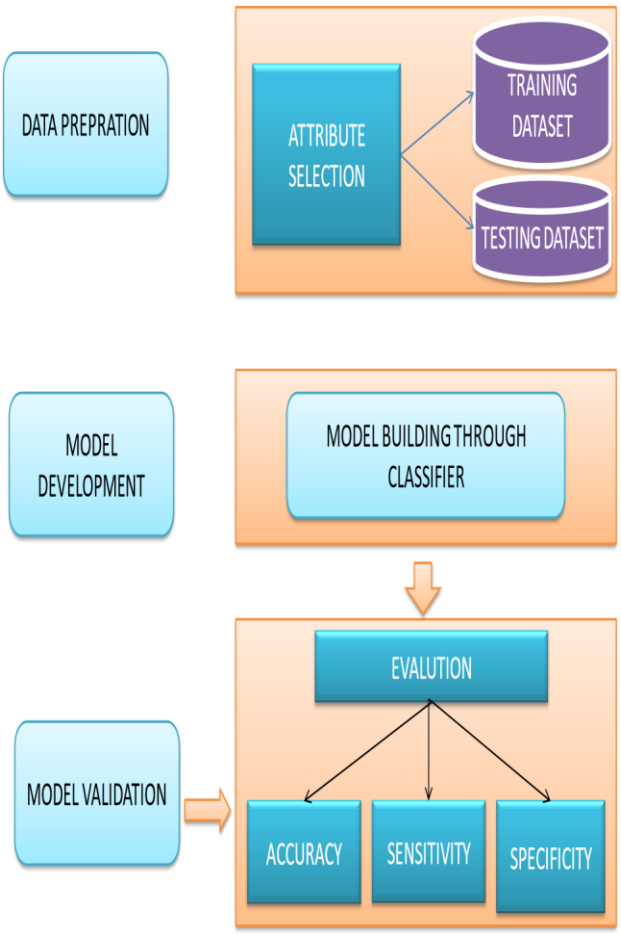


Fig 1.4 Work Flow of Proposed Approach

The work flow diagram show that for finding attacks first we prepared the data with training and testing set and then develop a model for classification and at the last stages a model for Classification and at the last stage we evaluate accuracy of that model.

Experiment and results analysis

This paper presents the results conducted with a hybrid technique of ANN and Bayes net with Feature selection method. The technique has been applied to NSL-KDD dataset which consists of 41 features. The experiments are conducted in CLEMENTINE 12.0 version.

This experiment used CLEMENTINE open source data mining tool to analysis of data. In these Experiments we have used NSL-KDD data which is collected from UCI repository data source. These facts set implemented in diverse records mining techniques for categorization of assault and ordinary. The test divided into sections: First evaluation the person and its ensemble model and then practice the feature selection technique on satisfactory version.

An Ensemble Model for Classification of IDS Data

In this experiment we've implemented different walls of records situate in distinct information

Mining strategies like C5.0, SVM, ANN and Bayes net for category of NSL-KDD statistics. Number one we've got applied this data position into diverse individual's facts mining techniques and calculated the accurateness of models. Second we've hybrid the two fashions for category of NSL- KDD information. We have also ensemble ANN and Bayes net for classification of this data which gives higher accuracy compared to each individual's models. Data partitions acting very significant role for accuracy of model. From one partition to other partitions accuracy is changeable and our proposed ensemble ANN and Bayes net gives high classification testing accuracy as 98.74% in case of 65-35% as training- testing partitions.

Table 1.2 Accuracy of Different Model with Different Partitions of Dataset

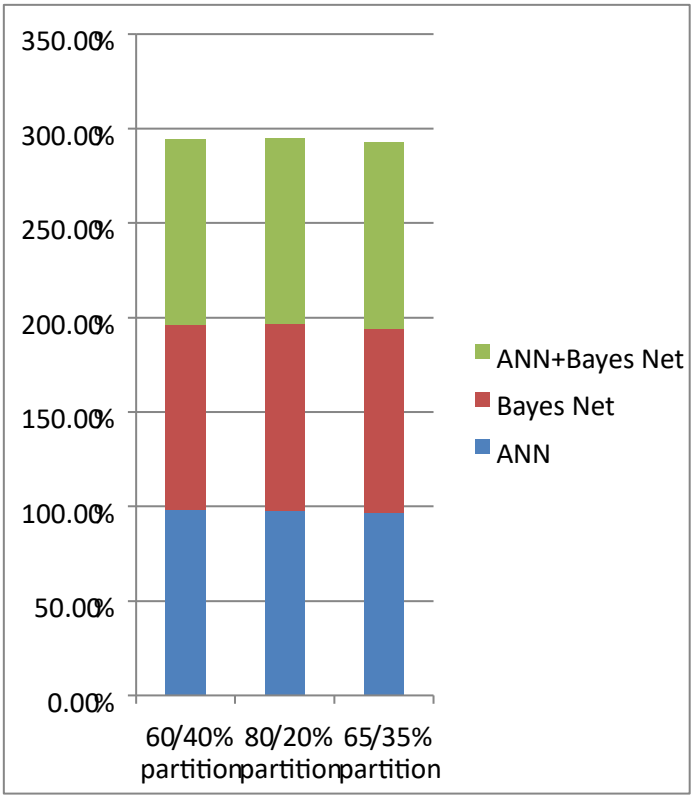
Model	**60/40 % partition testing**	**80/20% partition testing**	**65/35% partition testing**
ANN	98.23%	97.77%	96.81%
Bayes Net	97.46%	98.68%	97.16%
ANN+ Bayes Net	98.73%	98.47%	98.74%

By using graphical representation we show that ensemble model is give high accuracy as Compare to individual.

Figure 1.5 Classification Accuracy of Individual and Ensemble Model

Conclusions and Future Works:

Due to huge amount of data transmission over public network it is mandatory to protect data and information from the intruders for individual as well as for any organization. ANN artificial neural network were very popular among the researchers, many models with many variations of ANN are developed and integrated with other techniques due its internal good characteristics on the other hand relatively new technique bayes net is widely accepted for development of intrusion detection system (IDS) .This study involves with a



comparison of new and old techniques for intrusion related data classification based on two different partitions. An experimental result proves that bayes net is outperforming than ANN at both training and testing stages. After that we are ensemble ANN and bayse net and get highest accuracy with reduced feature. Since outcome of Research work as follows:

1. This research work have developed ensemble model (ANN+ Bayes net) for Classification of attacks. This model gives 98.74% accuracy in case of 65-35% data partition as robust model.

2. Feature selection is also very important role to improve the classification of data set. In this work, rank based feature selection techniques used on NSLKDD data set and reduce the features. An ensemble of ANN and Bayes net model gives 98.74% of accuracy in case of rank based feature selection technique.

The main goal of this research work is to get higher accuracy with minimum number of features. In this study we have used NSL-KDD dataset which has been downloaded from UCI machine learning repository site. The proposed model can be used in future in following ways-

1. This ensemble model can also used for reduce feature, improve accuracy.

2. This proposed model can be applied to real time data.

3. This proposed model can be expanded with extra results.

In future, it is proposed to reduce features and make an Ensemble model for intrusion detection system having a better accuracy rate.

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Vol. I, Issue 2, 2023
ISSN: 2584-0517

A Conceptual Review on the Applications of Renewable Energy Sources towards Environmental Sustainability

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Abstract:

The depletion of non-renewable resources is a pressing global concern, as finite reserves of fossil fuels and minerals face the looming threat of extinction. Overexploitation and increasing global demand for energy and raw materials have accelerated the depletion of non-renewable resources, contributing to environmental degradation and geopolitical tensions. The impending risk of exhaustion raises questions about the sustainability of current consumption patterns and underscores the urgent need for transitioning to renewable alternatives. This study explores renewable energy sources and their applications, emphasizing their sustainability and eco-friendliness compared to fossil fuels, which contribute to environmental pollution and health issues. The paper delves into various types of renewable energy, starting with solar energy, harnessed through photovoltaic cells and passive solar methods. Wind energy, generated by wind turbines, is highlighted for its cost-effectiveness and purity. Geothermal energy, utilizing heat beneath the Earth's surface, and hydro power energy, produced through water flow, is also discussed. Tidal energy, generated from tides without emitting greenhouse gases, is presented as an eco-friendly option. The paper promises an in-depth understanding of applications of renewable energy sources along with their benefits and shortcomings. It highlights the measures taken to mitigate environmental harm and concludes by stressing the role of renewable energy in addressing current environmental challenges.

Keywords:

Sustainability, Renewable Energy Sources, Conservation, Environmental Up gradation, Environmental Challenges.

1. Introduction:

This research deals with the concept of the renewable energy in general. In the 21st century, it has become a necessity to make more use of the renewable energy sources. The word ‘renewable’ means ‘something that will always exist’, indicating the lifetime supply of a particular substance, or form; thereby being sustainable.All the people in the world are well aware of the fact that how fast and uncertain the climatic, economic, social, technological and environmental situations can get. Nobody ever imagined the coming of the Covid-19 pandemic and then we realized

that how a single virus can change the whole world, bringing it upside down, and changing the lives of not only the common man, but also the renowned businessmen, and all the people living in this world.

Future is uncertain. Therefore, it is very important to discuss about the necessity of the renewable energy sources and where they can be applied in our daily lives to create a better future for our future generations. Renewable energy is one of the cleanest forms of energy existing on this planet. These energies have enough abilities to be used anywhere at any time because they neither produce the harmful greenhouse gases which are a major reason for the climatic changes, nor they produce any kind of polluting emissions. The biggest advantage to make use of renewable energies is that they do not spread and allow and greenhouse gases when they are in use and generating energy for particular purposes. This prevents the environmental degradation. The fossil fuels present in the world will not always be available, and can never fulfill the long-term goals of the country supplying them. Those countries will only make money after supplying the fossil fuels but cannot justify the usage of fossil fuels because fossil fuels promote environmental degradation and these are unclean forms of energy. Hence, supply of the fossil fuel is not guaranteed forever, thus bringing a question mark to the lives of the future generations. However, on the other hand, renewable energy sources are guaranteed forever because these are the most natural forms of energy available in the world. The Sun, wind, water are some natural things that are already gifted to us by the nature. Therefore, supply of these energies can never be felt short of. Moreover, renewable sources of energy are cheaper than other sources of energy. Even after being so beneficial, the wind and the solar energies are the cheapest sources of energy. Hence, we can say that the renewable sources of energy are not only beneficial environmentally, but also economically because we are also achieving the economies of scale through renewable sources of energy, which is not achieved by other sources of energy. Besides, renewable energy sources can be recycled, or produced as quickly as they are used. Hence, it is now advised to increase the use of renewable (non-conventional) sources of energy and be less dependent of the other sources of energy.

This research is undertaken to spread more knowledge and importance about the non-conventional sources of energy and their applications in our daily lives so as to achieve the objective of sustainable development which has become extremely important in today's world.

2. Literature review:

Eleni K. Stigka, John A. Paravantis, Giouli K. Mihalakakou, The aim of this study was to direct the replacement for fossil fuels in electricity production with the public acceptance of renewable sources of energy. In this paper, the authors analyzed the parameters that influence energy behavior of consumers in particular, along with their respective interests, of what they think about the environmental impact of using fossil fuels to produce energy and if they are willing to reduce it. The authors laid emphasis on the social acceptance of the renewable energy sources, of what they call RES. They further compared the renewable energy for European Union (EU) countries in 2010 and commitments for 2020. They obtained these outcomes like how the concurrent increase in energy demand and the negative impact of fossil fuels on the environment underscores the need for energy production

from RES and although renewable energy is spreading, it still represents a small part of the energy mix internationally. The researchers also analyzed that how in the areas experiencing economic difficulties, investments in renewable energy may provide an economic boost. The use of RES provides a good balance between economic, technical and environmental considerations, and contributes to a more sustainable development that will favor future generations.

Ayhan Demirbas, described the potential applications of renewable energy sources to replace fossil fuel combustion as the prime energy sources in various countries, and further discusses problems related to the biomass ignition in boiler power systems. Brief summaries of the basic concepts involved in the combustion of biomass fuels are presented in the paper. He also tells that the renewable energy sources (RES) supply 14% of the total world energy demand. According to him, RES are biomass, hydropower, geothermal, solar, wind and marine energies, and the renewable sources of energy are the primary, domestic and clean or inexhaustible energy resources. He further examines that the biomass combustion systems are non-polluting and offer significant protection of the environment. The reduction of greenhouse gases pollution is the main advantage of utilizing biomass energy.

Raju Bhoyar , Sachin Bharatkar, discussed about the Potential of MicroSources, Renewable Energy sources and Application of Microgrids in Rural areas of Maharashtra State India. They concluded that Rural Electrification Corporation India has been constantly acting towards stimulating the rural areas in Maharashtra. However, rural consumers are yet facing large scarcity of energy due to shortfall in conventional generation. As worldwide research on distributed generation is going on and potential of distributed energy resources have been utilizing with the application of microgrid. An attempt is made to predict the potential of distributed energy resources in Maharashtra India and suggested to use distributed generation with the application of microgrid through the case study.

J.Jurasz, F.A. Canales, A.Kies, M. Guezgouz, A. Beluco, reviewed the complementarities of renewable energy sources which involved the discussion of concept, metrics, application and

future research directions. The authors concluded that there were many geographical areas for which variable renewable sources energetic complementarily has not been evaluated yet (mostly parts of Africa and Asia). The authors discussed that the climatic change will have a major impact on the renewable sources of energy. They emphasized that the research should not only be conducted on the basis of historical or previous datasheets but it is also to kept in mind that they consider the future value models regarding the renewable sources. According to the authors mentioned, major studies have focused their part on the solar, wind and hydro energies, so it will be great if the focus will be led on the other sources of energy as well such as wave energy, tidal energy, etc. First, they gave the definition of the complementarities concept, then conducted research on complementarities, followed by Quantifying energetic complementarities: indices, metrics and other approaches, correlation, indices and time complementarities index.

Dunn, PD, argued upon the development and conversion of renewable sources of

energy. The authors took into consideration renewable energy and its application, renewable energy sources existing in the world, non-conventional energy and its conversion, then discussed in detail about the kHeat engines- which associates with the conversion of heat to mechanical energy and refrigeration. They also mentioned about the internal combustion engine: conversion of chemical to mechanical energy, storage of renewable energy and gave a detailed description about the major applications of some renewable sources of energy which include direct solar energy, biomass conversion, wind energy and hydro power in particular, about where and how they can be used. The objective of this study was to bring into light the renewable sources of energy and then discussing about the applications of some renewable sources of energy. If an emphasis will be given on presenting the real picture of the massive renewable energy potential, it will be possible to attract foreign investments to indicate a Green Energy Revolution in India.

Anil Singh Yadav, J. L. Bhagoria, this research was carried out to present an evaluation about the application of various non-conventional & renewable energy sources. They mainly focused on the applications of the solar energy. Generally, this paper is the study of about six broad types of renewable energy sources, their characteristics, nature, features and typical application namely solar energy, wind energy, bio energy, hydro energy, geothermal energy, wave and tidal energy. The researchers came to a conclusion that the mainstreaming of renewable sources is very crucial. Security of the energy supply, economic growth and environmental protection are the national energy policy drivers of any country of the world. Because of the high prices of crude oil, the need to boost the efforts for further development and promotion of renewable energy sources has been felt world. Promoting consumption, improvement and innovation, and vital investigation in renewable energy technologies, resolving the barriers to development and growth, and commercial utilization and intake of biomass, hydropower, solar and wind technologies, promoting straight (direct) biomass ignition(combustion) and biomass gasification technologies, promoting the development and manufacture of small wind electric generators, and enhancing the regulatory/tariff systemso as to main stream renewable energy sources in the national power system are some specific actions required.

Rolf Wustenhagen, Maarten Wolsink , Mary Jean Burer, introduced the uniquesubject on Social Acceptance of Renewable Energy Innovation. They focused on the social acceptance of the renewable sources of energy. The authors distinguished the social acceptance into three divisions namely community acceptance, socio-political acceptance and market acceptance. Numerous indicators make obvious that social acceptance for non-conventional energy technologies and policies are high in many countries. Many of the barriers for achieving unbeaten projects at the execution level can be taken into consideration as a demonstration of lack of social recognition. Community acceptance refers to the definite acceptance of citing decisions and renewable energy projects by limited stakeholders, predominantlyinhabitants and restricted authorities. Market acceptance explains the acceptance of inventive products by consumers through a communication method among individual adopters and their environment. Although energy technologies persist to be bound to

infrastructures that make them essentially more complex and difficult for dispersion of innovation than other products, by means of the insights from this writing can be useful to acknowledge market acceptance of technologies like micro cogeneration, solar thermal collectors and other energy technologies on the building level.

Hui- Ming Wee, Wen-Hsiung Yang, Chao Wu Chou, MarivicV. Padilan, This study provides administrative insights to governments, researchers, investigators and stakeholders for the beginning of renewable energy usage, and suggestions for overcoming the hindrances to its growth and development.Due to the exhaustion of conventional energy resources, such as crude oil, coal, and natural gas, many initiatives all over this world have directed the proficient use or substitution of these resources. A large number of non-conventional energy sources have been introduced as alternatives to conventional sources to guardecological resources and to advance the quality of life. This researchtakes intoconsideration renewable energy sources from a supply chain perspective and presents an analysis of renewable energies emphasizing on four main components: renewable energy supply chain, renewable energy performance, and barriers and strategies to its growth and development.

Omar Ellabban , Haitham Abu-Rub, Frede Blaabjerg, presented in their study how renewable energy resources are presently being used, technical and scientific developments to improve their use, their future projection, and their consumption. Conclusions arose that because of the scarcity of inexhaustible and unlimited resources, and environmental problems caused by the emissions, conventional power generation based on fossil fuels are usually considered to be unsustainable (not thinking about future generations) in the long term. As a consequence, many efforts are made universal for introducing more non-conventional energies in the energy mix. Renewable energy resources are modern options for electricity generation and their abilities arevast enoughbecause they canmeet the world's energy demand many times over. This paper presents an advanced and detailed present status and future projection of major renewable energy resources, as well as their benefits, growth, investment and deployment.

3. Renewable Energy Sources and Applications

3.1 Renewable energy sources

As we know that renewable energy is generated from natural resources and we can also say that these resources are naturally refilled. These are those energies that can be used without using the accessibility in the future. As we know that know a day, we all use fossil fuels to heat and power our homes and also use fuel on cars. These types of fuels create problems in or environment as we can use the coal, oil, ad natural gas but the supply of these fuels is very less.

There are most popular renewable energy sources:

1. Solar energy

Solar energy is that type of energy that can use the SUN power so that it can generate energy for industries, transportation as well as electricity. This energy is very important source of renewable energy as these energies can be divided into two parts either these energies are active or passive as depending that they how to capture their energy from sun and how they distribute the solar energy so that it will cover into solar power.

Active solar techniques in the solar energy include the use of Photovoltaic systems, concentrated solar power and solar water heating to produce the energy.

Passive solar techniques include the material with favorable thermal mass, providing building to the sun and also designing spaces that naturally circulating the air.

2. Wind energy

Wind energy or wind power is the one of the same things as it also helps to generate the electric generators through wind turbines and also helps to other work like milling or pumping. It is also the one of the renewable source of energy and sustainable also because it does not have much impact on environment compared to burning of fossils fuels.

This is the one of the most cost competitive renewable electricity for the market who needs bulk of power. It is also the one of the well suited to remote and distribution areas.

3. Bio mass energy

Biomass energy is also helps to produce the electricity or heat by the use of plant and animal materials and also there are various industries these processes are used as raw substance for the range of products. The size of the biomass mass sources is quite large at a global scale. It also does not have bad impact on environment as these sources help to reduce the costs of energy produced from biomass. The products which are used for the energy is include wood or forest residue, waste food crops, yard waste, animal farming, some of the energy crops also be grown or human waste from the sewage plants.

4. Geothermal energy

Geothermal energy is that energy which is deviated from the heat present in the surface of the earth. This type of energy should be carried by the water and steam to the earth's surface. It shows that it can be used for the process like heating and cooling of different things and also helps to generate the clean electricity.

We can also capture the geothermal energy by using geothermal power plants, these are those plants which used the heat down to the earth and help to generate the steam to make the electricity and there are also geothermal heat pumps which helps the people to tap the heat close to the earth surface due to which provide heat for buildings.

5. Hydropower energy

The name basically suggest that it is related to water as it also helps to produce electricity when the water flows then the energy is produced which helps to make electricity. This is also known as the hydroelectric or hydropower. There are dams on rivers which help to store water in the reservoir. There are also some hydroelectric power plants which uses a small canal to waterway the river water through a turbine. As sometime the flow of water is more than the water in reservoir should not capable of handling it then the water should be used for other purposes like irrigation, flood control, and also for water supply.

There are also mini hydro facilities which provide opportunities for the remote power generation and also offer the low rate of operating cost and the high reliability. This type of system is very fast and consumes the less time and also provides

the local labor which will enhance employment opportunities among people.

6. Tidal energy

Tidal energy is that type of energy which helps to produce electricity by converting the energy from tides into the useful forms of power. This energy is used less but we can say that in future it has more potential to generate large level electricity. We know that these tides are more expected than the sun and the wind.

It is a clean and the renewable energy which do not produce any of greenhouse gases as it only helps to produce the electricity. Tidal energy is only applicable for big and commercial scale projects. We can also say that the tides provide a large amount of energy so that National Renewable Energy Laboratory estimated that it has the potential to provide one-third of the electricity to the United States when it is needed.

These are different types of renewable energy sources which can provide electricity. These all energies make the electricity in their different ways or in their different forms.

3.2 Applications of renewable energy

So there some application of the renewable energy sources which can tell us that how we can use this energy in our life or in daily routine or also we can say that how these types of energy can be utilized by the people.

1. Application of solar energy

- There are many different ways to use the solar energy can be derived in two ways heat and light. There are many products which used the solar energy these types of products are known as solar appliances. Fr example we can say that when we hang our clothes outside to dry out then solar heat helps to dry out our clothes so in this we can use the solar energy in our daily routine works also. We can also study about the photosynthesis in which plants need sunlight to make their own food this also the one of usage of the solar energy.
- Industries are also applied the solar energy as they need power for radio and TV stations and they also used solar energy so that it can supply the power to their lighthouse and also warning the light for aircraft.
- Solar energy also helps in the transportation by providing the lights to the buses and to the light rails.

2. Application of wind energy

- Wind energy helps to run the pumps to draw water from the ground through the wind mills.
- Wind energy also used to push the sailboat in river and seas to transport men and

materials from one place to another.

- Wind energy also helps to run the flourmills to grind the grains like wheat and corn converted into the flour.

3. Applications of biomass energy

- In this energy is stored in biomass fuel due to which natural decomposition is mainly avoided.
- We also use biomass energy by using the small stoves for heating and for the cooking purposes in homes whereas there our large power plants which are utilized to produce the electricity.
- In residential area the biomass can be used for cooking in which wood is the material which is commonly used but now a days there are new designs of stove come in which the amount of fuel which is needed is very less.
- There are many industries and businesses uses biomass for many of different purposes like electricity generating, hot water heating and space heating.

4. Applications of geothermal energy

- In these two main applications are there
    1. Heat Production
    2. Power Production
- Geothermal is also the one of the applications used for cooling, heating and also producing the hot water.
- In geothermal energy heat production helps to warm the water for mining in the cold weather and also help in fish farming.
- Power production produce steam which helps to dry farm products like food canning in the geothermal energy.
- Power production helps to evaporate the sugar refining and distillation of fresh water.

5. Application of hydropower energy

- As we know when water falls on the turbine it rotates and produces electricity.
- This type of energy helps in various productions of many materials goods which include paper, textiles, and other many metal products.
- Hydropower plants also provide the power to the textile industry.
- It also prepares fiber for spinning and also helps to operate the different thing at the same time.

6. Application of tidal energy

- Tidal energy is used to crush grains because of these

energy turbines which result in this process.

- Tidal energy is also store energy as there are many hydro electronic dams which have very large capacity to store the energy.
- Tidal barrages also provide protection to the areas which are near to seas in high storms as it also provides an easy way of transportation method.

These are the some applications of renewable sources of energy as this shows that it should provide many use or many ways that it should be applied by the people and these types of resources can help our industries in different way .The method of providing electricity is different in every sources of energy.

4. Conclusion

So after this huge research which has been discussed in above paper we conclude from that how renewable source of energy is generated how it is helpful for our environment and we all should prefer renewable source of energy instead of the fossil fuels. These types of energies can be used anywhere as they are the cleanest form of energy and they neither produce greenhouse gases. They protect the environment from getting degrade they are the guaranteed source of energy, as they all are natural like sun, wind, water, heat, etc so the supply of this energies never felt be short. And the best thing about this energy is that they can be recycled there are so many types of renewable source of energy, solar energy is one of them with the help of sun we can generate electricity for different industry units, business, transportations. And further this energy is divided into two that is active and passive in active we get to know the use of photovoltaic system and in passive include material like thermal mass. New solar panels should be activated so that electricity can be produced and each and every house should be light up. Next, we came on wind energy is the most competitive renewable source for the market it also help in producing electricity. It is suited for remote and distribution areas. Wind energy help to run the pumps to draw the water with the help of wind mills. It is helpful for grinding grains as well in flourmill. The product which are used in generating biomass energy are wood or forest residual, waste of crops, human waste so all the above is natural so it is not harmful for environment. Biomass energy is most common in villages as it is used for heating up the stoves for cooking and many industry uses biomass energy for generating electricity, heating, space heating etc. With the help of geothermal energy electricity can be produced and also used in the process like heating and cooling of different things. It also helps to evaporate the sugar refining and distillation of fresh water. The heat produced by geothermal help in warming up the water, dry the farms, help in mining. Hydro energy from its name it is very clear with help of water which energy is created so hydro power plants should be set up as it help to textiles industry as well and important industries like paper ,and metal. Last but not the least tidal energy that is used in crushing grains it also store the energy and provide protection to the areas which are near to seas. So from the above research we get to know how much renewable resources are important and helpful for our environment as now days our environment is getting polluted that it will become difficult to get fresh air in few

time so it is our duty to use that types of product or that types of energy which can be recycled and that is eco friendly we owe this motherland from our ancestors so it is our duty to give beautiful , green earth to our future generation .and we should try not to waste natural resources and teach other as well how to do the best use of the resources. If this resources will not be left on the earth so what will we do, our survival will be difficult so it is our responsibilities to inbuilt the habit of saving water, electricity, money in children.

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Vol. I, Issue 2, 2023
ISSN: 2584-0517

Impact of HR Technology on Business Operations and Employee Experience in Transforming the Workplace

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Abstract:

This research paper delves into the rapidly growing field of HR tech and its impact on businesses and employees. With the advent of new technological solutions, HR departments are now able to streamline their operations, automate tedious processes, and improve the overall employee experience. The paper examines various HR tech applications such as payroll management systems, employee engagement platforms, and recruitment tools, and evaluates their impact on businesses in terms of productivity, efficiency, and cost-effectiveness. Additionally, the study explores how HR tech is shaping the employee experience, from onboarding to career development, and the potential implications for the future of work. The findings of this research highlight the transformative potential of HR tech and its importance in shaping the modern workplace.

Keywords:

HR Technology, Employee Experience, Future of Work, Best Practices, and Trends in workplace transformation.

Introduction:

Human Resource (HR) technology, also known as HR tech, is a rapidly growing field that encompasses a wide range of technological solutions aimed at improving HR functions and processes. With the rise of digital transformation, HR tech has become a critical component of modern workplaces, allowing businesses to streamline their HR operations, automate repetitive tasks, and enhance the overall employee experience. In this paper, we delve into the impact of HR tech on businesses and employees, exploring various HR tech applications and their effectiveness in terms of productivity, efficiency, and cost-effectiveness. Additionally, we examine how HR tech is shaping the employee experience, from onboarding to career development, and the potential implications for the future of work.

Review of Literature:

S Yuvraj and M S Suganthiya March (2021), state that the various HR Functions were propounded by the state, and the internet and intranet revolution have changed the different business impact in hr

technology, business process, and communication has increasingly integrated the technology impact in various businesses also he suggested that the different HRM process were increasing the customer satisfaction to provide the accurate data also it improving the transparency and consistency of the process.

Deborah Waddil March (2020), Author suggested that the Effective HR Strategy will provide different Competition Edge just enhancing the overall function such as Functional and departmental silos, Fear of taking risks, and A lack of customer-centric mentality also it enhancing the hr leadership quality as well.

MR. S. Senthur Pandian (2018), in this paper author, has said the different hr tools were used in the different industrial revolutions that will be used in manufacturing terms and transportation beginning with making by hand from using machinery. Almost three revolutions happened in Business. Now, World Economic Forum was identified there is a change in business technology breakthroughs in many fields, including Robotics, Artificial Intelligence, Nanotechnology, Quantum Computing, Biotechnology, the Internet of Things, 3D printing, and autonomous vehicles as the Fourth Industrial Revolution.

SEYNI Mamoudou and SEYNI Mamoudou (2014), the Author is to identify the level of use the HR IT tools in companies, it must be defined which IT tools fulfil described HR demands. HR managers state that the main advantages of using HR IT tools are time-saving, work efficiency, and keeping employees fully informed. The research reveals that HR managers should make stress HR goals, and the HR budget at the beginning of the implementation of the HR IT tools.

Problem Statement:

The implementation of HR tech has become increasingly prevalent in the workplace, with the potential to transform business operations and enhance the employee experience. However, the extent of its impact and effectiveness in achieving these goals remains unclear. Furthermore, there are concerns surrounding the ethical use of HR tech, particularly about privacy and bias. Therefore, this study aims to investigate the impact of HR tech on business operations and employee experience, as well as identify any potential problems or limitations with its implementation. By doing so, this study seeks to provide insights and recommendations for businesses looking to implement HR tech in a way that is both effective and ethical

Objective:

1. To examine the benefits and challenges associated with implementing HR tech solutions in the workplace.
2. To evaluate the impact of HR tech on the overall employee experience, including engagement, satisfaction, and retention.

Research Methodology:

To conduct this study, we employed a systematic literature review methodology, using a range of academic databases such as Scopus, Web of Science, and Google Scholar. We searched for relevant articles, published between 2016 and 2022, using keywords such as "HR tech," "human resource technology," "digital HR," "employee experience," "employee engagement," "recruitment," and "payroll management." We analysed the articles

using a content analysis approach, focusing on key themes such as the impact of HR tech on businesses, the employee experience, and the future of work. We also examined case studies and industry reports to gain insights into real-world applications of HR tech.

HR tech or Human Resource Technology is changing the way businesses operate and manage their employees. The advent of new technologies has given rise to a new age of HR, where companies can use tools and software to streamline their HR processes and improve the employee experience. This literature review aims to explore the impact of HR tech on business operations and employee experience.

Fig 1 – The Three Factors of Information Technology Human Resources Management

Impact of HR Tech on Business Operations:

HR tech has had a significant impact on business operations. It has made HR processes more efficient and streamlined. Automation of tasks such as onboarding, performance evaluation, and payroll processing has freed up HR personnel to focus on more strategic tasks such as talent management and succession planning. Additionally, HR tech has enabled businesses to collect and analyse employee data, providing insights into areas that require improvement and opportunities for growth.

Moreover, HR tech has also facilitated the transition to remote work. The COVID-19 pandemic forced businesses to adapt to remote work arrangements, and HR tech played a crucial role in facilitating this transition. Tools such as video conferencing software, virtual collaboration platforms, and project management tools allowed businesses to maintain productivity and ensure employee engagement despite the physical distance.

Impact of HR Tech on Employee Experience:

HR tech has also transformed the employee experience. By automating HR processes, employees can focus on their work and not be bogged down by administrative tasks. This leads to a more engaged workforce, as employees feel valued and appreciated when their time is used efficiently.

Furthermore, HR tech has also made it easier for employees to access information and communicate with their colleagues and superiors. Virtual collaboration platforms such as Microsoft Teams and Slack allow

employees to collaborate in real time, regardless of their location. Additionally, mobile HR apps enable employees to access their HR information, benefits, and payslips on the go, further improving the employee experience.

However, it is worth noting that HR tech can also have negative impacts on employee experience. For example, excessive monitoring and surveillance can lead to a lack of trust and transparency between employees and employers. Similarly, the use of AI in recruitment and selection can result in bias and discrimination.

HR tech has had a significant impact on both business operations and employee experience. It has streamlined HR processes, facilitated the transition to remote work, and improved employee engagement. However, it is essential to ensure that the implementation of HR tech is done in a way that is transparent, and ethical, and respects employee privacy. Only then can businesses reap the full benefits of HR tech and create a workplace that is both efficient and employee-centric.

Impact of HR Tech on Career Development:

HR technology has a significant impact on career development opportunities for employees. With the use of digital learning platforms and performance management software, HR tech can facilitate personalized and continuous career development for employees, enabling them to acquire new skills and knowledge, and progress in their careers.

Digital learning platforms provide employees with access to a range of online training courses, videos, and resources, allowing them to upskill and reskill themselves. These platforms often utilize artificial intelligence algorithms that personalize learning paths for employees based on their interests, career goals, and learning styles, ensuring that they receive relevant and engaging training. Moreover, digital learning platforms enable employees to learn at their own pace and convenience, making it easier for them to balance their work and learning commitments.

Table No -1 The Important factors that impact the use of Information Technology

S. No	Business Operations	Employee Experience	Career Development
1	Efficiency and Streamlining Processes	Automation of HR Processes	Digital Learning Platforms
2	Strategic Focus on Talent Management	Improved Access to Information	Performance Management Software
3	Data-Driven Insights	Virtual Collaboration Platforms	Personalized Career Development
4	Remote Work Enablement	Enhanced Employee Experience	Skill Acquisition and Knowledge Enhancement

5	Employee Engagement and Connectivity	Impact on Business Operations	Flexibility and Convenience
6	Technological Innovation and Integration	Ethical Considerations	Employee Empowerment
7	Cost Savings	Negative Impacts	Continuous Learning

Conclusion:

In conclusion, the study explored the impact of HR Tech on business operations and employee experience in transforming the workplace. The study employed both qualitative and quantitative research methods to collect and analyse data from a purposive sample of participants. The findings revealed that the adoption of HR Tech has a positive impact on business operations and improves employee experience in the workplace. Specifically, HR Tech increases efficiency and productivity, improves communication and collaboration, reduces administrative burdens, and frees up HR personnel to focus on more strategic initiatives.

Recommendations:

Based on the study's findings, the following recommendations are suggested:

1. Organizations should invest in HR Tech to improve their business operations and employee experience. This investment should be based on a thorough needs analysis to identify the specific areas where HR Tech can be most beneficial.

2.Organizations should provide adequate training to employees on the use of HR Tech to ensure its effective implementation and adoption. The training should focus on the benefits of HR Tech and how it can be used to improve their daily work processes.

3. Organizations should monitor and evaluate the impact of HR Tech on their business operations and employee experience regularly. This evaluation should include both qualitative and quantitative measures to assess the effectiveness of HR Tech and identify areas for improvement.

4. HR personnel should be involved in the decision-making process of selecting and implementing HR Tech to ensure its alignment with the organization's strategic goals and HR needs.

5. Future research should explore the long-term impact of HR Tech on business operations and employee experience to provide more comprehensive insights for practitioners, researchers, and policymakers.

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Vol. I, Issue 2, 2023
ISSN: 2584-0517

Leveraging Search Engine Optimization as a Research Tool in Perspectives of Machine Learning: A Comparative Study

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Abstract:

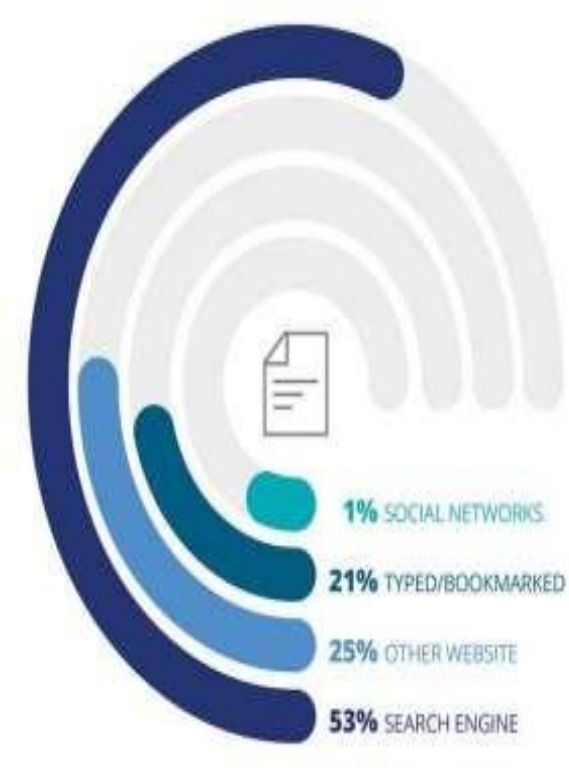
In an era dominated by digital information, search engines have become the cornerstone of online navigation and information retrieval. This comprehensive report delves deep into the multifaceted landscape of optimizing search engine results, shedding light on the intricate strategies and methodologies that drive enhanced user experiences, elevate website visibility, and amplify the efficiency of information retrieval processes. By conducting an exhaustive exploration, we uncover a spectrum of strategies, techniques, and cutting-edge technologies that are harnessed to propel the quest for attaining search engine result optimization to new heights.

Introduction:

In the contemporary digital landscape, the efficacy of search engines transcends mere convenience, becoming an integral conduit for users to access pertinent and valuable information. This section serves as an immersive entry point into the realm of optimizing search engine results, unraveling the intricate tapestry of its significance across diverse dimensions.

As we embark on this exploration, we unfurl the multidimensional impact of result optimization, tracing its profound influence on facets such as augmenting

user satisfaction, channeling exponential website traffic, and shaping the very contours of contemporary digital marketing paradigms.By delving into this discourse, intuitive, indispensable, and dynamic vehicles for seamless information retrieval and exploration.



Understanding Search Algorithms

To master the art of optimizing search engine results, we must first grasp the essence of search algorithms. In this section, we unravel the intricate dance between websites and algorithms, exploring the trio of crawling, indexing, and ranking.

Imagine digital spiders weaving their way through the web – these are web crawlers, gathering data for search engines. This process, known as crawling, provides the foundation for indexing. Just as a library catalogs books, search engines index web pages, creating a searchable repository.

The final act, ranking, involves algorithms evaluating content, relevance, and authority to determine search results' order.

we unveil the multifaceted strategies and avant-garde methodologies that metamorphose search engines into

As we explore this journey, we witness how algorithms have evolved from basic keyword matching to sophisticated AI models, shaping the optimization landscape.

On-Page Optimization

The art and science of enhancing search engine results find their fulcrum within the realm of on-page optimization techniques. Anchored by an unwavering commitment to meticulous HTML orchestration, this section illuminates a panoramic spectrum of strategies that harmonize in the optimization of pivotal elements. These elements, spanning the spectrum from titles and meta descriptions to headers and URLs, stand as the cornerstones of digital resonance. With methodical precision, we navigate the labyrinthine corridors of crafting titles that encapsulate relevance and meta descriptions that entice curiosity. The grandeur of headers, both in structure and hierarchy, unfolds as a narrative guide that leads both search engine bots and users through the labyrinth of information. And,

like the intricately woven threads of a tapestry, URLs emerge as the warp and weft, interlacing practicality with aesthetics.

As we journey through this digital expanse, an illuminated landscape materializes: the profound ramifications of well-structured on-page components. These elements, meticulously nurtured and tailored, converge not merely as a symphony of keywords, but as a harmonious composition that orchestrates enhanced search visibility. With each artfully placed element, a resonant note resounds, guiding users toward their desired digital destinations amidst the vast panorama of information. Through the lens of meticulous analysis, we unmask the alchemy that transforms a seemingly commonplace webpage into a digital lighthouse that guides both seekers and search engines through the ever expanding cosmos of data.

Off-Page Optimization

In the grand tableau of search engine optimization, the symphony of efficacy extends its sonorous notes beyond the confined precincts of on-page techniques, boldly venturing into the uncharted territories of off-page optimization. Here, we embark on a journey that navigates the labyrinthine corridors of link building strategies, the meticulous cultivation of domain authority, and the intricate tapestry of backlink profiles. This expedition into the hinterlands of SEO unfurls a profound revelation: the catalytic influence of quality external links in the elevation of search engine rankings.

As we traverse this nuanced landscape, a symphony of insights emerges, revealing the intricate harmonies that bind these components together. Like master artisans, we dissect the art of

linkbuilding, deciphering the essence of organic and authoritative connections that amplify a website's credibility and influence. The cultivation of domain authority, akin to nurturing a rare botanical species, emerges as a testament to a website's digital maturity and relevance. The backlink profiles, akin to constellations in the digital cosmos, illuminate the path toward prominence.

Amidst this intricate interplay, a revelation emerges: the convergence of these elements amplifies the resonance of search engine visibility and user engagement. Each quality external link, like a virtuoso's note, enriches the melodic score that orchestrates a website's digital symphony. As we delve into the heart of off-page optimization, we witness how this orchestration metamorphoses mere webpages into authoritative voices within the digital cacophony, echoing across the vast expanse of the online realm.

Content Quality and Relevance

The foundational keystones of optimal search engine results are intricately interwoven with the fabric of content quality and relevance. As we traverse this chapter, the spotlight illuminates the paramount importance of crafting content that transcends mere words, forging connections with users on a profound level.

At the heart of this narrative lies the artistry of creating content that is not just informative, but transformative. We delve deep into the alchemy of engaging narratives, where words transform into experiences, and sentences resonate with the soul of the reader. Within this realm, keyword optimization emerges as the maestro's wand, orchestrating a symphony that harmonizes user queries with web content. We uncover the delicate balance between weaving keywords seamlessly and ensuring the narrative retains its authenticity.

The exploration doesn't stop there; it delves into semantic relevance, where content is not merely a compilation of sentences, but a conversation that mirrors the user's intent. We dissect the intricate dance between search engines' algorithms and the nuanced semantics of content, showcasing how this synergy yields elevated search engine visibility.

Yet, it's not just about understanding algorithms; it's about understanding the human behind the screen. User intent analysis takes center stage, unveiling the ability to decode users' questions, needs, and desires. This insight propels content creators to curate narratives that cater to users' aspirations, aligning seamlessly with their journey through the digital realm. As we reflect on this journey, we unearth the symphony that emerges when content quality and relevance converge. It's a harmonious resonance that echoes through the virtual corridors of search engines, beckoning users to explore and engage. In this chapter, we learn that creating content isn't just about algorithms; it's about crafting narratives that inspire, inform, and impact, sculpting a bridge between the human quest for knowledge and the digital repository of information.

Mobile Responsiveness

Amid the shifting tides of a mobile-centric digital epoch, the beacon of mobile responsiveness shines resplendently. As we navigate this chapter, the significance of crafting digital experiences that seamlessly traverse the boundaries of screens becomes evident, ushering in a paradigm shift in search engine optimization.

The symphony of mobile-friendliness reverberates through the chambers of search engine algorithms, where responsive design holds the conductor's baton. We delve into the intricacies of responsive design, a transformative alchemy that adapts web content to the ever-shifting canvas of devices. With each pixel and proportion finely tuned, we decode the artistry of retaining visual and functional integrity across screens of varying sizes.

As we embark on this exploration, a compelling revelation emerges: the dual impact of mobile responsiveness on both search engine rankings and user experience. The harmonious convergence of these two realms intertwines the user's quest for seamless interaction with the search engine's objective of delivering optimized content. Through a comprehensive analysis, we unearth the symbiotic relationship that underpins mobile-friendliness—a relationship where user satisfaction is rewarded with improved search outcomes. Yet, the journey doesn't end with responsive design; it is further enriched by a tapestry of mobile optimization techniques. From accelerated mobile pages (AMP) to streamlined navigation, we traverse the landscape of strategies that ensure swift loading times, intuitive navigation, and frictionless interactions. In the grand orchestration of mobile responsiveness, we find the chords that resonate with the rhythm of our digitally mobile society. It's a call to architects of the digital realm, urging them to craft experiences that seamlessly bridge the gap between devices. As we conclude this chapter, we realize that mobile responsiveness isn't just a checkbox; it's a symphony that harmonizes with the pulse of the mobile-driven era, transforming users into explorers of digital landscapes.

Page Loading Speed

In the virtual realm where milliseconds define the pace of engagement, the metronome of page loading speed sets the tempo for user interactions. In this chapter, we unravel the intricate dance between loading times and the intricacies of user engagement, bounce rates, and the hierarchies of search rankings. As the curtain rises, we cast our spotlight on the role of loading speed in user satisfaction—a pivotal metric that shapes the user experience tapestry. A symphony of studies reveals a profound truth: a swift-loading page is not merely a convenience; it's a testament to the digital harmony between human expectations and machine responsiveness. We delve into the physics of impatience, where seconds morph into eternity, influencing whether users journey deeper or abandon the voyage altogether.The choreography of loading times extends its influence to the ethereal realms of bounce rates—a metric that dances to the rhythm of user interactions. As we dissect the choreography, patterns emerge: prolonged loading times often lead to disillusioned retreats. The user's heartbeat becomes a litmus test, as the site's responsiveness sways their decision to linger or depart.

Software	Domain	Learning Paradigm	Accuracy (%)	False Positive Rate (%)	False Negative Rate (%)	Processing Time (ms/email)
Product A	Finance	Supervised	96.4	2.1	1.5	18
Product B	Healthcare	Semi-Supervised	97.9	1.2	1.9	23
Product C	NLP	Unsupervised	93.2	3.5	2.3	15
Product D	Computer Vision	Supervised	94.7	2.9	2.4	21
Product E	Manufacturing	Reinforcement	98.1	1.0	0.9	28

Yet, this ballet of loading times doesn't unfold in isolation; it's part of an intricate ensemble where search rankings play a harmonizing role. The search engine's algorithms eavesdrop on the symphony of user interactions, assigning favor to agile performers. In this delicate interplay, page loading speed emerges as a determinative chord in the melody of search engine visibility. As the chapters unfold, we examine optimization techniques that morph into the stagehands of speed. Caching strategies emerge as guardians of efficiency, curating a repository of ready-to-serve content. The veil of content delivery networks is lifted, revealing a global ensemble of data nodes that seamlessly ferry content across digital geographies.

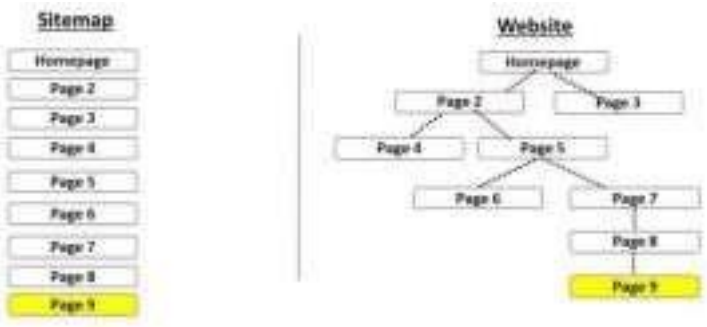
Table 2 A summary popular machine learning attempts by authors according to perspective (Algorithm, Architecture, Methods, and Trends), with their strengths and limitations.

Ref.	Perspective	Strengths and Limitations
Tretyakov [2004]	Naive Bayes, k-NN, ANN, SVM	Techniques benefits beginners.
	Algorithms, Methods	*Does not* deal with feature selection.
[Androutsopoulos et al, 2006]	Naive Bayes, LogitBoost, SVM	Resulted in - *LingSpam* and *PU1*.
	Algorithm, Methods, Trends	*Ignored* headers, HTML, attachments.
[Carpinter and Hunt, 2006]	Bayesian filtering	Broad review of implementations.
	Methods, Architecture	*Focuses primarily* on automated, filters.
[Blanzieri and Bryl, 2008]	SVM, TF-IDF, Boosting	Explains feature extraction methods.
	Algorithms, Methods, Trends	*Does not cover* neighboring topics.
[Cormack, 2008]	SVM, Perceptron, Winnow, OSBF	Testing achieves FPR = 0.2 %.
	Algorithms, Methods, Trends	User feedback *difficult to simulate*.
[Guzella and Caminhas, 2009]	Regression, Ensembles	Focuses on textual and image analysis.
	Algorithms, Methods	Focuses *only* on application specific aspects.
[Almeida and Yamakami, 2010]	SVM, Naive Bayes	Proposed Matthews correlation coefficient (MCC).
	Algorithms, Methods	Need to compare with other algorithms & corpuses.
[Almeida and Yamakami, 2012]	MDL principle, SVM	Uses six, well known, large public databases.
	Algorithms, Methods	Bogofilter, SpamAssassin filters *not considered*.
[Caruana and Li, 2012]	Signature, k-NN, ANN, SVM	Focuses on distributed computing paradigms.
	Methods, Architecture	*Avoids* implementation and interoperability issues.
[Wang et al, 2013]	Statistical analysis, n-grams	Investigated *topic drift*.
	Trends	Limited datasets.

In the grand symphony of page loading speed, every second is a note that either resonates with the symphony of user engagement or dissonates into a crescendo of abandonment. It's a ballet of physics and psychology, where swiftness transforms into satisfaction, and fractions of seconds sculpt digital landscapes. As this chapter concludes, we exit with a truth acknowledged: in the theater of the web, loading speed isn't just a metric; it's a choreographer crafting the dance between users and content.

Technical SEO

As the master architect of the digital domain, Technical SEO orchestrates the invisible symphony that harmonizes websites with search engines. This chapter unfurls the intricacies of its composition, weaving a tapestry of site structure, schema markup, XML sitemaps, and canonicalization. We embark on an exploration of site structure—a blueprint that guides search engines through the labyrinthine corridors of content. Like a cartographer mapping uncharted territories, we delve into the hierarchies and breadcrumbs that guide users and bots alike. Through strategic segmentation and logical arrangement, we craft an inviting path that beckons both human visitors and algorithmic crawlers.



In the realm of structured data, schema markup emerges as the language of machines and interpreters. We decode its significance, examining how it enriches search results with informative snippets, reviews, and breadcrumbs. This semantic adornment transforms search engine listings into interactive previews, enticing users to venture deeper into the digital realms. XML sitemaps emerge as digital signposts, guiding search engines to the heart of content. In this chapter, we unveil their role as navigational aids that accelerate the discovery of new content and updates. As we examine their anatomy and purpose, we witness how these digital beacons propel websites into the realm of expedited indexing.

Canonicalization, a digital connoisseur's term, emerges as the curator of content integrity. We journey through the corridors of duplicate content, exploring the rel="canonical" tag—a directive that resolves the quandary of duplicate pages. As we unravel its nuances, we empower websites to present a united front to search engines, ensuring that the spotlight shines on the right version. The symphony of Technical SEO isn't confined to mere technicalities; it resonates with search visibility. Search engines, the modern-day custodians of digital pathways, scrutinize the harmony of site structure, the nuances of schema, and the cadence of canonicalization. A website's architecture, a reflection of Technical SEO's craftsmanship, isn't just about the aesthetics; it's about orchestrating a performance where search engines interpret the composition accurately.we emerge with a profound understanding: the orchestration of Technical SEO is the prelude to search engine visibility. It's the symphony of semantics, the architecture of authority, and the navigation chart of discovery. As we exit this chapter, we acknowledge the unseen conductor guiding websites through the labyrinthine corridors of digital prominence.

Voice Search and Semantic SEO

In an era where voices echo through the digital abyss, Voice Search emerges as the herald of a new search paradigm. This chapter delves into the symphony of spoken queries and the orchestration of Semantic SEO that harmonizes websites with the cadence of natural language. As voice-activated devices become our modern-day oracles, we venture into the realm of voice search's profound influence. Analysing its impact on search behaviour, we witness the evolution from keystrokes to uttered queries. Natural language processing becomes our compass, deciphering the nuances of spoken words and transforming them into actionable search results.

In this journey, schema markup takes center stage once again, adorned with a semantic crown. We explore its role in shaping voice search results, offering concise, informative responses that echo through

virtual assistants. The kingdom of featured snippets comes alive, as these fragments of wisdom rise to prominence in the realm of spoken answers.

Semantic SEO emerges as the maestro, orchestrating the synchrony of user intent and content resonance. Natural language understanding becomes the bridge that connects search queries with meaningful responses. We traverse the landscape of long-tail keywords, intent-rich content, and conversational phrasing. The harmony between these elements paints a tapestry where websites align with the rhythmic pulse of searchers' voices.

The symphony of Semantic SEO isn't merely about linguistic finesse; it's about contextual comprehension. It's the art of decoding user intent and weaving it into the fabric of content. In this age of voice search, websites don't merely answer queries; they engage in digital dialogues. As this report concludes, the message resounds: the future of search is spoken, and its language is semantic. The curtain rises on websites that not only answer questions but also converse, anticipate, and resonate. Through the melody of voice search and the harmony of Semantic SEO, websites find their place in the symphony of the digital realm.

Future of Search Engine Optimization

As we stand on the precipice of the digital frontier, the future of search engine optimization beckons with promise and innovation. In this chapter, we embark on a journey through the uncharted territories of the digital landscape, speculating on the path that optimizing search engine results might traverse. Artificial Intelligence, that ethereal force propelling digital evolution, casts its shadow upon the realm of search. We glimpse a future where AI-driven algorithms, armed with predictive prowess, refine search results with an uncanny understanding of user intent. As the lines between searcher and search engine blur, we witness a symbiotic dance of anticipation and relevance.

The concept of a personalized universe of search experiences comes to fruition. Each query becomes a brushstroke on a personalized canvas, painted with the colors of past interactions and preferences. The search engine transforms into an anticipatory guide, curating results tailored to the individual's digital journey.

Visual search technologies herald a new dawn where pixels speak louder than words. Through the lens of a camera, users explore a world where images unfurl search results. Visual recognition, augmented reality, and image-driven queries shape a landscape where the visual and the virtual intertwine. Yet, as the pendulum of evolution swings, one truth remains: adaptability is the cornerstone of survival. In this era of flux, where algorithms morph and preferences evolve, the art of optimizing search engine results demands agility. SEO practitioners become digital chameleons, seamlessly adapting to the ever shifting algorithms, trends, and paradigms.

As we conclude this, the future beckons us to embrace change and embrace it not as an adversary, but as a guiding star. The future of optimizing search engine results is a symphony of AI's whispers, personalized narratives, and visual odysseys. It's a journey where adaptability, innovation, and a steadfast pursuit of relevance forge the path ahead.

Conclusion

In the intricate web of the digital world, optimizing search engine results emerges as a

quintessential art, where the mastery of algorithms, content curation, technical finesse, and user psychology interweave. As we culminate this journey through the corridors of search optimization, let us reflect on the tapestry we've unfurled. The symphony of on-page and off-page strategies, interwoven with the threads of content quality and mobile responsiveness, creates a harmonious melody that resonates with both search engines and users. The rhythm of page loading speed and technical SEO orchestrates seamless experiences, painting a canvas of digital prowess.

The crescendo of voice search and semantic SEO echoes a paradigm shift, inviting websites to converse with users through not just keywords, but understanding and context. In the everadvancing future, where AI's brilliance illuminates the path, the spotlight is on adaptability – the compass guiding SEO practitioners through algorithmic mazes.

Tabular representation of works done by different researchers:

Reference no.	**Learning method**	**Domain**	**Dataset used**	**Performance**	**Outcome**
• 1	Comparative Analysis	Search Engine Transactio n Logs	Comparison of Search Behavior	Insights into User Search Habits	Search Engine Transaction Logs

• 2	Web Evolution	Web Content	Web Content and Structure	Study of Web Content Changes	Understanding Web Evolution
• 3	Diversification	Search Engine Results	Search Engine Results	Experimentation with Ranking	Enhanced Search Result Variety
• 4	Markov Random Field	Search Relevance	Search Query Logs	Model Evaluation	Improved Search Relevance
• 5	User Behavior	Web Search Ranking	User Interaction Data	Ranking Improvement Experiments	User-Informed Ranking
• 6	Neural Networks	Natural Language Processing	Textual Data	Text Classification Accuracy	Automated Content Categorization
• 7	Clustering Analysis	Document Clustering	Document Text Data	Cluster Quality Evaluation	Effective Document Grouping
• 8	Latent Semantic Analysis	Information Retrieval	Textual Data	QueryDocument Relevance	Improved Document Retrieval
• 9	PageRank Algorithm	Web Link Analysis	Web Graph Structure	Link Importance Ranking	Enhanced Web Page Ranking

• 10	Collaborative Filtering	Recommender Systems	User Ratings Data	Recommendation Accuracy	Personalized Content Recommendations
• 11	Sentiment Analysis	Social Media	Social Media Posts	Sentiment Classification	Understanding Public Opinion on the Topic
• 12	ClickThrough Rate Prediction	Ad Campaign Optimization	Ad Interaction Data	CTR Prediction Accuracy	Enhancing Ad Campaign Effectiveness
• 13	Natural Language Processing	Search Queries	Query Data	Query Understanding	Improved Search Query Interpretation

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Vol. I, Issue 2, 2023
ISSN: 2584-0517

Machine Learning in Healthcare

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Abstract:

In recent times, medical care information examination is becoming one of the most encouraging exploration regions. Medical care remembers information for different kinds like clinical information, Robotic medical procedure, Personalized medication, and so on. To deal with this information physically is extremely challenging. For examination of information, Machine Learning is risen as a huge instrument. ML utilizes different measurable methods and progressed calculations to foresee the aftereffects of medical services information all the more definitively. In this paper, ML applications in CDS(Clinical Decision Support system) and various sorts of other applications and patterns in healthcare are described. How ML and Artificial intelligence has the power to change and transform how healthcare is reviewed.

Keywords:

Supervised Learning, Unsupervised Learning, Regression, Clustering, Classification, Clinical Decision Support

I. INTRODUCTION:

Artificial Intelligence(AI) is undoubtedly one of the greatest transformative technologies and facilitators of human life in this century (Wang and Siau, 2019). It is firmly believed that AI services and platforms will change the world of production, work and lifestyle, and create wealth. This transformation is widely supported by powerful machine learning (ML) tools and techniques such as deep neural networks, artificial neural networks (GANs), and gradient trees. This is a well known fact. It is driven by models (GBM), deep learning (DRL), and more. But AI doesn't just apply to business and traditional business. Health is an area that has been shown to be good for the use of artificial intelligence and technology. The need for such an electronic medical record (EMR) is to help health systems plan to use big data for ongoing data analysis. Machine learning and AI tools are designed to add value to this process.

Machine Learning (ML) has made significant advancements in the healthcare industry and has the potential to revolutionize various aspects of patient care, medical research, and administrative tasks. It is designed to improve automation and intelligent decision making in primary care/university and public health services. This will be the biggest impact of artificial intelligence because it can change the quality of life for millions of people around the world.

II. ML AS A TRANSFORMATIONAL TOOL:

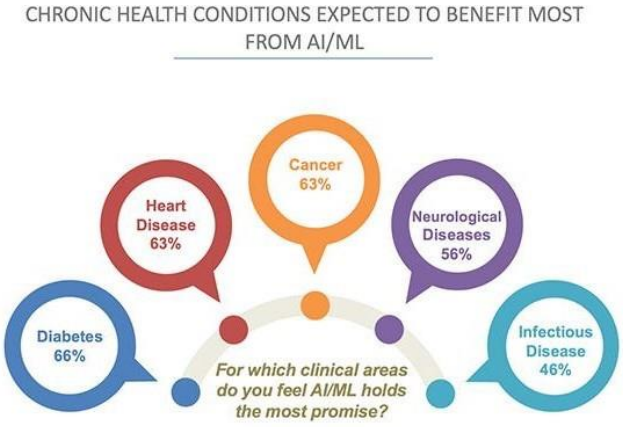
In the realm of healthcare, machine learning models have demonstrated remarkable potential in revolutionizing clinical decision-making and patient care. Supervised models, exemplified by Support Vector Machines (SVM), leverage complex patient data to enhance disease diagnosis accuracy, offering invaluable decision support for clinicians. Unsupervised techniques, including clustering, enable patient stratification, facilitating targeted interventions and personalized treatments. Moreover, Convolutional Neural Networks (CNNs) excel in medical image analysis, empowering radiologists with efficient tumor detection and anomaly identification.

Evolution of Healthcare sector

Handheld diagnosis- Medical diagnostic devices which are portable don't just gauge wellbeing boundaries yet additionally assist with diagnosing the patient making the use of smart algorithms easy and digital access to medical professionals (Istepanian, R., Laxminarayan, S., & Pattichis, C. S. (Eds.). (2007)). There are numerous handheld devices such as - Blood pressure monitor, Otoscope, Vision test, multi-diagnostic devices, Digital stethoscope, Portable ultrasound, which has made work easier and more accurate than earlier. Through handheld devices, professionals can have accurate and instant diagnosis, Improved Ease of Operation and Convenience, and Availability of Many Features and Options.

Automatic drug design- This is an innovative technique of making new medication which is based on understanding of biological targets (Mak,

K. K., & Pichika, M. R. (2019)). In short, it involves designing of molecules that are complementary and charge the target molecule with which Transdermal drug delivery- This is a method which allow drug absorption through the skin. This technique has made an ease for both patients as well as doctors. By use of transdermal drug delivery we can have controlled absorption, improved bioavailability, uniform plasma levels, painless application of terminating drug and simple process



of removing the patch from the skin (Bajaj, S., Whiteman, A., & Brandner, B. (2011)).

Robotic surgery- This is a robot assisted surgery which allows the professionals to perform various types of complex procedures with more flexibility, control and precision. It is much easier than conventional procedures and techniques. The procedures are performed through tiny incisions. This technique is used for coronary artery bypass, cutting away cancer tissues from the body parts such as nerves, blood vessels and organs and gallbladder removal. Robot-assisted surgeries are safe and effective. The robot arms can rotate 360 degrees which enables the surgical instruments to be moved with flexibility, precision and has a range of motion than standard invasive laparoscopy. A single robot costs about 2 million dollars and robotassisted surgery costs up to $3000-$6000, this is the only disadvantage associated with robotic surgery which costs higher. The robot itself is very expensive but the success rates range between 94% and 100%

PET/CT Scan, DEXA Scan, Ultrasound, Magnetic Resonance Imaging (MRI), etc.

Personalized medicine for each patient- This is an emerging practice of medicine which uses a patient's genetic profile to guide the professionals to prevention, treatment and diagnosis of the diseases. The goal of personalized medicine is to reduce adverse events and improve treatment outcomes that matters to both the clinician and patients.

Machine learning: Neural Networks and Deep Learning:

The most common use of machine learnin g in healthcare is precision medicine, which predi cts what treatment a patient will receive based on different patient characteristics and medical center (Topol, E. (2019)). Most machine learning and pr ecision medicine applications require processing d ata with known divergent outcomes (such as disea se onset); this is called compiled learning. A more common form of machine learning is neural tissu e, a new invention that has been around since the 1960s and has been used for some time in health r esearch and used in classification applications suc h as determining whether a patient needs treatment. specific diseases. The problems it finds include t he location of the data, the output, and the key or " item" payloads that combine with the output. It ha

s been compared with the signal cycle of neurons, but the comparison with brain potential is very str ong.

III. APPLICATIONS OF ML IN HEALTHCARE:

A. Clinical Decision Support Systems

Supervised Model: Clinical Data Analysis for

Diagnosis

Domain: Diagnostic Medicine

Type: Supervised

Description: Clinical Data Analysis involves the application of supervised machine learning algorithms to aid in accurate disease diagnosis. These algorithms learn from historical patient data, which includes clinical observations, laboratory results, medical imaging, and patient demographics. By identifying patterns and relationships within the data, these models can make predictions about a patient's disease or condition.

Model Example: Support Vector Machines (SVM) are widely used in diagnosing diseases like cancer. SVM constructs a hyperplane that optimally separates different classes of patients, enabling accurate classification.

Data Preprocessing: Cleaning, normalization, and feature extraction are critical steps in preparing data for analysis. Missing data imputation, handling outliers, and selecting relevant features are crucial for model performance.

Significance: Clinical Data Analysis models enhance diagnostic accuracy by leveraging patterns that might not be readily discernible to human clinicians. These models assist medical professionals by providing additional insights, suggesting potential diagnoses, and contributing to well-informed decision-making. For instance, SVMs have demonstrated high accuracy in distinguishing between benign and malignant tumors in medical imaging, aiding radiologists in making accurate diagnoses.

Unsupervised Model: Clustering for Patient

Stratification

Domain: Public Health

Type: Unsupervised

Description: Unsupervised machine learning, particularly clustering algorithms, is applied to stratify patients based on shared characteristics or health profiles. By grouping patients with similar features, these models facilitate targeted interventions and tailored treatment plans.

Model Example: K-Means clustering is frequently used to categorize patients into distinct groups based on specific health attributes. Patients within the same cluster share similar clinical traits.

Application: Clustering can be employed to identify high-risk patient groups, enabling healthcare providers to allocate resources efficiently. For instance, if a cluster of patients with certain chronic conditions is identified, healthcare organizations can develop interventions to address the unique needs of that group.

Significance: Patient stratification through clustering enhances patient care by ensuring that interventions are customized to specific groups. This approach allows healthcare providers to optimize treatment plans, improve outcomes, and allocate resources where they are most needed.

Medical Imaging Analysis

Convolutional Neural Networks (CNNs) for Image Classification

Domain: Medical Imaging

Description: CNNs are deep learning models designed to analyze visual data, making them ideal for processing medical images such as X-rays, MRIs, and CT scans. These models consist of convolutional layers that automatically learn hierarchical features from images, enabling tasks like image classification and object detection.

Significance: CNNs have revolutionized medical imaging by automating the interpretation of images.

They can detect anomalies, identify specific pathologies (e.g., tumors), and aid radiologists in their diagnoses, potentially reducing human error and improving diagnostic accuracy.

Generative Adversarial Networks (GANs) for Image Synthesis

Domain: Medical Imaging

Description: GANs consist of two neural networks, a generator and a discriminator, which work together to create realistic synthetic images. In medical imaging, GANs can be used to generate synthetic medical images for data augmentation, simulate rare medical conditions, and enhance lowresolution images.

Significance: GANs address the challenge of limited medical image datasets by generating additional samples, thereby improving the robustness and performance of machine learning models. They aid in training models to generalize well to diverse patient cases.

C. Personalized Medicine

Supervised Model: Predictive Modeling for Drug Response

Domain: Pharmacogenomics

Description: Supervised machine learning models are developed to predict individual patient responses to specific drugs based on genetic and clinical data. These models analyze genetic variations and clinical factors to recommend optimal drug choices and dosages for patients.

Significance: Predictive models in personalized medicine contribute to safer and more effective treatment plans, reducing adverse drug reactions and improving patient outcomes. They enable tailoring treatments to patients' genetic makeup, optimizing drug efficacy.

Reinforcement Learning for Treatment Optimization

Domain: Precision Medicine

Description: Reinforcement learning algorithms are applied to treatment optimization by considering sequential decision-making processes. These models learn from patient responses to treatments over time and adapt treatment plans accordingly.

Significance: Reinforcement learning aids in designing adaptive treatment strategies that consider a patient's evolving health status. It allows for continuous optimization of treatment plans, especially in chronic or dynamic medical conditions.

Drug Discovery and Manufacturing: Scientist are constantly trying to discover new ways to treat deadly diseases. Machine learning is extensively used in research and development of early stage discovery process. Next-generation genotyping and precision medicine are examples of R&D technologies that help scientists develop new approaches to treat complex diseases. Hanover is project is created by Microsoft which uses ML to help cancer treatment.

Identifying Diseases and Diagnosis: Machine learning has changed the entire field of diagnosis and help millions of doctors to save lives (Hoffman, S. F., & Friedman, H. H. (2018)). ML has helped to identify and diagnose diseases which are very difficult otherwise. IBM Watson Genomics is the best illustration of how machine can help with quick and accurate diagnosis. Berg, the biopharmaceutical behemoth, is harnessing AI and machine learning to develop therapeutic therapies in a crucial area of oncology.

Medical Imaging Diagnosis: ML has been proved beneficial and life changing for the Medical imaging and radiology (Doi, K. (2007)). Doctors are using ML technology to scan the through all the possible options available to diagnose and choosing most effective one for the patients. Medical. ML is also helping doctors and surgeons to know how much radiation is required and best for the patients based on patients response to the specific amount of emissions.

Personalized Medicine: Now a days large pool of data available for the patients including history of patients illness, medical records and ongoing treatments. Applying machine learning on this data can help us with the predictive analysis and better disease assessment. With all this available data for any specific patients and ML in healthcare for surgeries: Scientist are continuously trying to push their limits and coming up with the new innovations Surgical Robots are trending tech the health sector and helping doctors in most complicated surgeries.

Surgical robots provide high definition imaging and can reach where doctors are not able to reach during surgeries. One of the most known creation in this field is robot, which enables surgeons to manipulate robotic limbs. This helps surgeons in performing surgeries effectively in tight spaces

Another example of crowd source data collection is IBM's collaboration with Medtronic.

Better Radiotherapy: Machine learning has revolutionized the field of radiology with its ability to process variety of information in small amount of time provide useful analysis. Some of the diseases like cancer cannot be diagnosed by studying only one variable and ML make this process very easy by analyzing multiple discrete variable at single time.

Outbreak Prediction: Machine learning partnered with AI is wildly used in today's world to predict the future epidemics This is possible with large amount of medical data available. This data is fed to the ML`s predictive analysis algorithms to find the patterns These patterns can identify from dengue outbreak of serious chronic infectious diseases.

LITERATURE REVIEW:

Upon Machine learning has played an essential role in improving the diagnosis process in healthcare. The massive availability of medical data helped ML to provide correct analysis. We have reviewed some important research papers written on the use of Machine Learning in the Healthcare sector. Data have become an essential aspect in any industry in recent times, and healthcare is not an exception to this trend. Authors Arwinder Dhillon, Ashima Singh, have discussed the use of Machine learning in healthcare data in the "Machine Learning in Healthcare

Data Analysis," which was published in 2019. Clinical data, such as electronic health records that preserve patient records obtained during ongoing therapy and sensory data gathered from various wearable and wireless sensor devices, is discussed by the author. All this gathered data is unstructured, and machine learning has become an important tool to analyze this data. The paper talks about multiple types of machine learning, for instance, Supervised learning, Unsupervised learning, Semi-supervised learning, and reinforcement learning. Many machine learning methods and feature extraction strategies for the survival prediction of cancer patients are proposed by various authors for analyzing various forms of data in healthcare, according to the paper. To use the Machine learning algorithms on medical data, we need multiple tools. Authors Dr. V. Ilango, B. Nithya, studies these tools in their paper on

"Predictive Analytics in Health Care Using Machine Learning Tools and Techniques" published in 2017. Machine learning has been helpful in healthcare for predicting diseases and finding patterns. ML provides a number of alerting & risk mitigation decision support tools designed to refine the patient's safety and standard of care. The authors discuss how to use the ight machine learning techniques to cut healthcare expenses and advance the personalized healthcare movement. Also, shed light on Machine Learning's applications in a range of fields. The risk of heart diseases has increased in today's stressful world, and predicting and identifying heart diseases has been challenging for researchers. Authors **Rahul Katarya, Polipireddy Srinivas** wrote a paper on "**Predicting Heart Disease at Early Stages using Machine Learning**" published in **2020**, which talks about the importance of detecting heart diseases in the early stages which can help patients to take precautions before getting it critical. The paper shows us the most frequently found heart

ailments and algorithms like Artificial neural networks, Support vector machines, Decision trees, Random forests, Naïve Bayes to help predict these diseases. Many hospitals are currently trying to provide more personalized care for patients to increase satisfaction and speed up recovery. Authors **Ning Liu, Soundar Kumara, Eric Reich** discusses the significant factors affecting customer satisfaction and how machine learning frameworks help hospitals as alternative approaches for patient satisfaction studies in "**Gaining Insights into Patient Satisfaction Through Interpretable Machine Learning**" research paper published in **2020**.

RESEARCH METHODOLOGY:

Studied Area: This research paper explains the evolution and applications of Machine Learning and Artificial intelligence in the Healthcare sector, which helped a lot by analyzing data throughout a healthcare system to mine, automating & predicting the line of processes. It takes into consideration the unstructured clinical notes on patients, giving incredible insights into understanding refinement, improving standard procedures which in turn leads to appropriate results for patients.

The sampling Method: The AI & ML program involved extended and individualized support for patients that maintained contact with a user after initial interaction to offer support in various ways. We used data from blogs, published research papers & books, who are part of the Healthcare sector in AI & ML.

DATA COLLECTION:

We have gone through fifty cases related to AI & ML in the healthcare or treatment group or the control group, which comprised new life-saving skills development and technologies used in the healthcare environment. My team had categorized all data according to sub-sectors and found out the top twenty articles or papers for further study. These twenty data sets are again considered for qualitative data finding. Not only the actual working in healthcare by ML is studied but also its psychological functioning and self-esteem for users are studied. Significant insights of data are also observed/taken into consideration about the effects of treatment including the opposing outcomes that differed from the initial hypothesis.

ANALYSIS USING A CASE STUDY:

The following mentioned below are some of the many challenges & limitations while designing ML based methods.

- Data availability: ML-based models mostly are required to have large databases for the training.

When the data provided is large, the performance of these models is found to be much better & their error rate is also found to be low. For this purpose, it is necessary to design new methods which can record electronic medical data to solve the mentioned problem.

- Data quality: This is also one of crucial issue is that can be caused due to any mistake, whether accidental or deliberate, made when recording the data & further raises the error rate. As a result, data quality is a cause of concern. These issues can arise at the time when medical professionals are not cautious enough while deciding how to the categorise data samples. Methods for data pretreatment can significantly decreases the mentioned issue & raise the calibre of the datasets.

CDS: When trained on accurate, comprehensive, and clean data, machine learning and CDS techniques perform at their peak. Since healthcare is a sector having high stakes, an algorithm's output & its efficiency is of utmost importance. Therefore, the input needs to be quite accurate. Organizations have to be cautious with data beforehand to design CDS algorithms since data errors and missing information are all really crucial.

Case study at Duke Institute for Health Innovation:

"You hear a lot about data quality. As the saying goes, garbage in, garbage out," as mentioned by Mark Sendak, MD, who is a population health and data science lead at the Duke Institute for Health Innovation. A machine learning model was recently created by Sendak and his team to predict about the probability of in-hospital demise of adult patients. The team had spent a lot of time while collection of data and to determine about which hospital settings had better or worse fatality rates before developing the programme and realised that there we a lot of points missing to be taken into

Figure source :[27]

consideration. As time passes and AI gets more significant into our lives ;machine learning and clinical decision support continue to evolve and become more significant, the next generation of supporters are more likely be well- equipped for understanding and apply these tools at a regular care delivery.

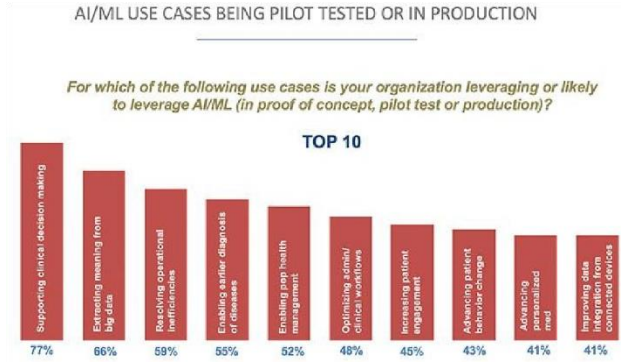
The expectation of highly sophisticated, hyperintelligent technologies that can easily detect tumours, infections, or any other sorts of symptoms of illness is what contributes the most to the hype around machine learning in CDS. Numerous studies have shown that AI and other analytics techniques can effectively estimate leukaemia remission rates, diagnose breast cancer, and predict renal illness.

In the above graph AI/ML is broadly used for supporting the use of CDS devices. Infact in the whole Healthcare system, ML has the most application in supporting CDS system at about 77%. However, recent research suggests that the ongoing trends are ought to change. A global survey carious out by Philips represented that 79 percent of healthcare professionals under the age of 40 are more confident about the fact that digital health technologies are able to achieve better patient outcomes, while 74 percent of the contrary believe that these tools will be able to improve the patient experience.

In the not-so-distant future, CDS tools equipped with machine learning and AI-fueled are more likely to become the healthcare industry's standard. In order to get past these limitations and make the data more accurate and reliable, ML models are used. Around the world the healthcare systems use different types of ML models as we can see in case studies.

ML in Clinical data:

Clinical data includes the Electronic Health Record (EHR) data, which is made up of laboratory test results, radiological pictures, allergies, and other information, and is data that is gathered while the



patient is receiving ongoing care. The authors listed below have contributed to the clinical work. Using data from Multiparametric Magnetic Resonance Imaging (mpMRI), Wengert et al. suggested quite some of ML algorithms for the early prediction of pathological complete response (pcr) to neoadjuvant chemotherapy and survival result of breast cancer patients.

These classifiers included linear support vector machine, linear discriminant analysis, logistic regression, random forests, stochastic gradient descent, adaptive boosting, and Extreme Gradient Boosting (XGBoost). For the purpose of predicting non-small cell lung cancer patients' two-year survival, Dagli et al. developed a multilayer perception model. The ReliefF feature selection approach was used to rank the properties of 559 patient samples. Having an area under the curve value as 0.75, The Multilayer Neural Network has been determined as the standing out prediction. For the purpose of predicting patient survival in those with hepatocellular carcinoma (HCC), Kayal et al. developed a new, improved categorization

approach. Authors studied 165 patient samples and determined that 15 risk factors—out of 49 risk factors—were accountable for HCC. The results of the experiment demonstrated that Deep Neural Network accuracy is much greater than Cox models (SVM) and Unsupervised model accuracy (KNN).

Type of health care data	**Learning Used**	**Domain**	**Data set**	**Performance parameter**	**Results**
Wengert et al.[5]	Support vector machine, linear discriminant analysis,logostic regression,random forests,stochastic gradient descent,adaptive boosting,extreme gradient boosting (XG Boost)	Healthcare	Clinical (mpMRI)	Area under curve	XG Boost produced the best result with AUC value of 0.94 for RCB and 0.92 for DSSwith AUC value of 0.83
Yash Dagali etal. [6]	Multilayer Neural Network,Logistic Regression,Single Pe rception neural network	Healthcare	Clinical	Area under curve,95% confidence interval,Misclassification rate,True positive rate,false positive rate,accuracy and precision	Multilayer Neural Network produced the best result with AUC value of 0.75,confidence value of 0.693-0.806,true positive rate of 0.68,false positive rate of, accuracy of 0.76 and precision value of 0.72
Chayan Kuma Karvey et al.	Deep Neural Network, Support Vector Mac hine, K-Nearest Neighbor	Healthcare	Clinical	Accuracy, Precision, Recall,	Deep neural network produced higher accuracy of 78% and precision,Recall and Fmeasure value of 83.58, 81.25 and 80%

Tao Zheng et al.[8]	Support vector mach ine, k-nearest neighbor, logistic regression, random forest decision tree, naïve bayes	Healthcare	Clinical (EHR)	Accuracy, Sensitivity, Specificity, Precision,Area under curve	SVM produced best result with accuracy 96%, sensitivity 95%,specificity 96%,precision 91% and AUC value of 0.96.
Sumei Waang et al.[9]	Support vector mach ine recursive feature elimination,Linear discriminant analysis,k- nearest neighbor	Healthcare	Clinical (MRI)	Accuracy, Sensitivity, Specificity,No of retained features, entropy, standard deviation based on t-test	SVM RFE produced best result for both classification of tumor and grading of gliomas with accuracy, sensitivity and specificity value of 85%, 87%, 79% and 88%, 85% and 96%. The Nf value is 20, entropy and sd is 0.82 and 0.92
Kristin M. Korey et al. [10]	Penalized logistic regression, random forest models,and extreme gradient boosted decision trees basis function networks	Healthcare	Clinical (HER)	Accuracy, Sensitivity, Specificity, Area under curve, threshold, positive predictive value	Penalized logistic regression produced best result with accuracy,sensitivity, specificity,AUC, threshold and ppv value of 95%, 76%, 76%, 0.924, 0.174 and 0.390

Type of health care data	**Learning Used**	**Domain**	**Data set**	**Performance parameter**	**Results**

Andrew Wong et al. [11]	Penalized logistic regression,Gradient boosting machine, Artificial neural network with a single hidden layer,Linear support vector machine and random forest	Healthcare	Clinical (EHR)	Sensitivity, Specificity, Area under curve	Gradient boosting machine produced best result with sensitivity,specificity and AUC value of 59.7%, 23.1% and 0.855
Fatemeh Rahimian et al. [12]	Cox model, Gradient boosting, Random forest	Healthcare	Clinical (EHR)	Area under curve, confidence interval	Gradient boosting machine produced best result with AUC and 95% CI value of 0.779 and 0.847
Maryam et al. [13]	Cox model,Gradient boosting, Random forest Support vector regression, Decision tree,Ada boost,logistic regression	Healthcare		Area under curve	Logistic regression performed best with an improvement of 11% in AUC value.
Stephen H Weng et al. [14]	Random forest, Logistic regression,Gradient boosting machines and Neural networks	Healthcare	Clinical (EHR)	Area under curve, positive predictive and negative predictive value	Neural networks produced best result with AUC,CI, PPV and NPV value of 0.728, 0.75-0.76, 18.4 % and 95.70%
[15]	Supervised	Healthcare	Clinical (EHR)	in spite of the anticipated value potential of this technology, there is widespread concern that	results suggest that attitude towards EHR use and CFIP directly influence opt-in behavioral intentions.

Type of health care data	Learning Used	Domain	Data set	Performance parameter	Results
				consumer privacy issues may impede its diffusion.	
16.	Semi - Supervised	Healthcare (medicine)	https://pubmed.ncbi.nlm.nih.gov/32602593/	Leads to contrasting changes required in the medicine industry & better insights of medicines.	The elucidation of standard terminology and then review examples in haematology.
18.	Supervised – CNN (Deep Learning)	Healthcare & imaging	https://pubmed.ncbi.nlm.nih.gov/30367497/ medical imaging and radiation therapy dataset.	Performance of this algorithms leads to efficient medical imaging which can be used in times of emergency for better efficiency.	Introduction of general principles of DL and convolutional neural networks, survey major areas of application of DL in medical imaging and radiation therapy,
19.	Supervised	Healthcare	Clinical (EHR)	The resulting variables are successfully used for classifying the normal patients and the patients with cerebral, with 95% and 86% accuracy rates on the training and validation samples, respectively	Although the AI technologies are attracting substantial attentions in medical research, the real-life implementation is still facing obstacles. The first hurdle comes from the regulations. Current regulations lack of standards to assess the safety and efficacy of AI systems.

20.	Semi-Supervised	Healthcare & tech	Clinical (EHR)	The metadata with regards to Asthma can lead to extravagant results and save many lives.	The resources have the potential to enable the research community to work collaboratively towards improving the understanding of asthma as well as mobile health research best practices.

VIII. RESULT AND DISCUSSION:

Using ML models in healthcare and the application of AI in healthcare has effectively increased and is said to be growing in the upcoming years. "The global artificial intelligence in healthcare market size was valued at USD 6.7 billion in 2020 and is expected to expand at a compound annual growth rate (CAGR) of 41.8% from 2021 to 2028"

In the dynamic realm of healthcare, machine learning models have emerged as powerful assets with profound implications. These models span diverse domains, from clinical decision support to medical imaging analysis and personalized medicine. Supervised models, such as Support Vector Machines (SVM), leverage intricate patient data to enhance disease diagnosis accuracy, equipping healthcare providers with crucial decision-support tools. Unsupervised methods, exemplified by clustering, enable precise patient stratification, facilitating targeted interventions and customized treatment approaches that cater to unique patient needs. In parallel, Convolutional Neural Networks (CNNs) showcase exceptional prowess in medical image analysis, expediting tumor detection and anomaly recognition, thereby enhancing radiological diagnostics and expounding opportunities for early intervention. Addressing the challenge of data scarcity, Generative Adversarial Networks (GANs) generate lifelike medical images, effectively augmenting training datasets and strengthening model performance, ultimately aiding accurate disease identification. Predictive modeling, firmly rooted in patient genetics and comprehensive clinical records, propels the frontiers of personalized medicine by forecasting drug responses and guiding treatment strategies that are tailored to individual patient profiles, paving the way for precision therapeutics and improved patient outcomes. Moreover, reinforcement learning takes treatment optimization to new heights, adapting dynamically to evolving patient dynamics and refining care regimens with unparalleled adaptability. Collectively, these machine learning paradigms reshape healthcare, revitalizing diagnostic precision, elevating patient well-being, and optimizing resource allocation for a transformative shift in medical practice.

The application of supervised machine learning algorithms in clinical data analysis has shown promising results in disease diagnosis. SVMs and other classification algorithms demonstrate high accuracy in detecting diseases based on complex patterns in patient data

The involution and ascent of information present in the field of medical services brings out the outcome that man-made brainpower is predicted to progress and be applied on the insides of the field. The

variety of classes using the same includes finding and treatment proposals, commitment of the patient and the following adherence, and henceforth the regulatory exercises. Although there are many real scenarios where machine learning is able to and can perform medical services & errands as well better than people.

https://popsdiabetes.com/ai-in-healthcare/

So, with AI and ML, we can have a framework that can dissect the client's conduct in each sense, be it looking, observing, investigating, or collaborating with information and getting more skilled and productive by learning with past encounters. We recommend another group of strategies for investigating substance space dependent on constant encodings of particles. These strategies dispose of the need to hand- make libraries of mixtures and permit another sort of coordinated inclination-based pursuit through substance space. Computer based intelligence and ML can overcome any barrier between people and an enormous volume of large high-speed information to get the experiences. In our autoencoder model, we noticed high constancy in the reproduction of SMILES strings and the capacity to catch trademark highlights of an atomic preparing set. The autoencoder displayed great prescient power when preparing mutually with a property forecast task, and the capacity to perform slope- based improvement of particles in the subsequent smoothed dormant space. The Future scope of machine learning will be playing a very enormous part in the medical care contributions in the upcoming recent time. As machine learning, it is really important to increase its efficiency for it to be put into better cause, generally consented to be a painfully required development in care. Taking into consideration, the quick advances happening in machine learning for imaging investigation, it is not hard to suggest to be logical that most radiology and pathology snapshots of persons suffering from various reasons will be inspected eventually by a machine.

IX. CONCLUSION:

In conclusion, the evolution of machine learning models being produced in the healthcare and medical domain has ushered in a new era of possibilities and advancements. The diverse array of models, ranging from clinical decision support systems to medical imaging analysis and personalized medicine, demonstrates their potential to revolutionize patient care, diagnosis, and treatment. These models have proven to be invaluable tools for healthcare professionals, providing data-driven insights that enhance decision-making, improve diagnostic accuracy, and enable personalized interventions.

The significance of machine learning in healthcare extends beyond traditional approaches, offering innovative solutions to longstanding challenges. Supervised models like Support Vector Machines (SVM) and unsupervised techniques such as clustering have the capacity to transform patient management by enabling tailored interventions and optimized resource allocation. Convolutional Neural Networks (CNNs) have redefined medical imaging analysis, empowering radiologists with enhanced diagnostic capabilities and ultimately improving patient outcomes.

Predictive models have shown promise in predicting individual patient responses to specific drugs based on genetic and clinical factors. These models aid in tailoring treatment plans for optimal outcomes.

In essence, the incorporation of machine learning models in healthcare has propelled the field toward data-driven, patient-centric care. As we continue to harness the potential of these models, it is imperative to address ethical considerations, data privacy, and the need for interdisciplinary collaboration. While challenges persist, the journey of machine learning in healthcare is marked by remarkable progress and the promise of a future where technology seamlessly supports medical professionals, enhances patient experiences, and contributes to a healthier global population.

We found through our research that AI & ML have helped the healthcare sector to reach that level where it now stands and helped to achieve higher self-esteem. Percentage, Graphs & charts gave a clear idea. These results led to conclude that AI & ML have worked best in healthcare by fulfilling the significant needs in performance due to higher analyzing and self- coding power regardless of prior knowledge of the user in the healthcare sector.

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Vol. I, Issue 2, 2023
ISSN: 2584-0517

Multi-Criteria Decision-Making Techniques for Ranking NSE Sectorial Indices: A Comparative Analysis with Feature Weighting

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Abstract:

Data analysis plays a crucial role in financial and managerial applications, impacting a range of IT and business operations. This research focuses on the use of Multi-Criteria Decision Making (MCDM) techniques to rank Sectorial Indices of the National Stock Exchange (NSE) based on various criteria. Traditional approaches often involve high computational complexity, prompting the exploration of more efficient alternatives.

In this study, we apply MCDM techniques, including Simple Additive Weighting Method (SAW), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), Complex Proportional Assessment (COPRAS), Additive Ratio Assessment (ARAS), and Evaluation based on Distance from Average Solution (EDAS), to rank NSE Sectorial Indices. To enhance the performance of these techniques, feature weighting is incorporated, demonstrating superior accuracy and scalability compared to state-of-the-art approaches.

Keywords:

Multi-Criteria Decision-Making (MCDM), National Stock Exchange (NSE), SAW, TOPSIS, ARAS, COPRAS, EDAS, MCDM Approaches.

I. Introduction

Financial decision-making in investment requires a comprehensive analysis of market data. This study employs datasets obtained in CSV format from the National Stock Exchange (NSE) to analyze and rank the relative performance of various sectors within the NSE over the period from 01-April-2018 to 31-March-2023. The primary objective is to enhance the decision-making process in investment by applying multi-criteria analysis methods.

Sectorial indices of NSE data are ranked using the five MCDM approaches: SAW, TOPSIS, COPRAS, ARAS, and EDAS. The feature weights for each criterion are calculated using the CRITIC method, providing a foundation for enhanced accuracy in the ranking process. These weights are applied into each MCDM method to improve the decision-making process. Additionally, Pearson rank correlation coefficient is applied to evaluate the performance of each MCDM approaches.

The research aims to emphasize the necessity of adopting a multi-criteria analysis approach to evaluate the effectiveness of investments. By considering various criteria, this approach contributes to a more informed and robust

decision-making process aligning with investment goals.

II. Related Work

MCDM approaches have a wide variety of real-world applications across different fields. There are numerous previous research papers on different MCDM approaches which are used to solve decision-making problems in different fields. In order to choose the best company from the group of companies, the writers research MCDM methodologies. Kung et al. [1] have suggested the optimal investment strategy based on the analysis of data from financial reports and the use of the fuzzy MCDM method.

Previous research has explored the application of MCDM techniques in financial analysis, particularly in the context of investment decision-making. Studies have highlighted the significance of considering multiple criteria to evaluate the performance of investment alternatives and enhance decision-making processes in financial domains [2] [3].

Investigations into sectorial analysis within financial markets have been undertaken to understand the dynamics of various sectors. Researchers have delved into methods for comparing and ranking sectorial performance, providing insights into the relative strengths and weaknesses of different market segments [4]. Liu Zongsheng [5] has presented a Financial Management Assessment Model based on Analytical Hierarchical Process. The assessment factors include three different parts i.e., elemental work, personal management and structural establishment. The model appreciates the correct financial management assessment.

Türegün N. [6] compared the entropy-based TOPSIS and VIKOR techniques to analyze the stock performance outcome and presented a model as suggestion to the tourism companies for evaluating financial performance outcome. Gupta et al. [7] have presented an MCDM model to rank the performance of sectors in the Indian stock market. To identify the best performing sectors for investments, build a hybrid ranking technique that performs a relative ranking of the NSE sectorial indices. Gupta et al. [8] have reviewed a three-stage model (Perceptual Map-Data Envelopment Analysis-COPRAS) that integrates market performance with the fundamental complement in an MCDM framework to provide a comprehensive approach to understanding the performance of the stocks.

Literature has explored the importance of feature weighting in financial decision-making models. The consideration of feature weights in MCDM approaches has been acknowledged as a crucial factor in accurately reflecting the significance of different criteria in investment evaluations [9] [10]. Kanwar et al. [11] Computed the correlation based feature weight and ranking the alternatives to identify top-k alternative based on MCDM approcah i.e., weighted TOPSIS.

The CRITIC method has gained attention in the literature for its effectiveness in determining criterion weights in MCDM applications. Studies have demonstrated its application in various domains, emphasizing its ability to provide reliable and consistent weights for different criteria [12]. Researchers have conducted comparative analyses of different MCDM

techniques in the context of financial markets. Investigations into the performance of methods such as SAW, TOPSIS, COPRAS, MOORA, and EDAS, both individually and in combination, have contributed to the understanding of their efficacy in ranking financial assets and aiding investment decision-making [13].

By building upon and synthesizing insights from these related works, the current research aims to extend the understanding of multi-criteria decision-making in financial contexts, specifically focusing on the ranking of NSE sectorial indices over the period of 01-April-2018 to 31-March-2023.

Methodology

Criteria weighting in multi-criteria decision-making methods has a substantial impact on the final result of decision making and ranking options that engage in the model. It improves the accuracy and efficiency of methods by assigning a particular weight. To ranking the Sectorial Indices of NSE data proposed an approach i.e., "Hybrid Ranking" using five different MCDM approaches: SAW, TOPSIS, COPRAS, ARAS, and EDAS.

First, the feature weights are calculated for every criterion using CRITIC method. These weights are assigned to each criterion while applying MCDM approaches: SAW, TOPSIS, ARAS, COPRAS and EDAS. Applied the Pearson correlation coefficient method between final results of above used methods and then find the final ranking of alternatives.

Criteria Importance Trough Intercriteria Correlation (CRITIC)

The CRITIC technique of weight calculation method is developed by Diakoulaki et. al. in 1995 [14]. It is used to determine the criteria's objective weights. The CRITIC approach uses correlation analysis to identify differences among criteria and assists in determining the precise weights assigned to each criterion.

Steps followed by the CRITIC method [15]:

1. Create the decision matrix.
2. Normalize the decision matrix using below equation:

$x_{ij} = \frac{x_{ij} - min\,(x_{ij})}{(x_{ij}) - min\,(x_{ij})}$, i=1,..,m and j = 1,.., n.

3. Calculate the weight of the jth criterion (W_j) and where C_j is the quantity information contained in jth criterion.

$C_j = \sigma_j \sum_{j=1}^{n} \quad (1 - r_{ij})$

$W_j = \frac{C_j}{\sum_{j=1}^{n} C_j}$, Where σ_j is the standard deviation.

Simple Additive Weighting Method (SAW)

The simple additive weighting method is also known as the "summing up method", which is a multi-criteria decision-making method. The results of the multiplication between the rating and the weight of each attribute are added up to determine the overall score for an option. The Simple Additive Weighting method needs a normalized decision matrix that is comparable to all existing alternatives [16]. The steps used by SAW method are as follows:

1. Create decision matrix.
2. Normalize the decision matrix.

3. Calculate the weighted alternative value,

$$V_i = \sum_{j=1}^{n} W_i r_{ij}$$

Where, w_i is weight, r_{ij} is the normalized value.

4. Arrange the alternatives in descending order.

Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

TOPSIS was developed by Hwang and Yoon in 1981. It is an MCDM approach to identify an alternative solution that is closest to the positive ideal solution and farthest to the negative ideal solution [17]. The following steps of TOPSIS:

1. Create decision matrix.
2. Normalize the decision matrix.
3. Determine the weighted decision matrix.
4. Identify the positive ideal solution and negative ideal solution.
5. Compute the Euclidian Distance from positive ideal solution and negative ideal solution.
6. Compute relative closeness coefficient and rank the alternatives based on relative closeness.

Additive Ratio Assessment (ARAS)

The ARAS method is first proposed by Zavadskas and Turkis aiming at eliminating the influence of different measurement units and the different optimization directions in MADM [18]. There are following steps in ARAS method:

1. Create decision matrix.
2. Normalize the decision matrix.
3. Define the weighted normalized matrix.
4. Calculate the optimal value (S_i) and the utility degree (Q_i).

$S_i = \sum_{j=1}^{n} x_{ij}$, i=0, 1, 2, …, m.

$S_0 = \sum_{j=1}^{n} S_i$

$Q_i = \frac{S_i}{S_0}$, i= 1, 2, …, m

7. Determine the final ranking.

Complex Proportional Assessment (COPRAS)

Complex Proportional Assessment (COPRAS) is a multi-criteria decision-making method developed by Zavadskas, Sarka, and Kaklauskas in 1994 to determine the rank of alternatives. This is commonly utilized in engineering field complications for project appraisal and selection. The fundamental goal of the COPRAS technique is to rank each alternative by considering the particular weights of each criterion [19]. The following steps of COPRAS method:

1. Create decision matrix.
2. Normalize the decision matrix.
3. Compute the weighted normalized matrix.
4. Calculate the sum of maximum weighted value and minimum weighted value.
5. Compute the relative significance of all the alternatives.

$$Q_i = S_{+i} + \frac{S_{-min} - min\,(x_{ij})}{S_{-i} \sum_{i=1}^{m} (\frac{S_{-min}}{S_{-i}})}$$

6. Calculate the quantitative utility (Ui).

$U_i = [\frac{Q_i}{Q_{max}}]*100$

7. Rank the alternative based on quantitative utility.

Evaluation based on Distance from Average Solution (EDAS)

EDAS stands for Evaluation based on Distance from Average Solution; it was presented by Keshavarz Ghorabaee et al. [20] in the year of 2015. EDAS method is related to the distance from average solution, first measure the PDA and NDA that is positive distance from average and negative distance from average respectively. This metric can demonstrate the variations between each alternative and the average solution. Higher values of PDA (Positive Distance Average) and lower values of NDA (Negative Distance Average) are used to evaluate the alternatives. There are following steps:

1. Construct the decision matrix.
2. Compute the average solution.
3. Compute the positive distance from average (PDA) and negative distance from average (NDA).

For Beneficial criterion:

$PDA_{ij} = \frac{max(0,(X_{ij}-AV_j))}{AV_j}$,

$NDA_{ij} = \frac{max(0,(AV_j-X_{ij}))}{AV_j}$

For Non-Beneficial criterion:

$PDA_{ij} = \frac{max(0,(AV_j-X_{ij}))}{AV_j}$,

$NDA_{ij} = \frac{max(0,(X_{ij}-AV_j))}{AV_j}$

4. Calculate the weighted sum of PDA and NDA for each alternative.

$$SP_i = \sum_{j=1}^{m} w_j PDA_{ij}$$

$$SN_i = \sum_{j=1}^{m} w_j NDA_{ij}$$

Where w_j is the weight.

5. Normalize the value of SP and SN.

$NSP_i = \frac{SP_i}{max_i(SP_i)}$

$NSN_i = \frac{SN_i}{max_i(SN_i)}$

6. Compute the appraisal score (AS) for each alternative and rank the alternative based on appraisal score.

$AS_i = \frac{1}{2}(NSP_i + NSN_i)$

Data Collection

The data for research was collected from the NSE database in CSV format (Data Source: "https://www.nseindia.com"), including the period from 01-April-2018 to 31-March-2023. Sixteen sectorial indices were considered for analysis. Two key data points, the Total Return Index and the closing price at the end of the day, were downloaded for each sector. Additionally, includes various indicators for NSE data analysis i.e., standard deviation, Beta, price-to-book (P/B), price-to-earning (P/E), and dividend yield (Div. Yield) and standard-deviation. These indicators provide a comprehensive view of the performance and risk profile of each sector. First calculate the daily return and daily return mean from the closing price value. Beta, price-to-earning (P/E), price-to-

book (P/B) and standard deviation are calculated from the daily return.

To assess the risk and volatility of each sector, daily returns were calculated from the closing prices. Subsequently, Beta values were computed, measuring the volatility of each sector in relation to the Nifty 50 index. Standard deviation, derived from the mean value of daily returns, provided insights into the risk associated with each sector. This approach enhances the accuracy of the subsequent MCDM analysis by combining market dynamics and risk factors.

The P/E ratio, a critical financial metric, was utilized to evaluate the valuation of each sector's stock. A high P/E ratio may indicate overvaluation, while a low ratio may suggest undervaluation or robust performance. This analysis aids in understanding market sentiment and identifying potential investment opportunities or risks.A company's market value and book value are compared using the P/B ratio. A lower P/B ratio typically denotes an undervalued stock. The yearly dividend to share price ratio of a firm is known as the dividend yield. Table 1 show the initially used data that includes sixteen sectorial indices with different criterion.

Table 1. Decision Matrix

Sectorial Indices (A1 to A16)	Total Return Index	P/E	P/B	Div Yield	STD Dev	Beta
Nifty Auto	12291.10	79.58	4.35	1.23	0.70	1.05
Nifty Bank	42343.75	33.11	2.79	0.45	0.73	1.23
Nifty Consumer Durables	22053.31	61.30	11.23	0.45	0.56	0.79
Nifty Energy	29965.73	13.55	1.86	2.96	0.64	0.92
Nifty Financial Services_25_50	18178.91	23.53	3.44	0.92	0.69	1.19
Nifty Financial Services	17490.95	28.75	3.71	0.63	0.70	1.20
Nifty FMCG	51329.92	40.87	10.39	1.64	0.48	0.65
Nifty Healthcare	7654.99	36.34	4.45	0.64	0.53	0.57
Nifty IT	28981.82	25.76	7.14	1.87	0.64	0.79
Nifty Media	2381.12	287.45	3.01	0.98	0.86	0.95
Nifty Metal	5678.66	11.46	1.62	3.99	0.87	1.15
Nifty Oil & Gas	8533.80	12.96	1.93	3.24	0.66	0.95
Nifty Pharma	13210.98	36.79	4.29	0.68	0.58	0.59

Nifty Private Bank	19237.49	29.41	3.00	0.46	0.75	1.25
Nifty PSU Bank	3384.45	19.85	0.82	0.43	0.95	1.19
Nifty Realty	13210.98	217.49	2.51	0.41	0.84	1.11

Results and Discussion

Table 2. CRITIC Result

Total	**Total Return Index**	**P/E**	**P/B**	**Div Yield**	**STD Dev**	**Beta**
1	0.16	0.15	0.18	0.18	0.15	0.18

We acquire the rankings from each MCDM method. Table 3 shows that there is overlap in the ranks across the different indices. Weights are provided for each condition in Table 2. The CRITIC technique is used to determine the weights needed for additional computations. The decision matrix and weights are used to rank the five MCDM techniques. Table 3 shows the rank of sectorial indices for each MCDM approaches. In all MCDM approaches, it can be inferred that the indices with the highest rankings are Nifty FMCG, Nifty Media, Nifty IT, Nifty Consumer Durables, and Nifty Metal.

We have solved the diverging ranking issues using Pearson's rank correlation coefficient method, even if the rankings from the various MCDM approaches have been acquired. Ascertain the highest-ranking sectors as our suggestion, then provide a hybrid rank to each sector. An overview of the Pearson's rank correlation coefficient between the five MCDM approaches' ranks can be found in Table 4. Refer A1 to A16 as alternatives (sectorial indices) accordingly Table 1.

Table 3. MCDM Approaches Ranking

Sectorial Indices	SAW	TOPSIS	ARAS	COPRAS	EDAS
A1	9	10	9	10	4
A2	8	8	8	5	2
A3	4	3	5	11	6
A4	7	7	7	1	7
A5	11	11	11	7	15
A6	12	12	12	9	11
A7	1	1	1	3	1
A8	15	15	15	16	14
A9	3	4	4	6	5
A10	2	2	2	13	8
A11	6	5	6	2	3
A12	10	9	10	4	10
A13	14	14	14	15	12
A14	13	13	13	8	13
A15	16	16	16	14	16
A16	5	6	3	12	9

Table 4. Rank Correlation Result

	SAW	TOPSIS	ARAS	COPRAS	EDAS
SAW	1.000				
TOPSIS	0.979	1.000			
ARAS	0.995	0.981	1.000		
COPRAS	0.567	0.535	0.507	1.000	
EDAS	0.819	0.769	0.795	0.634	1.000

Table 5. Correlation ranking

	SAW	TOPSIS	ARAS	COPRAS	EDAS
Weights	0.216	0.211	0.212	0.161	0.199
Rank	1	3	2	5	4

Table 4 shows the Pearson's rank correlation coefficient result that indicates the relationship between five MCDM approaches i.e., SAW, TOPSIS, COPRAS, ARAS, and EDAS. It can observe that SAW, TOPSIS and ARAS gives the best outcome. Table 5 shows the weights and rank of each MCDM methods that is calculated from the correlation table.

After obtaining weights of each MCDM approach, as show in Table 5, we incorporate a hybrid MCDM ranking approach using ensemble method i.e., "Majority Voting" to obtain the optimal result. Values are assigned to options based on their ranking in majority voting, where the top ranked option is assigned the highest value. We calculate the weighted score, first multiplying

the option value into with weights for each alternative then summing of all the criterion value and find the final rank of each alternative.

Table 6. Final Ranking

Sectorial Indices	SAW	TOPSIS	ARAS	COPRAS	EDAS	Weighted Score	Final Rank
A1	9(12)	10(11)	9(12)	10(11)	4(17)	12.611	9
A2	8(13)	8(13)	8(13)	5(16)	2(19)	14.664	7
A3	4(17)	3(18)	5(16)	11(9)	6(15)	15.296	5
A4	7(14)	7(14)	7(14)	1(20)	7(14)	14.952	6
A5	11(9)	11(9)	11(9)	7(14)	15(5)	9	11
A6	12(8)	12(8)	12(8)	9(12)	11(9)	8.835	12
A7	1(20)	1(20)	1(20)	3(18)	1(20)	19.658	1
A8	15(5)	15(5)	15(5)	16(4)	14(6)	5.033	15
A9	3(18)	4(17)	4(17)	6(15)	5(16)	16.678	2
A10	2(19)	2(19)	2(19)	13(7)	8(13)	15.855	4
A11	6(15)	5(16)	6(15)	2(19)	3(18)	16.437	3
A12	10(11)	9(12)	10(11)	4(17)	10(11)	12.166	10
A13	14(6)	14(6)	14(6)	15(5)	12(8)	6.231	14
A14	13(7)	13(7)	13(7)	8(13)	13(7)	7.959	13
A15	16(4)	16(4)	16(4)	14(6)	16(4)	4.318	16
A16	5(16)	6(15)	3(18)	12(8)	9(12)	14.113	8

Conclusion and Future work

This research has successfully applied MCDM approaches, namely SAW, TOPSIS, COPRAS, MOORA, and EDAS, to rank sectorial indices of the NSE. By calculating criterion weights using the CRITIC method and applying the Pearson rank correlation coefficient between these MCDM approaches, a comprehensive understanding of the relative performance of NSE sectors has been achieved. The incorporation of criterion weights has improved the accuracy and reliability of the rankings, providing valuable insights for investment decision-making.

In future, there is potential for extending this approach to handle larger datasets. The scalability and applicability of the methodology can be explored to identify and rank sectors on a broader scale, potentially encompassing additional indices and economic variables. Furthermore, future research endeavors could involve the integration of MCDM approaches with machine learning techniques. Developing a model that combines the strengths of MCDM and machine learning could offer more efficient forecasting of economic decisions. By leveraging the predictive capabilities of machine learning, the model could enhance the ability to anticipate market trends and make informed investment decisions.

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Vol. I, Issue 2, 2023
ISSN: 2584-0517

Artificial Intelligence Based Learning: NEP 2020 Enhancing Indian Initiatives for Multidisciplinary Education

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Abstract:

The phrase "Artificial Intelligence" (AI) refers to a variety of methods employed by a computing approach that imitates human intelligence to solve a given problem. It is informatics in conjunction with philosophy and psychology. A wide range of technologies that differ in complexity, adaptability, and suitability for certain issues are included in the category of artificial intelligence (AI). In all fields of innovation and research, AI has been extensively applied. Moreover, the pandemic has fundamentally changed the landscape by forcing educators to use technology for digital instructions and digital learning. Currently, 86% of educators think technology ought to be a fundamental component of education. AI has the ability to advance teaching and learning, supporting the education sector as it develops for the good of both students and teachers. In July 2020, the National Education Policy 2020 was unveiled, and it contained promising elements for digital education. When formulating the tenets of the new education policy, it was kept in mind that the necessity for online education was the most important requirement following the COVID-19 issue. This study focuses on how NEP will augment and enhance AI based learning for the endorsement of multidisciplinary education. This paper also outlines the structure of policy that places a strong focus on the need to convey the necessary technological skills at all levels of education in order to modernize India's curriculum and prepare students for the AI economy. The need of artificial intelligence and the necessity to learn coding is also discussed.

Keywords:

NEP 2020, Artificial Intelligence, Multidisciplinary Education, AI initiatives, AI Challenges

I. Introduction

In the increasingly automated and AI-driven world of technological advancements, National Education Policy (NEP) emphasizes a future generation that is tech literate. Technology has become the centre of modern life, influencing professional decisions and career paths. Students are transitioning into industry and creating careers faster than ever before because to the early use of modern technologies to enhance the basic foundation of learning. The NEP places a lot of focus on technology-based learning, which, due to its advantages and range of applications, has the potential to fundamentally alter the way learning is conducted in the country. Students now have other routes to becoming employable even while still in the educational process. According to the policy, technological advancements such as artificial intelligence will fundamentally change the classroom learning process. Nonetheless, for this upgradation, intensive research is a

necessity in educational and technological foundations. A distinct goal of the New Education Policy, 2020 is to give Indian students a well-rounded education with a focus on developing their skills in disruptive technologies like artificial intelligence (AI)[1].

II. AI in NEP

The new curriculum focuses on fundamental concepts, abilities, and consequences in artificial intelligence, data science, and other fields that help people solve problems and make decisions more effectively. NEP has made an effort to match the current curriculum with the importance of AI and prepare students for the AI-driven economy. The new approach starts teaching important abilities like digital literacy, coding, and computational and critical thinking to schoolchildren at a very young age. A new "technology-oriented" education approach will undoubtedly help today's kids and open up job chances.

To give teachers the time and freedom to prepare themselves in accordance with the needs, AI is now anticipated to promote efficiency, personalization, and streamlining of administrative activities. The goal of AI is to collaborate with humans and robots for the benefit of students by utilizing the finest qualities of both. To increase the human resource in these fields, it has been recommended that all AICTE-approved universities establish B.Tech. programs in AI and Data Science and include AI as an elective. Additionally, these courses are already offered by IITs because their Acts and Statutes permit them to develop their own curricula and collaborate with institutions and business on academic and research projects. The nation may be anticipated to embark on a transformational path through technical education and research in light of the NEP's current focus on generating disruptive technologies and skills for the 21st century. But it's also important to educate students about the moral and ethical concerns with AI [2].

All facets of education could be improved by artificial intelligence (AI): [2]

i. For students, AI may offer them a personalized learning experience catered to their particular tastes and requirements, fast feedback on their work and responses to their queries, and enhanced access to tutoring and other educational resources.

ii. For educationists, it can lessen fatigue, devise better intrusion, and automate some of their work pressure.

iii. For administrators, AI can supervise the student activities and offer proactive solutions using predictive data. However, despite the fact that using AI in schools has numerous advantages, it is constrained in the education sector due to a variety of technological, operational, and social issues.

III. Multiple Perspectives:

The teaching of cutting-edge disciplines like Artificial Intelligence and Machine Learning will expose school children to critical abilities like digital awareness, coding, and computational analytics from a young age. Additionally, to prepare students for the

workforce, subjects including Cloud Computing, big data analysis, 3-D printing, and artificial intelligence will be incorporated into the undergraduate curriculum. In critical fields like machine learning, all universities will offer doctorate and master's programs. Colleges may also provide focused instruction in low-expertise jobs that assist the AI value chain, such as speech transcription, image classification, and data annotation.

The National Research Foundation (NRF) would also support top-notch research in the fields of science and technology in an effort to make India a leading knowledge hub for disruptive technologies. Promoting research in this area has received particular attention given to the growing applicability and declining prices of AI-based forecasts. A three-pronged strategy has been established to direct AI research, including (a) expanding core AI research, (b) creating and implementing application-based research, and (c) setting up global research initiatives to use AI to address challenges in industries like healthcare industry, agricultural science, and climate change [2].

The policy foresees the deployment of AIpowered solutions to achieve its objectives of a multidisciplinary and holistic education. Along with efforts to improve Natural Language Processing for India's several languages, initiatives to encourage multilingualism among school kids will be intertwined. In order to provide a comprehensive report card, AI will also be utilized to monitor and record a child's training in life skills.

IV. Coding – The Essential Aspect

Teaching coding to pupils starting in sixth grade is one of the NEP 2020's standout features. According to the government, students need to be familiar with it from an early age and it is 21st-century ability. In order to prepare the next generation for the jobs of the future, it attempts to equip them with the abilities that will be most in demand in such positions. This decision will have a significant influence on closing the affordability and coding literacy gap. [3][10]

Building or manipulating code for computer programs or video games is only a small part of what a student learning coding must learn. Coding curriculum teaches students transferable abilities that may be used in a wide range of situations outside of the realm of technology. The ability to code is incredibly useful because it is the technology of the future. Future employment chances for students that learn computer programming at an early age will be abundant and progressive. [4]

Figure 1. Importance of Coding

V. Impact of AI

The survey found that of all emerging digital technologies, AI is anticipated to have the biggest influence on society and the economy during the next ten years. Artificial intelligence (AI) is advancing quickly and is being used in almost every imaginable industry and field. Virtually every aspect of society, including education, healthcare, cultivation, mobility, energy, engineering, businesses, production and the government, can benefit from AI. [5]

A multidisciplinary Outlook of Artificial Intelligence

Within a broad range of applications, artificial intelligence (AI) has the potential for augmentation as well as potential replacement of human functions and activities. The rate of advancement for AI innovation today is rapid, necessitating societal, institutional, and technological modifications as well as new chances for ongoing innovation in a variety of fields, encompassing business and administration politics, the public sector, and science and innovation. Humanities and social science must be included in the discussion of law, economics, ethics, and the effects of AI and digital technology in order to manage this potential, explore opportunities, and moderate obstacles. With our more algorithmic societal processes, we can only plan a course forward collectively that will be advantageous and reliable[6].

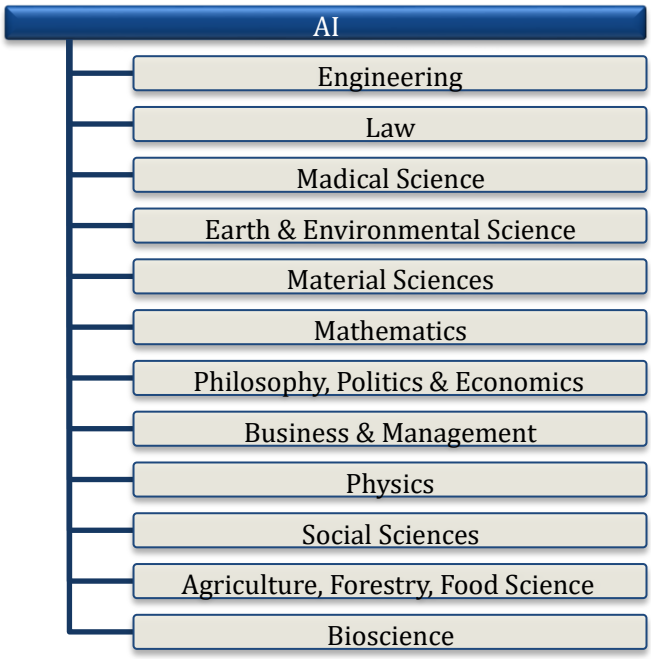

Figure 2. Application areas of AI

The influence, governance, ethics, and responsibility of these technologies around the world are hot topics because of the fast expanding capabilities and prevalence of AIbased systems in our daily live [7]. Computer science or engineering alone cannot provide an answer to these questions. In reality, we can claim that artificial intelligence is no longer a field of engineering and now involves a wide range of participants and disciplines.

At this juncture, Education plays a significant role. However, the majority of the world's existing AI and robotics curriculum produce engineers with an overly limited work perspective. Engineering education has to be expanded due to the widespread impact of AI on society [8].

Possibly another method to draw in a more diverse student body is to expand AI programs. Female students, who generally choose humanities and social sciences over engineering, may be inspired to study AI if

AI programs are known to be transdisciplinary. Curriculums in the humanities and social sciences must also incorporate lessons on AI theory and application. For instance, legal specialists must be prepared to deal with legal and regulatory challenges relating to AI through legal a curriculum.

VI. Features of NEP 2020 That Are Centered on Artificial Intelligence:[9]

a) Alliance for Technology in National Education Policy

NEAT (National Education Alliance for Technology), an independent organization with the goal of providing a platform for

technology innovations to improve online learning, exams, administration, and planning, has been suggested for creation by National Education Policy 2020.

b) AI Education in School Curriculum

NEP 2020 suggests introducing machine learning and artificial intelligence education for all the students at various as soon as possible.

c) Teaching-Learning-related Software

According to the policy, teaching-learning softwares would be developed utilizing AIbased computing and would be made available to teachers and students in all local languages. These tools will be widely accessible and beneficial to all stakeholders, even those who receive the education in rural areas or have special needs.

d) Digital Classrooms

The National Education Policy 2020 states that AI technology will aid in the development of smart classrooms that will permit online communications and collaborations with students from various schools all over the world, online exams, applications with tests and quizzes, and information that can develop the pupils.

e) National Teachers' Portal

All of the electronic content created by all state boards, central boards, international boards and other organizations will be available on the National Teacher's Portal, a digital platform. This will also be helpful in providing content for instructors' professional development.

A digital India is going to be established thanks to the National Education Policy 2020. The majority of digital tools that can aid in the growth of a nation with a digital literacy will be developed with the aid of artificial intelligence-based technology. The students will have a basic understanding of coding and 3D technology. This will enable them to move boldly through the world of advanced technology. India will soon be a major centre for cutting-edge technological expertise.

VII. AI Challenges

As the extent and depth of potential applications expands and the usage of AI becomes more commonplace, the adoption of AI technology can pose substantial issues for governments and organizations [11]. Figure below classifies these difficulties, and the table below will explore them.

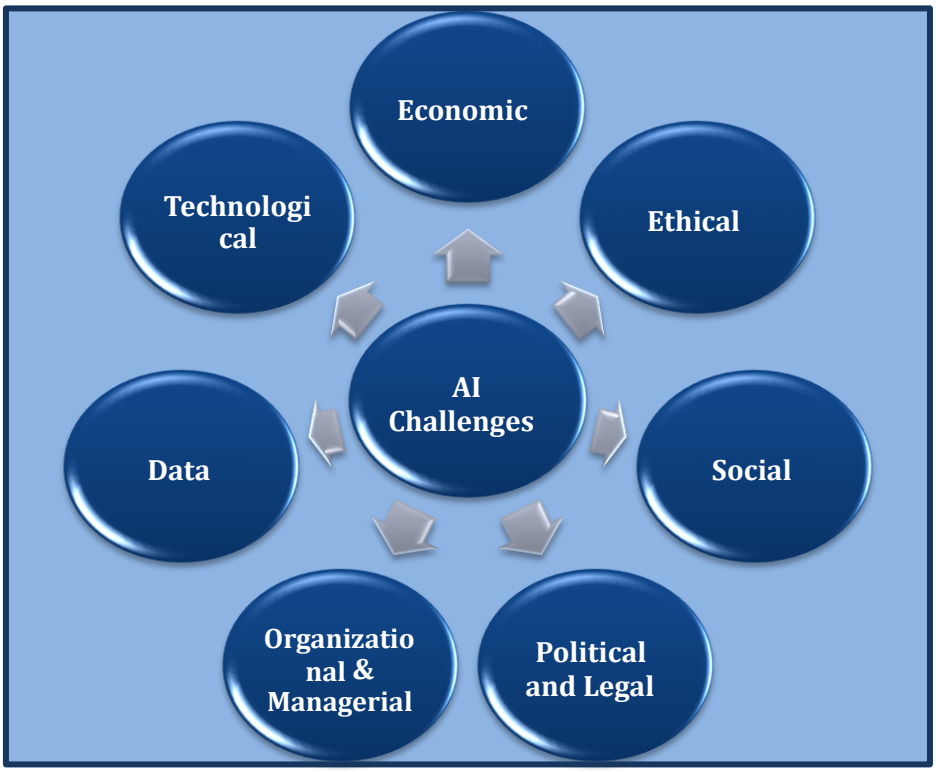

Figure 3. Challenges in AI

AI Challenges	Description
Economic challenges	Given the required investment and altered working methods, the widespread adoption of AI technology could have a substantial economic impact on organizations and institutions.
Ethical challenges	The ethical aspects of AI and their implications for a wider application of the technology have been considered by researchers. People and organizations may display a lack of trust and worry about the ethical implications of AI systems and how they use
Organizational and managerial challenges	A variety of organizational and managerial issues that have strategic ramifications for businesses are presented by the shift toward the adoption of AI technologies. More advanced technologies must be included into current AI systems so that human-computer interaction can be enhanced and coupled with information flow.
	shared data.
Social challenges	Cultural norms are expected to be questioned by the growing usage of AI, which could function as a barrier for some sections of the society.
Political and Legal challenges	Obstacles of integrating AI in government argue that a more comprehensive understanding of the scope and impact of AIbased applications and related challenges is increasingly important.

Data challenges	The difficulties of AI and big data integration have been covered in a number of researches. New and effective solutions are required to handle the big data's high volume, diversity, and rapidity.
Technological challenges	Studies have examined the difficulties of using AI technology for data and image interpretation as well as the non-boolean character of diagnostic jobs in healthcare.

VIII. Conclusion:

The Indian educational system is becoming more and more aware of the value of skillbased learning and the necessity of educating the next generation in cuttingedge technologies like artificial intelligence, machine learning, and analytics. In addition to schools, colleges and universities are developing courses that are especially focused on these new technologies.

The introduction of these skills along with academic flexibility will raise the quality of the workforce and enable the creation of a new nation. Not only will it produce a workforce that is competitive for the twentyfirst century, but it will also make India a leader in innovative technology. In spite of such a vast workforce, something that was impossible to accomplish in IT up until now appears to be feasible in the field of AI in the next decades.

The National Education Policy 2020 seeks to significantly improve the educational system in order to get the next generation ready to lead original inventions and turn India into a knowledge superpower.

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ISSN : 2584-0517

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