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A COMPREHENSIVE ANALYSIS OF ARTIFICIAL INTELLIGENCE'S TECHNIQUES IN VARIOUS INDUSTRIES: APPLICATIONS, BENEFITS AND CHALLENGES

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Abstract
In this study, we briefly review various popular artificial intelligence methods with their benefits, drawbacks and compare their applications in financial domain, medical domain Energy industry, Engineering and construction sector. Our research objective is based on existing literature which assist researchers in selecting and developing AI based on meta-analysis. A systematic study of articles investigating a topic of interest is necessary to do a meta-analysis. A wide range of AI techniques can complicate the process of choosing the best algorithm for specific systems. The results are encouraging and shows that, when it comes to solving financial problems, the aforementioned artificial intelligence approaches perform and are more accurate than traditional statistical techniques, especially when it comes to nonlinear models.

1. Introduction

Meta-analysis has its limits. First of all, its scope is far more constrained than that of a standard literature review, which might include studies that are only loosely connected to the phenomena being studied and cover a very wide variety of research.

1.1. Artificial intelligence (AI)

Combining computer science with physiological research results in artificial intelligence. In a nutshell, intelligence is the computational component of the ability to achieve goals in the global arena. Artificial Intelligence includes the ability to analyze, envision, retain, comprehend, recognize patterns, make judgments, adapt to change, and learn from skill. The process of having computers behave more like humans and in a more human-like way in a notably shorter period of time than a person is known as artificial intelligence. [41] [30]

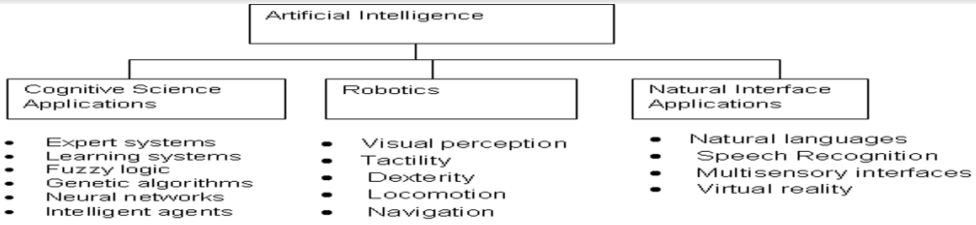

Fig. 1. Areas of Artificial Intelligence [23]

Since the very beginning of time, people have utilized a broad range of tools to do various tasks more quickly. The ingenuity of the human brain led to the creation of several inventions. These technologies make human existence simpler by enabling people to meet a range of needs, including computing, transport, and industry. Machine learning is one of them. The area of artificial intelligence that teaches machines to learn is called machine learning. A condensed form of machine learning is called deep learning. [1] [30]. In real life, the contemporary technology environment has a wide variety of data kinds, such as information from the Internet of Things (IoT), cybersecurity, smart cities, companies, mobile devices, social networks, health, COVID-19, big data, etc. [2]

By using machine learning (ML), machines may be taught to process information faster. After viewing the data, we are unable to interpret the information that was taken out of it. In these situations, we employ machine learning. Because there are so many datasets accessible, there is an increasing demand for machine learning. Many industries employ machine learning to extract relevant data. The goal of machine learning is to learn from the data [3].In recent years, machine learning (ML) and artificial intelligence (AI) have been used to analyze data and permits intelligent operation of the applications. [3]

With the use of computer systems that are capable of solving issues rather than being explicitly programmed to do so, machine learning refers to a collection of methods that are frequently employed to address a range of everyday problems. An AI must be a computer with a mind, according to the "Behavioral Modeling" stream, which refers to thinking like a human being. This also entails thinking as a person would, using the same reasoning processes that resulted in the same conclusion as well as the same outcome when given the same information. [4]

1.2 Background

Introduction of a machine learning method that integrates several parameters and meta-data of research papers, as well as an empirical comparison of different artificial intelligence approaches, such as machine learning, deep learning, natural language processing, expert systems, genetic algorithms, and fuzzy logic. Crucial methods and strategies have been emphasized.

2. Literature Review

A wide range of Artificial Intelligence techniques have been developed to address data problems and provide trustworthy and accurate prediction models. These algorithms find patterns in historical data to forecast future events. Adaptive Neuro Fuzzy Inference System (ANFIS), Bagging Functional Tree (BFT), Fuzzy Logic Algorithm, Evidential Belief Functions (EBF), Naïve Bayes Tree (NBT), Alternating Decision Tree (AD Tree), Logistic Model Tree (LMT), Kernel Logistic Regression (KLR), Support Vector Machines (SVM), Weight-of-evidence (WoE), Logistic Regression (LR), Bayesian Logistic Regression (BLR), Support Vector Machines (SVM), Fuzzy Logic Algorithm, Naïve Bayes Tree (NBT), Alternating Decision Tree (AD Tree), Logistic Model Tree (LMT), Kernel Logistic Regression (KLR), Logistic Regression (GPR), and Adaptive Neuro Fuzzy Inference System (ANFIS) are some of the algorithms used to create landslide vulnerability plans [10].

2.1. Techniques of AI

- Machine Learning (ML)

- Deep Learning
- Natural Language Processing (NLP)
- Expert Systems
- Genetic Algorithms
- Fuzzy Logic
- Robotics

2.1.1. Machine Learning (ML)

Machine learning (ML), a type of artificial intelligence without explicit programming, allows computers to learn from data and get better over time.

2.1.1.1 Supervised Learning

In supervised learning, once a set of simulated blocks or cases with the right results are supplied, the system develops the ability to respond more precisely by comparing its output with those that are given as input. Additional subcategories of supervised learning tasks include classification and regression tasks. In classification, the output labels are discrete, while in regression, they are constant. [5][6] [24]

A function mapping inputs to the intended outputs is produced by the different algorithms. The categorization problem is a common way to formulate the supervised learning task.

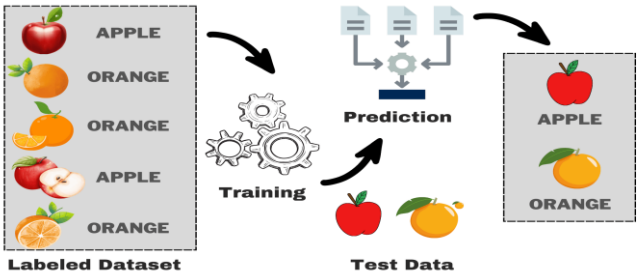

Fig.2. Supervised Learning

Classification: Assigning the data to the groups specified in the data set based on their unique characteristics.

Regression: Predicting or drawing conclusions about the data's other properties based on its accessible features is known as regression.

2.1.1.2. Decision Tree

A decision tree is a structure in which every point displays an aspect (attribute), each link (branch) displays a decision (rule), and each leaf displays a result (categorical or continuous value). Its branches, leaves, and roots all have nodes. Every internal node is used to test an attribute; hence, the leaf node has the branch and class label. A root node is the topmost node in a tree and the parent of all other nodes, as the name suggests. [8]

The decision tree's core branches divide the total number of samples into two or more sub-samples using a specific probability index, such as efficiency. Each terminating node is assigned to the class with the best response values. Numerous decision tree techniques, such as C4.5, C5.0, CART, and logistics trees, are available for both discrete and continuous features. [9] [24].

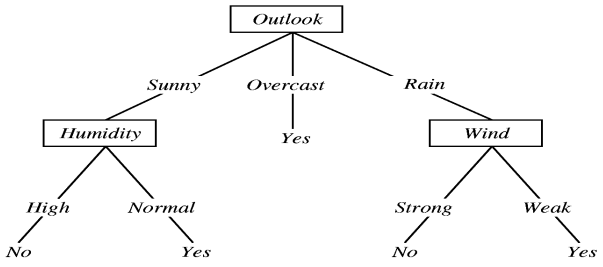

Fig. 3. Decision Tree

2.1.1.3 Decision Tree Pseudocode

Assume that the target Attribute, which is the attribute whose value is to be
Predicted by the tree, is a class variable.
Decision Tree as a node Node (instances)
# Use arbitrary labels to manage target characteristics
Dictionary = summarize Examples of dictionary keys (examples, targetAttribute):
If the total number of examples is equal to dictionary [key]
node. label = key
If attributes are missing or the number of examples is less than the minimum permitted per branch, return node #test for the number of examples to prevent overfitting:
node. label = most often used value in instances
Return node
The characteristic with the greatest knowledge gain is bestA.
For every feasible value v of best, node. decision = bestAA: subset = the subset of instances where v is the value of bestA
If the subset is not blank:
(id3 (subset, targetAttribute, attributes-bestA))
node. addBranch
Return node

2.1.1.4. Navie Bayes

It argues that additional characteristics have no effect on a feature's impact throughout a class. Navie Bayes is among the simplest supervised learning techniques. After computing the likelihood probability and prior probabilities for a given class label, it delivers the conditional probability of a certain target. It may be applied to the development of generic boosting algorithms, the prediction of sickness rates, and the study and mapping of intelligent ci0ties. Moreover, COVID-19 activity has been estimated using classifiers and the NB approach [11]. The Naive Bayes approach methodology is used in the following mathematical model for performance evaluation:
Assume that, for a given class label, each characteristic is conditionally independent of the others in order to use the Naive Bayes approach. In other words, we conclude that

$(x|y) = (A|y) * (G|y) * P(P|y) * P(V|y)$ (1)

Therefore, we apply the Naive Bayes classifier method to assess the model's efficacy on sample data:

$(y|x) = (y) * (A|y) * P(G|y) * P(P|y) * P(V|y) / P(x)$ (2).

where:
P(y)—the y class's a priori probability of success or failure
P(A|y) represents the likelihood of age A for a specific y class label; P(G|y) represents the likelihood of gender G for a specific y class label; P(P|y) represents the likelihood of the prior estimate of P for a specific y class label; and
P(V|y) represents the likelihood of attendance (for) at a specific y class label. [12]

2.1.1.5. Support Vector Machine

The categorization technique known as Support Vector Machine (SVM) was created in the 1990s and has subsequently gained traction. SVM is a supervised learning technique that uses features (Xs) to classify data sets and provide responses (Ys) that may be used to forecast future events. SVM uses a hyperplane that optimizes the margin between two classes and minimizes training error to find the optimal model for separating binary classes. We take into account every potential classification hyperplane because SVM is a linear learning technique. Different kernel functions can be suitably applied to distinct classes in nonlinear spaces. We give our training data binary outcomes, such -1 and +1, when there are separable states. Support vectors are training data on the margin, and the hyperplane that can create the greatest minimal distance between two classes is unique. We will permit misclassification in optimization problems in non-separable circumstances and aim to maximize margin while minimizing error. We will demonstrate the classifier's optimization and derivation in the next section. Furthermore, we demonstrate how the support vector classifier is reliant on the support vectors' inner product. Next, we'll talk about various kernel functions as well as non-separable and non-linear examples [13].

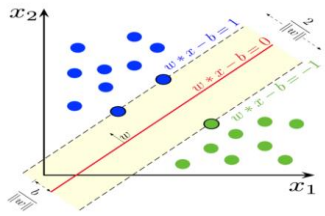

Fig.4. Maximum-margin hyperplane and margins [14]

A hyperplane may effectively split a classification issue in half, but SVM creates two boundary lines with a specific separation between them to make it simple to divide the classification points linearly. The closest positive (2 blue) or negative (1 green) points—basically, the extreme points on each side—are support vectors. These support vectors enabled the dotted hyperplane in Figure 1, which runs parallel to the main hyperplane. Furthermore, the distance between these two dotted hyperplanes is known as the margin. SVM maximizes this margin distance in order to get a superior classification result.

Supervised learning techniques are used to describe regression or classification issues. Regression issues frequently produce real values, whether they are positive or negative.

Classes or categories, such as whether or not a high-risk patient should be admitted to the intensive care unit, are the outcome of a classification problem. Encouragement One machine learning method for resolving regression and classification issues is the vector machine. Satellite data classification, text and face recognition, time series prediction, biological data processing, and medical diagnosis are just a few of the domains where SVM has been used.

SVM finds subtle patterns in huge datasets far more effectively than other machine learning approaches. [14]

2.1.2. Unsupervised Learning

The Unsupervised learning varies from supervised learning in that it does not give the output data. The procedure of learning is aided by the links and interconnections among the material. Furthermore, unsupervised learning lacks training data. [6] [24]

models consisting of inputs; there are no labeled examples available. [7]

Unsupervised learning also has two types

2.1.2.1. Clustering: is the process of identifying data sets that are comparable to one another when the data's natural categories are unknown.

2.1.2.2. Association: Searching the relationships between the data in a single data collection is known as association. [6]

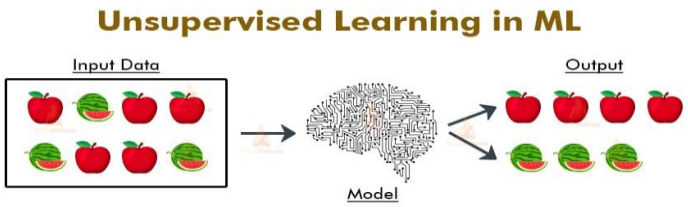

Fig.5. Unsupervised Learning

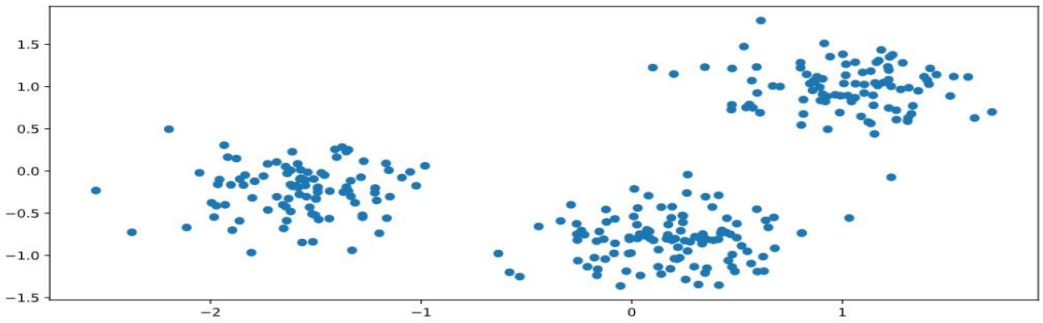

Fig.6. Unsupervised Learning

2.1.2.3 Reinforcement Learning

Reinforcement learning is a branch of machine learning that examines how algorithms should act in a certain environment in order to maximize the idea of cumulative reward. [19] [24]

Fig.7. Reinforcement Learning

Merits: • Effective at classifying or predicting based on past data; able to manage big, complicated information.

Limitation: For supervised learning, a significant amount of labeled data needed, an issue with overfitting may arise and the convergence of reinforcement learning may be sluggish.

2.1.2.4. K-Mean Clustering

K-Mean Clustering is an Un-supervised clustering technique. Among the several clustering techniques, K-mean clustering is widely used. K-means is used to identify the "k" clusters in a given database. [27]

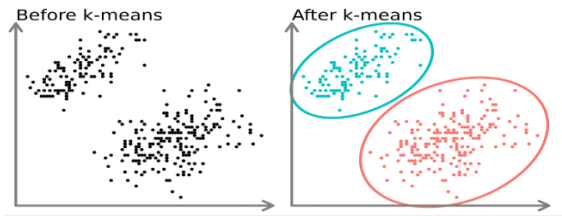

Fig.8. K-mean Clustering

2.1.2.5. Pseudocode for K-Means Clustering

Clustering using K-Means 1. Select K as the number of clusters, then get the data points.
2. Position the centroids c_1, c_2... c_k at random
3. Steps 4 and 5 should be repeated until convergence occurs or a predetermined number of iterations has passed.
4. for every x_i data point:
Determine which centroid is closest to you (c_1, c_2... c_k).
Give that cluster the point.
5. j = 1...k for every cluster.
The mean of all the points allocated to that cluster is the new centroid.

6. Finish (google)

2.1.3. Semi-supervised Learning

When there are insufficient labeled data points than unlabeled data points, both supervised and unsupervised learning are insufficient. In these scenarios, information about them is inferred from the unlabeled data, which is woefully insufficient. Supervised and semi-supervised learning are differentiated by the labeled data set. [6]

It generates a proper role or classifier by joining both labeled and unlabeled instances. [7]

2.1.3.1. Transductive SVM:

Transductive SVM Semi supervised learning has made extensive use of transductive support vector machines (TSVM) to handle partially labeled input. Because its basis in generality not well understood, there has been mystery around it. Using TSVM to find an exact answer is an NP-hard task. [15] [24]

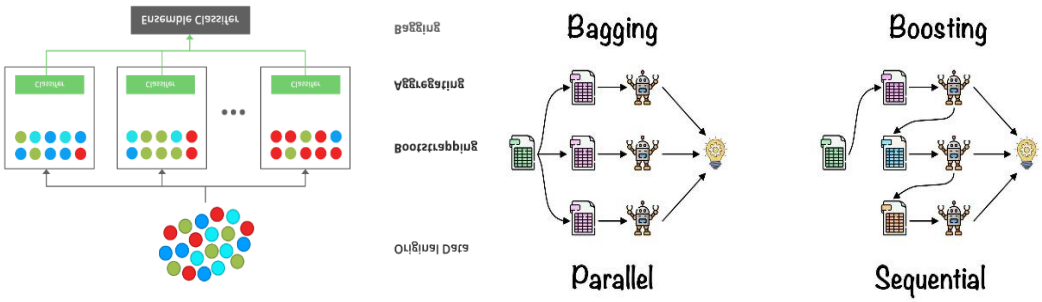

Fig.9. Boosting and Begging

2.1.3.2. Ensemble Learning:

One method that has dominated the field of machine learning is ensemble learning. By using the advantages of several base models, ensemble learning seeks to enhance classification performance. Ensemble learning methods are broadly categorized into boosting, bagging, and stacking. By combining two or more machine learning algorithms, a technique known as ensemble learning can get better results than when the individual algorithms are employed alone. [16] [20]

2.1.3.3. Boosting

Ensemble approaches gained popularity as a rather easy way to boost a base procedure's prediction ability. The bagging technique turns out to be a variance reduction strategy, at least for certain base procedures, for a variety of reasons. However, the main goal of boosting techniques is to lessen the underlying procedure's (model) bias. This alone shows that boosting and bagging are two rather distinct ensemble techniques. [20]

2.1.3.4. Begging

The term "bagging" refers to bootstrap aggregating, an ensemble technique used to enhance unstable classification or estimation techniques. Breiman encouraged bagging as a way to reduce variation for a certain base approach, including decision trees or linear model fitting and variable selection techniques. Due to the popularity of the bootstrap approach and its ease of application, it has garnered a lot of attention. [20]

2.1.4. Deep Learning

It is a branch of machine learning that uses neural networks with several layers to model complex patterns in data.

2.1.4.1. Artificial Neural Network

Artificial neural networks (ANNs), has become a prominent machine learning paradigm in recent years. In addition to providing robust data analysis methods, ANNs give neuroscientists a fresh way to investigate neural system optimization in ways that traditional models are not intended for, as well as to construct models for complex behaviors,

heterogeneous neural activity, and circuit connectivity. [17]

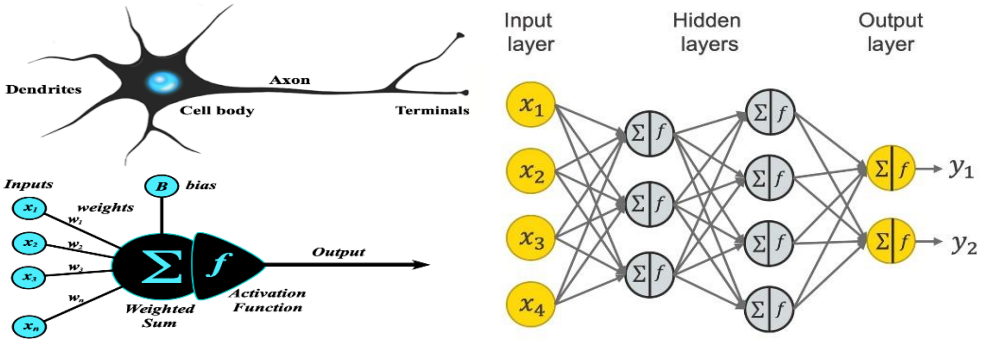

Fig.10. Neural Networks

The use of deep neural networks (DNNs) to create better predictive models has been suggested. They may be represented as a series of layers, where each layer performs a linear transformation followed by an elementwise nonlinearity, so that $f(x) = f_L \cdot \cdot f_1(x)$. The model gains significant prediction capability when many of these layers are combined. DNNs have demonstrated exceptional efficacy in computer vision tasks. [18]

2.1.4.2. Supervised Neural Network

The supervised neural network's output is predetermined. The neural network's predicted and real results are contrasted. After the error is corrected, the parameters are sent back into the neural network. Supervised neural networks are used in feed forward neural networks. [19] [24]

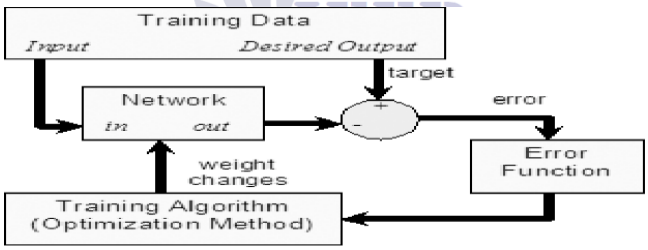

Fig.11. Supervised Neural Network

2.1.4.3. Unsupervised Neural Network

When class identities (labels) cannot be added to the training data sets, unsupervised learning is utilized. This is impossible when there is either no environmental information or the expense of learning about it is too great. As the name suggests, the ANN is not monitored by a "teacher" in unsupervised learning. Rather, it is given unlabeled data sets that simply include the input data and is then left to look for patterns in the data and create a new model from them. In this case, ANN uses the distance between clusters in the data to learn how to categorize it. [19] [24]

2.1.4.4. Merits of Deep Learning

Outstanding for problems involving big datasets, such as natural language processing or picture identification, able to automatically identify characteristics in unprocessed data.

Limitations:

- Has a high computational resource need.
- For training, enormous volumes of labeled data are needed.
- It might not apply well to tiny datasets.

2.1.4.5. Instance Based Learning

Instance-based learning is a set of classification and regression techniques that determines a class

label or forecast by comparing the request to its nearest neighbor or neighbors in the training set. It is evident that, unlike other methods such as decision trees and neural networks, instance-based learning algorithms do not create an abstraction from particular instances. Rather, they simply store all the data and utilize the nearest neighbor (s) of the query to compute the answer at the end of the query. [21]

2.1.4.6. K-Nearest Neighbor

The K-nearest neighbor (KNN) method is among the oldest, simplest, and most accurate algorithms for pattern recognition and regression models. KNN is one of the most significant data mining techniques and is a standard classifier for various pattern classification problems, including as pattern recognition, text categorization, ranking models, object identification, and event recognition applications. [25]

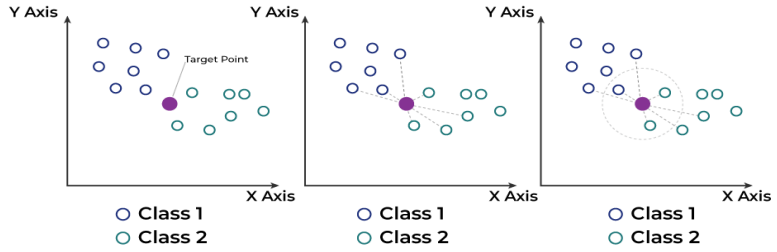

Fig.12. K-Nearest Neighbor

2.1.5. Natural Language Processing (NLP)

Natural language processing (NLP) has advanced significantly in recent years due to the rise of artificial intelligence (AI). Natural Language Processing (NLP) is a computer-assisted analytical approach that automatically analyzes and comprehends human language, making it possible to rapidly and efficiently extract valuable insights from textual information without requiring heavy computing work. [26]

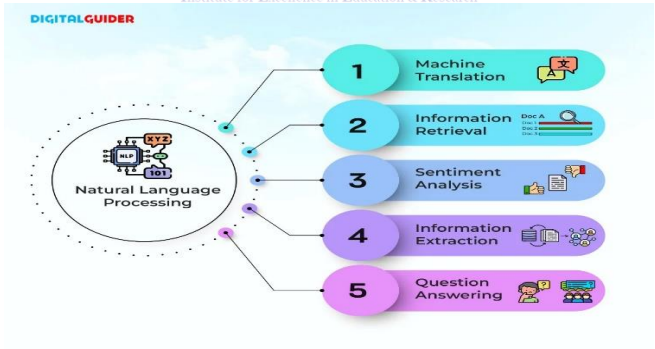

Fig.13. Natural Language Processing (NLP)

Merits of NLP

- Crucial for jobs requiring human language (such as translation and chatbots).
- Making quick progress with models like BERT and GPT.

Limitations: It may be challenging to grasp context or sarcasm due to the ambiguity and subtleties of human language.

2.1.6. Metaverse.

The term "metaverse," which combines the prefix "meta" (implying transcending) with the word "universe," refers to a fictitious artificial environment that is connected to the real world. The techniques used in metaverse are image classification, object detection, object tracking. A possible new world emerged for society in the Metaverse following the COVID-19 epidemic.

The community is talking about retail merchandising, corporate integration, partnerships, investment, and how to modify this model to fit global living. [28]

2.1.7. Expert System

An expert system is one that uses its knowledge to simulate the actions of an expert in solving complicated issues. The rules or experiences of the behavior of elements from a certain topic of knowledge are what make expert system knowledge. These artificial intelligence systems mimic a human expert's decision-making process. They base their choices or suggestions on a body of knowledge and a set of norms. [32]
It has two types which are

- Rule-Based Systems: These systems base their choices on a series of "if-then" rules.
- Inference Engines: Utilize the knowledge base to make deductions.

Merits of Expert System
Extremely understandable and explicable; useful tasks in domains such as forecasting finances or medical diagnostics.

Limitations: • Stiff and difficult to adjust to changing circumstances; if the guidelines or information resources are not updated, they may become out of date.

2.1.8. Fuzzy Logic

A mathematical idea known as fuzzy logic permits ambiguity and imprecision in thinking and judgment. Generally speaking, observations and assertions are either accurate or untrue; there is no in-between ground.

Merits of Fuzzy Logic
Excellent for managing ambiguity and uncertainty; easy to integrate into systems like washing machines or climate control.

Limitations:
• When accuracy is essential, it may not be as precise as other methods.
• The roles of membership must be well defined.

2.1.9. Robotics

Robotics deals with the inspiration, manufacture, and use of robots. The aim of the arena of robotics is to build intelligent devices that can help people in many ways. There are several types of robotics. With the rapid advancement of medical robotics, thousands of robotic surgical systems are currently in use in numerous fields like in clinics worldwide, and millions of surgeries have been carried out. [34].

3. Applications of Artificial Intelligence

- **AI in Medical**

It is now possible to analyze retinal photos and cutaneous lesions, read ECGs and white-cell differential counts, and do other image processing activities on a computer. [22] [38]. An Open AI-trained language model is called ChatGPT launched November 2022.
AI-driven machines such as Robots and other machines can interact with people
Additionally, AI and machine learning might be utilized to better analyze and forecast patient subpopulations and potential adverse events.

- **Robots and Library Management:**

The application of artificial intelligence in recent years has demonstrated its effectiveness in enhancing library services during pandemic situations, such as the COVID-19 pandemic. In various countries, including Germany, France, and Pakistan, robots have been employed in libraries to identify symptoms and suggest additional testing. [23][30]

- **Recommender System:** Machine-learning algorithms have been employed to create recommender systems that enhance the user experience by offering personalized suggestions. This is achieved through various methods such as filtering, rating, and identifying preferences or options that may appeal to users. Recommender systems enhance the variety of services available to library patrons. [23]

Scene classification is a typical problem in pattern recognition, where a system scans an image, examines its many components, and utilizes those aspects to classify the image into a certain class or

group. Semantic scene categorization, for instance, divides photos into semantic groups like parties, beaches, and sunsets; many photos may fall under more than one semantic class. [24] [30] [31]

Artificial Intelligence and Machine Learning are used in the classification of software engineering artifacts used for traffic forecasting services, machinery applications, database mining, computational advertisement, automated text categorization, data center optimization, hierarchical categorization of web pages, epileptic seizure detection, email batch detection, document organization, text filtering, anomaly detection, or recognizing anomalies. Intrusion detection, information retrieval, email and thread summarization, spam filtering, Automatic mail organization into folders, face recognition, handwriting recognition, acoustic factor analysis for robust speaker verification, and medical record [22] [30] [31] [37].

- AI agents used as player's opponents, teammates in computer games.
- Used for DNA classification: Understanding genomics
- AI and ML used in Acoustic Environment Identification (AEI) and Audio Forensics.
- A brain-computer interface is a partnership between a brain and a machine or technology that interprets electrical impulses from the brain and utilizes them to control exterior actions, such as moving a prosthetic limb or a cursor. The machine or gadget serves as a conduit between the brain and the item that the brain is supposed to regulate. [30] [31]

- **Applications to Music:** There are numerous approaches to categorize music since there is a plethora of possibilities available when choose which element to use as the basis for the categorization. Complex and frequently high-dimensional (when recorded as audio) musical data is where machines may help, as machine learning is ideally adapted to handle such data. [24] [30] [31]

- **Computational Finance:** Technologies that train a computerized intelligent proxy to identify patterns in the stock price dynamic just before to a significant market move have been created that allow for the prediction of future stock price movements. The agent monitors the market's current condition during the exploitation stage.

  In contrast to traditional e learning, which wastes bandwidth, mobile learning, or Mobile learning, refers to learning while on the go. Because of mobile or portable devices, information is readily available whenever and wherever needed. Thus, machine learning supports various users' learning processes by delivering information that is tailored to the user's preferences. [24] [30] [31] [36] [40].

  Energy Sector: The energy sector is at a turning point. Revolutions in digital technology have the power to adjust our energy supply, commerce, and consumption. Artificial intelligence (AI) technology is the driving force behind the new digitalization paradigm. [39]

- **Sentiment analysis/ opinion analysis:** When someone speaks, we can hear their words and the emotions in their voice. If the interaction is in person, we can also see their facial expressions. Textual data records facts and information, but it frequently misses the speaker's feelings, which causes the genuine meaning of the words to be misunderstood. One may argue that this is a loss of important knowledge. It needs to adapt to the ever-increasing complexity of the statements it uses to represent itself, and learning algorithms are quite helpful in this regard.

- **Analysis of gene expression data: cancer diagnosis:** One of the most important steps in treating cancer is determining its kind. Classifying patient samples is how it is accomplished. By examining the patient's gene expression, the categorization procedure and outcomes may be enhanced

and the physicians could get more knowledge. Numerous life-saving medical advancements have already resulted from the fusion of medical science and technology.

- **Smarter cars:** GPS was first made available for personal automobile navigation systems. Modern cars have sensors. [30]
- **Social media:** The billions of user accounts on social media platforms like Facebook, Twitter, and Snapchat need to be efficiently kept and handled. AI is capable of managing and organizing vast volumes of knowledge.

- AI is also used in Robotics, e-commerce, Education, Security etc. [30]

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4. Advantages AI Techniques

Moodle is an AI-powered platform that lets teachers set up online classes, post instructional materials, and give students assignments while enabling text, phone, and video chat communication from a distance. [29]

In order to properly program a distinct path through the content, students read instructional text, respond to brief questions, and travel through various pages according to their understanding skills. AI performs better on intellectual activities than perceptual ones, such as playing computer games and proving theorems. [30]

Useful applications of AI	Total					
	Frequency	%	Frequency	%	Frequency	%
Chatbots	36	90	4	10	40	100
Voice Assistants	19	47.5	21	52.5	40	100
Authentication and biometrics	26	65	14	35	40	100
Fraud detection and Prevention	37	92.5	3	7.5	40	100
KYC/AML	39	97.5	1	2.5	40	100
Smart Wallet	27	67.5	13	32.5	40	100

Table: 1 Multiple Response Analysis

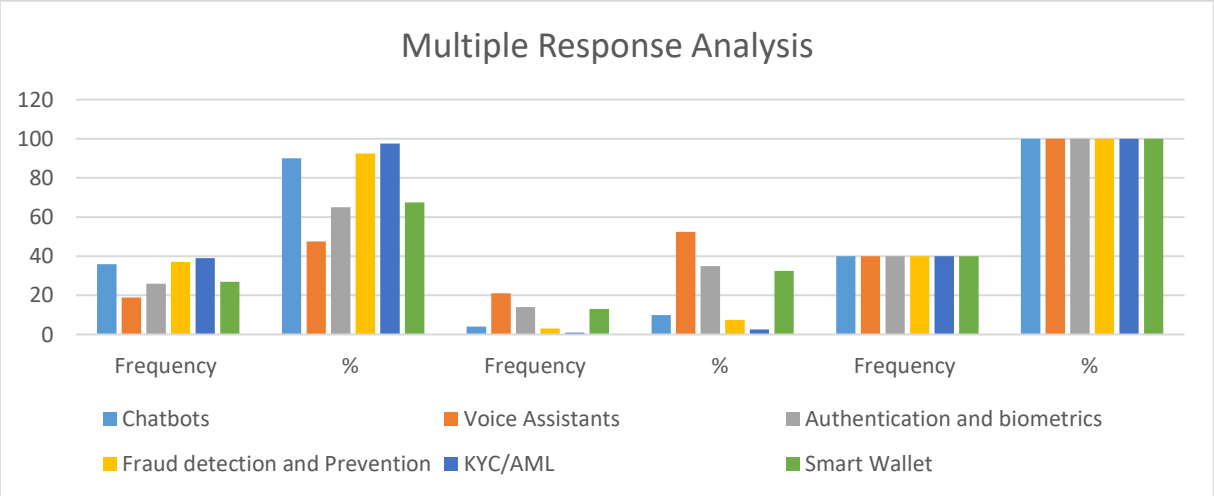

Fig. 14. Multiple Response Analysis

5. Disadvantages and Challenges in AI.

program mismatches can occur in the reverse manner of orders; human occupations are impacted; the unemployment issue worsens, the younger generation is becoming lazy, creativity is dependent on programmers, it lacks a human touch, it takes a lot of time and money, and it is more dependent on technology, ethical issues, Privacy challenges, emotionless, security risks, data privacy, implementation is costly, Relying excessively on technology and possible system breakdowns are risks associated with the growing integration of AI systems into regular operations, lack of transparency, Because AI algorithms can be intricate and hard to comprehend, there may not be enough openness, In a variety of contexts, including customer service and healthcare, a greater dependence on AI may result in less human engagement. AI can respond quickly and accurately, but it lacks the human touch and empathy that come from face-to-face communication, the significant computing and energy resources needed to train AI models, particularly large-scale ones, exacerbate Environmental issues.

6. Research Process

The principal sources for data chosen for identifying different AI approaches and their applications include academic journals, conference papers, textbooks, research papers, magazines. Only the self-organizing map, one of the recognized unsupervised learning strategies, will be covered in depth in order to focus this investigation. Along with listing and talking about the several uses of unsupervised artificial neural networks, some previous research pertaining to these uses is also included.

By doing a comparison analysis with AI systems for selecting a best one, the study aims to provide a solution to the final issue. Machine Learning (ML), supervised learning, unsupervised learning, decision trees, Naïve Bayes, support vector machines (SVM), fuzzy logic (FL) models, deep learning, artificial neural networks (ANNs), multiple regression analysis (MRA), reinforcement learning, K-means clustering, transductive SVM, boosting, bagging, ensemble techniques like scalable boosting trees (XGBoost), decision trees (DT), random forests (RF), intelligence-based learning, K-nearest neighbor, natural language processing (NLP), the metaverse, expert systems, and robotics are among the most popular artificial intelligence (AI) techniques covered in this study. Different papers are studied to conduct the research process.

Year	Title	Brief Description
2018	Machine Learning Algorithms – A Review	This article provides a concise overview and outlook on the wide range of uses for machine learning techniques.
2018	A Research on Machine Learning Methods and Its Applications	The evolution, strategies, applications and research all are covered in this study. The purpose of this study is to educate about machine learning and its uses.
2019	Machine Learning and Deep Learning	Deep learning, machine learning, and artificial intelligence are the foundations of data science, a rapidly expanding topic for scholars. This essay explains how these data science foundations relate to one another.
2019	Machine Learning in Artificial Intelligence: Towards a Common Understanding	After reviewing pertinent literature, we offer a theoretical structure that makes clear how machine learning is used to create artificially intelligent entities.
2021	Machine Learning: Algorithms, Real-World Applications and Research Directions	The article presents a thorough analysis of various machine learning methods that may be used to improve an application's intelligence and abilities.
2022	Application of machine learning models based on decision trees in	Useful characteristics in COVID-19 mortality were chosen in this work using the random forest approach,

	classifying the factors affecting mortality of COVID-19 patients in Hamadan, Iran	and logistic model trees (LMT), classification and regression trees (CART), C4.5, and C5.0 trees were utilized for classification based on significant features.

Table: 2 Brief Description of Literature

The above literature review has pointed out that, AI techniques have been used in number of fields like education, health.

Technique	Advantages	Disadvantages	Applications
Supervised Learning	High accuracy with good data quality	Requires labeled data, overfitting risk	Classification, regression, image recognition
Un-Supervised Learning	Can uncover hidden patterns in unlabeled data	Hard to evaluate and interpret results	Clustering, anomaly detection, dimensionality reduction
Reinforcement Learning	Excellent for interactive tasks, learns from environment	Computationally expensive, long training time	Robotics, autonomous vehicles, gaming
Deep Learning (CNN)	Excellent for image and video tasks	Requires large datasets and computational power	Image classification, object detection, face recognition
Deep Learning (RNN)	Ideal for sequence-based data like text	Long training times, vanishing gradient issues	Text generation, lang: Translation, speech recognition
NLP (Transformer-based)	State-of-the-art performance in text-related tasks	Resource-intensive, complex models	Text generation, sentiment analysis, translation
Fuzzy Logic	Handles uncertainty and imprecision well	slow convergence, computationally expensive	Control systems, decision-making under uncertainty

Table: 3 Advantages & Disadvantages of Ai

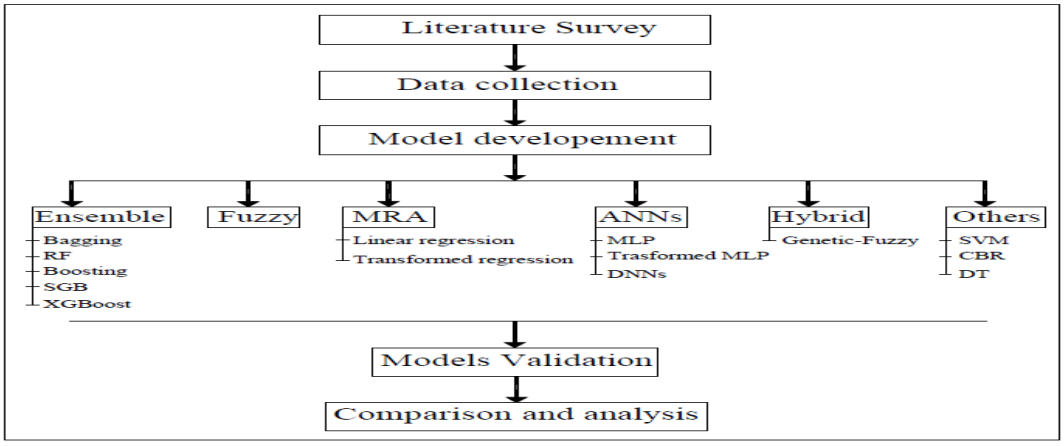

Fig.15.Research methodology

6.1. Comparison and Analysis

By studying various research paper consist of comparative analysis of various AI techniques the following data shows the accuracy of AI techniques by using Mean Absolute Percentage Error (MAPE), which measures the average percentage of the absolute errors and R-Squared (R^2), which measures the proportion of the variance in the actual values that is explained by the variance in the predicted values

AI Technique		Accuracy		Reference Paper
		MAPE	R^2	
Ensemble Learning (XGBoost)		9.091%	0.929	[36] **Comparison of Artificial Intelligence Techniques for Project Conceptual Cost Prediction**
Various Regression Techniques	Quadratic regression	9.120%	0.851	
	Plain regression	9.130%	0.796	
	Semilog regression	9.30%	0.910	
ANN's	Quadratic MLP	9.200%	0.902	
	Plain MLP	9.270%	0.912	
Ensemble method	Extra Tree	9.714%	0.947	
	Begging	10.246%	0.911	
	RF	10.503%	0.913	
Fuzzy Theory		26.300%	0.851	

Table: 4 Accuracy of Ai Techniques

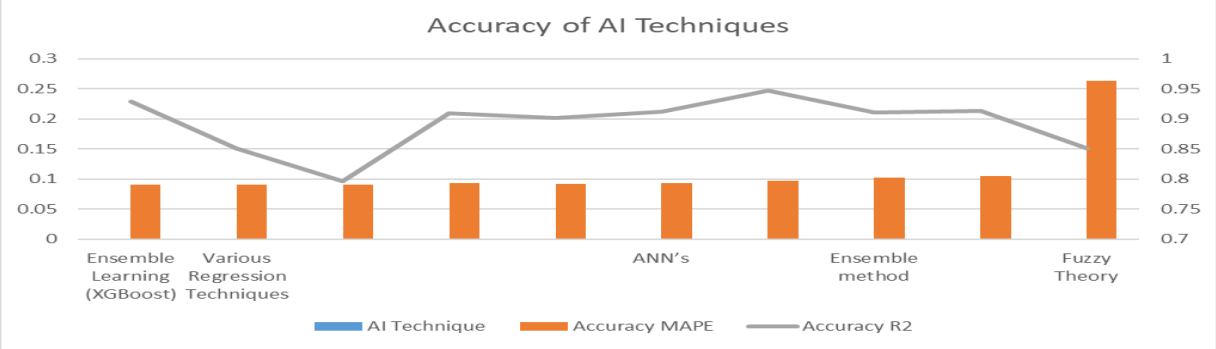

Fig.16. Accuracy of AI Techniques

Here The quadratic regression model is shown to be the best fit for FCIPs throughout the created regression and ANNs models, with 9.120 and 0.851 for MAPE and R*2, accordingly. The least MAPE value corresponds to the maximum accuracy. But according to this study, XGBoost outperforms quadratic regression in terms of accuracy. First position goes to XGBoost, which is somewhat better than Quadratic Regression with MAPE of 9.091% and R*2 of 0.929. Two metrics are used to evaluate the correctness of the created models: adjusted R2 and MAPE. According to the results, XGBoost is the most accurate and appropriate approach, with adjusted R2 of 0.929 and MAPE of 9.091%, respectively.

Another source paper [36] shows that the applications of three well-known artificial intelligence techniques in the financial domain have been analyzed. artificial neural networks, genetic algorithms, and particle swarm optimization. The financial market was divided into three areas financial forecasting, credit assessment, and portfolio management by taking into account the wide range of financial applications.

Domain	Author(s)	Approaches compared	Conclusion
Credit evaluation	[29]	Back-Propagation NN compared with MDA	Artificial NN has a better performance
Credit scoring	[30]	PNN and MLP compared with DA and LR	PPN and MLP have a better performance

credit measurement	[31]	Back-Propagation NN with OPM	Artificial NN has a better performance
Bond scoring	[32]	Back-Propagation NN compared with LR	Artificial NN has a better performance
Credit scoring	[35]	BPNN compared with MDA, LR, and LSSVMs	LS-SVMs and BPNN have a better performance

TABLE 5. A brief exploration of comparing artificial nn with traditional approaches Portfolio management

Domain	Author(s)	Approaches compared	Conclusion
Mortgages choice decision	[2]	NN compared with probit	Artificial NN has a better performance
Portfolio optimization	[3]	B&H strategy	Artificial NN has a better performance
Portfolio optimization	[1]	Back-Propagation NN with mean–variance model	Artificial NN has a better performance

Table-6: A brief explanation of comparing of Artificial NN with other methods of

Domain	Author(s)	Approaches compared	Conclusion
selecting Financial variables	[40]	In contrast to LR, B&H method, and random walk, ANN models that employ constant relevant variables	Artificial NN has a better performance
Exchange rates prediction	[10]	ANN compared to linear autoregressive and random walk models	PPN and MLP have a better performance
post-bankruptcy resolutions	[9]	5 various models of ANN	Artificial NN has a better performance
Bankruptcy forecasting	[8]	ANN with MDA	Artificial NN has a better performance
Classification of financial data	[41]	ANN with LDA and LR	Artificial NN has a better performance
Asset value prediction	[7]	BPNN with regression models	Artificial NN has a better performance
Consumer price index forecasting	[6]	ANN with random walk model	Artificial NN has a better performance

Table-7 A brief explanation of comparing of Artificial NN in forecasting and planning

While model-based strategies can answer more sophisticated nonlinear time variant issues, they can only do so to a limited extent. Conventional mathematical model-based approaches can significantly address linear, time invariant problems. These issues, in addition to other issues with conventional models, led to an increase in interest in artificial intelligence methods including fuzzy logic, neural networks, genetic algorithms, and evolutionary algorithms. This study presents a comparative analysis of three well-known artificial intelligence techniques used in the financial

market: ANNs, GA, and PSO. Three domains have also been used to classify a financial market: financial forecast and planning, portfolio management, and credit evaluation. The most well-known and particularly recent studies have been examined in a comparative manner for each approach. However, because of different evaluation standards and study designs.

In the study [37]. The performance of a CNN-coupled Wavelet Transform (WT) approach for streamflow time-series forecasting is presented and examined in this research. A preliminary analysis showed that the projected result trailed behind the actual data when streamflow series were forecasted using solely lagged factors. This result confirmed that WT was necessary. Additionally, a comparison study was conducted to evaluate the intricate interactions between different complexity components (decomposed wavelets) and streamflow affects that vary both geographically and temporally. To explore the potential of CNN in hydrological forecasting, a deep learning CNN algorithm was used and compared to ANN. The results showed that because CNN can extract features, it performs less stochastically than ANN performs and is therefore less vulnerable to input changes, particularly those involving spatial and temporal variability. Nevertheless, CNN encountered an overfitting problem due to the basic structure displayed by certain time series. The difference in prediction generated by including aleatoric and epistemic elements into artificial intelligence models was then demonstrated using a probabilistic neural network. Similar to the preceding non-Bayesian network, this network made predictions, but it also included a parameter that gauged the whole level of uncertainty. By exposing the mean and variance of the expected values, the model's dependability was improved and the inherent uncertainty in the forecasting process was reduced, since the uncertainty was brought on by either parameter fluctuation or data noise.

7. Conclusion

The ability of artificial intelligence (AI) to glean insightful information from large and diverse datasets has made it a disruptive technological force. Innovative solutions in a variety of fields have resulted from its capacity to evaluate, interpret, and learn from data. The field of artificial intelligence is dynamic and fast changing as researchers and practitioners from all over the world actively use it to solve real-world problems. The effect of AI is growing as more governments, businesses, and organizations invest in its development. The best AI methods and approaches are highlighted in this paper, demonstrating their applicability in resolving important issues. To fully realize AI as a technology-driven solution, one must comprehend its function, benefits, and variety of applications. AI holds great promise for transforming industries, improving decision-making, and increasing productivity across a wide range of fields as it develops further.

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