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VARIOUS ARTIFICIAL INTELLIGENCE TECHNIQUES AND ITS APPLICATIONS

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Abstract: ***With the upgrading requirements of automation and forecasting requirements in the industry automation and product prediction to improve the product quality cycle to make the product more affordable. The use of Artificial Intelligence is becoming increasingly important as technology is applied in industries today making products more reliable, robust and affordable. This paper deals with and explains various techniques of Artificial Intelligence. A review of the various applications of these technologies in industries is also included. This paper includes a review of Artificial Intelligence techniques applied in civil engineering, biomedical engineering, mechanical engineering, electrical and electronics engineering and many other fields.***

Keywords—Machine learning (ML), Artificial intelligence, Supervised learning, Unsupervised learning, Support Vector Machine (SVM), K- Nearest Neighbour (KNN) Artificial Neural Network (ANN), FUZZY etc.

1. Introduction

With advances in the automation industry, machine learning technology started to play an important role in reducing the actual cost, making the system more reliable and economical. Machine learning is a class of algorithms that allow software applications to more accurately convert results without explicitly encoding them. The basics of ML are to generate algorithms that can receive input data and use arithmetic tools to predict the output, while upgrading the output as new data is received. Machine learning deals with a deep system of calculations or algorithms that can describe, adjust, learn, infer and dissect information, enhancing our understanding and our ability with exceptional accuracy. Data experts decide which variable, or features, the model should examine and use to build up predictions. Once the training is complete the algorithm will apply what was learned to the new data. Are able to solve large non-linear problems separately using data from one of the fundamental focal points or benefit of machine learning systems many origins. In real-world scenarios ML empowers better decision-making and informed activities without human involvement. ML gives a great and adaptable structure for information-driven basic leadership as well as for joining master learning into the framework. Machine learning is widely used in the present scenario as big data analysis becomes important [1][2][3]. Well known example is Facebooks newsfeed. Also, search the data of ecommerce sites like Flipkart, Snapdeal etc. business analytics and intelligence providers use ML in their software to help users automatically identify theoretically important data points. Self-directed cars also use the same technique. Virtual assistant technology is also enhanced through ML. Again, with the ongoing advancement of the Internet of Things, remote interchange, web-based business and curious combinations, the method of gathering information has evolved in an exponential way [4]. In [5], The authors used machine learning techniques such as ANN, hierarchical and regression trees and random forest (RFs) to solve the pre-planting hazard prediction complexity of Stagonospora nodorum blotch (SNB) in winter wheat. They have created hazard assessment models that can be useful in deciding on disease control earlier to gardening. In [6], The authors indicated that pollution reduction and cost savings could be achieved by an automated decision process based on Bayesian structure for the identification of weeds in corn cultures. In [7] the authors demonstrated that field information, for example, soil moisture, climate, water system characteristics, and resultant yields can be interconnected through ML processes to provide automated suggestions to the water system. Machine learning can be classified as supervised, unsupervised and

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reinforced type, where in supervised learning we have predefined outputs whereas in unsupervised learning we do not have such things. The reinforced learning works on reward system. Supervised leaning can be divided into two types, first classification in which Support vector machine, Naïve bayes, nearest neighbors, discriminate analysis algorithms comes and second regression in which linear regression, decision trees, neural networks, ensemble methods and SVR, GPR are included. Under unsupervised learning the category of algorithm is clustering in which fuzzy, Hidden Marcov model, Gaussian mixture etc comes. Reinforced learning is basically a field of deep learning that involves models over multiple attempts to complete a process, the steps that produce good results are rewarded and the steps that produce unwanted results are punished until then. until the algorithm understands the optimal process.

Merits and Demerits of some of them have been listed by authors in [8]. Despite recent major improvements in machine learning and successful application in many fields. Machine learning methodologies have some primary restrictions, which are ideally only used in a data-driven manner. The accuracy of estimates and their uncertainties made by machine learning technology strongly depends on data quality, model representation and dependency is between the target and input variables in the prepared data. Data with high noise levels, inaccurate data, outliers and bias events in the data, and scarce datasets can greatly reduce the intellectual power of the model. An appropriate explanation of the machine learning model, such as the GP covariance function, the artificial neural network architecture and the SVR parameters, is also vital for achieving the best performance. To overcome these limitations, several schemes can be used, such as integrating expert data into a covariance function, emission detection, learning transfer, and model selection by computerized cross-checking. The purpose of this review is to express the potential of various machine learning methods to effectively solve these various but closely related tasks. An overview of current research in various sectors of the industry is presented, using different methods of machine learning. Some technical features of the machine learning methods used in the study are discussed.

2. Supervised Learning

Supervised learning has very wide range of applications. Supervised leaning have an input variable (Q) and the output variable (P) uses an algorithm to study the mapping function from the input to the output.

$$P= f(Q)$$

The goal is to approximate the performance function well enough that when you have new input data (q), you can define an output variable (p) for the data. In the context of ML, controlled learning is a type of planning in which both inputs and outputs are provided. Input or output data is labelled to provide a learning basis for processing future data. Supervised learning generates algorithms with known data to support future decisions. Supervised learning system mostly deals with retrieval-based ML. In [9], the authors implemented an SVM-based classifier with methods of prototyping content intelligence analysis and semantic speech to detect featureless untrue reviews on Amazon.com. In [10], the authors tested controlled learning strategies, such as SVM, decision trees, and logistic regression, to differentiate fraud from spontaneous online communication. Supervised learning problems can be clustered into classification and regression problems. The problem with classification is that the output variable is a class such as red or blue, a syndrome, or no syndrome. The regression problem is that the output variable is an actual value, for example, dollar or weight [10] [11] [12].

2.1 Classification Algorithms

Classification is a technique of supervised learning in which the desired output is already defined and different characteristics of several objects are compared. SVM, Discriminant Analysis, Naïve Bayes and Nearest Neighbours are the techniques which come under this algorithm.

The application of this technique is very wide which is shown in table 1.

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TABLE 1. Classification Techniques Applications

Ref. No.	Technique Used	Objective	Outcomes
[13]	SVM	Selective bipolar disorder from major depression using Whole-brain useful connectivity-a feature choice analysis With SVM-FOBA algorithm	The classification accuracy between bipolar disorder (BD) and major depression disease (MDD) up to 88% with leaving-one-out cruise authentication.
[14]	SVM	Support vector machine created differentiation between destructive and chronic periodontitis using microbial summaries	An SVC classifier using a section of 40 bacterial species was able to distinguish between PH, AgP in fresh individuals and ChP.
[15]	SVM	Failure exam of machinery bearings using the Variational mode of Decomposition and support vector machine as classifier.	Outcomes were obtained by Variational Mode Decomposition (VMD) and SVM process combinely are far better over normal process using SVM.
[16]	Discriminant Analysis	Fluid Dynamic Prototypes for Bhattacharyya-Based Discriminant Analysis	Proper prototypical reduction of prototypes to the optimal response to the events.
[17]	Discriminant Analysis	Sparse Exponential Discriminant Study and Its Uses to Fault Analysis	Sparse Exponential Discriminant Analysis (SEDA) algorithm can separate the faulty variables and simplify the discriminant prototype by removal of variables with tiny implication.
[18]	Discriminant Analysis	Improving the electrodiagnostic precision in GuillainBarre disease subtypes: Criteria sets and sparse linear discriminant investigation	The error rates, the reference diagnosis, were: 15.3% for scarce LDA, 30% for our criteria, 45% for Rajabally and 48% for Hadden. LDA has presented the highest analytical precision.
[19]	Naïve Bayes	Planning a machine learning created software risk Ideal evaluation using the Bayes Naïve algorithm	Based on this ideal framework, we will analyze all aspects of risk and improve the risk assessment process.
[20]	Naïve Bayes	Human Heart Infection Prediction System Using Data Mining Techniques	The person's risk level is classified using extraction classification methods, such as naive Bayes, improved k-media etc.
[21]	Nearest Neighbour	A nearest neighbour approximation of the remaining Variance	Problem of approximating the smallest achievable mean-squared error in regression function approximation solved

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[22]	Nearest Neighbour	Opposite k Nearest Neighbor Search over Paths	Path planning and capacity estimation. Has been done properly using this technique

2.2 Regression Algorithms

Regression is the most commonly used method to define the relationship between a dependent variable and another new example variable. This method is also known as pattern recognition technique. This method works on the problem where the output variable is the actual value. Linear Regression, SVR, GPR, Ensemble Methods, Decision Trees and Neural Networks are the techniques that come under this algorithm.

The various applications of this technique is shown in table 2.

TABLE 2: REGRESSION TECHNIQUES APPLICATIONS

Ref No.	**Technique Used**	**Objective**	**Outcomes**
[23]	Linear regression GLM	Prediction of Bitcoin Price using Machine Learning	Calculate the Bitcoin price exactly taking into consideration several parameters that bother the Bitcoin value.
[24]	Linear regression GLM	Citation Count Analysis for Papers with Preprints	Fitted regression model estimates that papers submitted to arXiv before acceptance, on average, tend to have 65% more citations in the following year compared to papers submitted after.
[25]	GPR AND SVR	A study of the User end workend application: Transitions from Freemium a Premium	The fitted regression model estimates that papers submitted to arXiv before acceptance, on average, tend to have 65% more citations in the following year compared to papers submitted after.
[26]	SVR AND GPR	A local perspective on the precision of machine learning predictions of tourism claim based on data features	The entropy and scatter display a negative relationship by precision, while the result of other data features on estimate accuracy is highly helpless on the prediction horizon.
[27]	SVR AND GPR	Calculate Twitter uses socioeconomic properties with networks and language test	The best performance model using graph based functions (Graph) achieves an accuracy of 50.44% in the work classification. In the income statement, the MAE 9,048 is and the Pearson correlation is 0.63.
[28]	Ensemble methods	An collective learning scheme for a 4-way organisation of Alzheimer's disease and mild cognitive injury	As a outcome, about 2% of the novel Characteristics were nominated to construct a new space of functions, which can attain the last four-way classification by an accuracy of 54.38% in the test data over a classified grouping, upper than several another methods in judgement.
[29]	Ensemble methods	Healthy ensemble learning outline for day-ahead	The outcomes show a significant development in the simplification capacity, as well as the relief

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		anticipating of household based energy consumption	of numerous unstable calculation difficulties. The outcomes also deliver information on the capacity of the advised set prototype to produce better forecast performance with limited data, which shows the validity of the knowledge character of the set in the future prototype.
[30]	Decision tree	A Nonlinear Decision Tree based Arrangement Method to Predict the Parkinson's syndrome using Dissimilar Feature Sets of Speech Data	In this a new method by comparing presentation measures with dissimilar sets of features such as unique feature sets, as well as feature reduction technique based on principal component analysis to select feature sets. Here a nonlinear ordering approach to associate presentation indicators. We create an accuracy of 96.83% using accidental forestry classifiers using PCA-based feature sets. This examination will help clinicians distinguish the PD collection from the strong group based on the speech data.
[31]	Decision tree	Landslide weakness plotting using J48 Decision Tree with AdaBoost, Catching and Rotation Forestry ensembles in the Guangchang zone (China)	The result showed that all representations of avalanche material have high presentations (AUC> 0.8). However, the Yankees and the model forest rotation has the highest capacity calculations (AUC = 0.855), followed by the Yankees and AdaBoost (0.850), packaging (0.839) and Yankees (0.814) respectively. Thus, the result is that authenticates JDT to spin the forest is a model of best improved in this study and can be measured as a talented methods to map the sensitivity of the material in the case is similar to a good accuracy.

3. Unsupervised Learning

An Unsupervised learning has only input data (P) and the corresponding output variable. The goal of this kind of learning is to model an underscore structure or data distribution to learn more about the data. For example, in unsupervised learning there is no need to tag data to detect or classify spam and genuine reviewers on website comments. Untrained learning does not need to be trained with outcome data. On the other hand, the deep learning approach which is an iterative approach is used to review the data and arrive at a conclusion. Unsupervised learning algorithm is very useful for solving complex processing functions such as image recognition and speech-to-text conversion. The main reason for using this algorithm is that it requires a large amount of training data such as large data sets. The application of unsupervised learning is self-driving cars, facial recognition and robots etc. [32] The authors employed unsupervised text mining strategies to isolate the basic characteristics of countless insiders. In [33] the authors developed an inclusive scoring method to calculate the degree of each reviewer's overall spam behavior. Unsupervised learning problems can be aggregated as clustering and association problems. Clustering problems are basically where the groups contained in the data are discovered.

3.1 Clustering Algorithm

Clustering methods are not directly predictive in nature; They are mostly descriptive and reveal an integral configuration that can be hidden in the data. Unlike regression, the application of the clustering method does not require a hypothesis. In a sense, clustering algorithms form hypotheses, which reveal how data are combined

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with group-specific functions. There are many different clustering algorithms, each with its own advantages and disadvantages [34]. The most common algorithms are hierarchical clustering, k means clustering and variable-shift clustering. Hierarchical and medium-term clustering gives more accurate and advanced results, but can reduce the quality and productivity of large datasets. K means, fuzzy, hierarchical, Gaussian mixture, neural network and hidden Markov model are methods that fall under this algorithm. Various applications of this method are shown in Table 3.

TABLE 3: CLUSTERING ALGORITHM APPLICATIONS

Ref No.	Technique Used	Objective	Outcomes
[35]	K-means Clustering	Spatial K-means Clustering of HF Noise Trends in Southern California Waters	Results indicate elevated noise levels throughout the high frequency (HF) band with minor spatial variation.
[36]	K-means Clustering	Examination of Card Sorting Data using K-Means and Multidimensional Scaling algorithms.	Analysis of the results indicates that the current approach can overcome the limitations of BMM, by allowing the card to be prepared again when the group formed.
[37]	Fuzzy c-means	Improved fuzzy C-means clustering algorithm use in medical image division	The results are shown as being NMFCM consequently less sensitive to noise than FCM. Conflict results NMFCM, FCM and FCM NMFCM show that the proposed work is very good and gives higher than the accuracy of segmentation and FCM FCM. Finally, the wrong root is the average error indication and mark the parameters of noise and experimental testing the contents of small and large and each interruption in image quality in the area well.
[38]	Fuzzy c-means algorithms	Methods for cholesterol and targets that can be gigantic GPCR seven helixel based cluster ghost and fuzzy c-organ algorithm	G-protein coupled receptors (GPCRs) plays a vital role for all type of complex signalling and inter cellular communication in membrane bilayer with secure connection. It is proved that an interaction between cholesterol and GPCR are tightly regulates with each other, using different parameters.
[39]	Hierarchical clustering	Nesterov's flattening technique and minimizing for hierarchical differences of convex roles clustering	We detect that parameter selection is the conclusive factor in terms of accuracy and speed of junction of our proposed algorithms. The presentation of the future algorithms highly depends on the primary values set to the consequence and smoothing parameters, $\lambda 0$ and $\mu 0$; and their particular growing/decaying factors $\sigma 1$ and $\sigma 2$.
[40]	Hierarchical clustering	Hierarchical Separating of the Output Space in Multi-label Data	The experimental results of experiments carried out on paper to convince Homer can restore the presentation techniques when applied to MLC. However, it is concerned about the way to honor the clustering algorithm optimal, because it is a part that affects the ability of the algorithm to the top. Especially for the work session, the results are

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			positive can show that the number is more suited to chatting on the multi-stage large fire
[41]	Gaussian mixture models	GGRaSP: Rtechnique to select a representative genome using a mixed model of Gauss	Creation of geometric, bio informational and graphic skills R, GGRaSP and accompanying R-script offers a single and customizable platform for launching several analyzes to create a subset of representative genomes. The user can specify clustering parameters and severity levels for ranking genomes, thereby allowing both generalized high throughput and more data to be used.
[42]	Gaussian mixture models	Anomaly detection and localization of video through Gaussian mixing Autoencoder Variational Full convolution	In the training stage, image patches of normal samples for each stream are extracted as input to train a Gaussian Mixture Fully Convolutional Variational Autoencoder (GMFC-VAE) that learns a Gaussian Mixture Model (GMM). In the testing stage, the conditional probabilities of each component of a Gaussian Mixture of test patches are obtained by employing the GMFC-VAE for each stream. Here a sample energy based method for predicting an appearance and motion anomaly score.
[43]	Neural network	Automatic identification of shock able and non-shock able life-threatening ventricular arrhythmias using CNN	Here left precision, sensitivity and specificity of 93.18%, 95.32% and 91.04%. Respectively Pintonanna above suggests that arrhythmias that can threaten life, potentially threatening your life can be detected directly and, therefore, increases the disclosure of which is the support provided by NGN or AED.
[44]	Neural network	NN adaptive fuzzy controller for robot constraints by learning impedance	Dynamics are certainly in the robot's work online, use the opportunity to exercise diffuse structure NN. To test the success of the proposed approach, there are four things that are considered: 1) control with controlfree ban free space; 2) organize all countries ban the free space; 3) control the output limited to confined space; and 4) manage all state restrictions on confined space.
[45]	Hidden markov model	Website finger printing attack on secrecy networks based on profile hidden markov model	The results of the research show that this approach has a high accuracy of the modern method of site classification, and beyond the identification of traditional web pages are separated. In addition, the study considered two types of hyperlink transition from state to trial. The result indicates that the method can be used to attack the environmental website is more applied, but the methods are only penetrate in a web page is the last one separated and ignore the discovery of the open potential Finally, two that could be willing to be identified to protect the intended methods.

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[46]	Hidden markov model	Facial Expression Recognition using Moments Invariants and Modified Hidden Markov Model	Experimental result shows that Proposed System achieves better than normal HMM and has the overall accuracy of 84% using JAFFE database.
[47]	Hidden markov model	Sentiment Analysis on the Online Reviews Based on Hidden Markov Model	By this device, it is possible to take consideration of the webpage layout from Amazon Japan's product review page under the human webpage reading behaviors, 2dHMM has shown the highest precision and f1 score. Such an extensive design of analysis model to higher dimension HMM is applicable not only to Amazon Japan, but also more to general commercial Web pages.

4. METHODOLOGY

AI is affecting our lives in a big way. Organizations are also taking steps towards adopting AI technology, which can give them new ways to work as well as understand data patterns for maximum productivity. AI Approaches and Concepts Less than a decade after cracking the Nazi encryption machine Enigma and helping Allied forces win World War II, mathematician Alan Turing changed history for the second time with a simple question: "Can machines think?" Turing's paper "Computing Machinery and Intelligence" (1950), and its subsequent Turing Test, established the fundamental goal and vision of artificial intelligence. At its core, AI is the branch of computer science that aims to provide an affirmative answer to Turing's question. It is an attempt to replicate or simulate human intelligence in machines. The overarching goal of Artificial intelligence has given rise to many questions and debates. So much so, that no singular definition of field is universally accepted.

Can machines think? - Alan Turing, 1950

The major limitation in defining AI as simply "creating intelligent machines" is that it doesn't really explain what artificial intelligence is. What makes a machine intelligent? AI is an interdisciplinary science with many perspectives, but advances in machine learning and deep learning are creating a paradigm shift in almost every area of the technology industry. In their ground breaking textbook Artificial Intelligence: A Modern Approach, authors Stuart Russell and Peter Norvig answer this question by integrating their work around the topic of intelligent agents in machines. With this in mind, AI is "the study of agents that receive perceptions from the environment and perform actions." (Russell and Norvig viii) Norvig and Russell go on to explore four different approaches that have historically defined the field of AI:

- Thinking humanly
- Thinking rationally
- Acting humanly
- Acting rationally

The first two are related to thought processes and logic, while the other deals with behavior. Norwig and Russell focus specifically on rational agents that act to achieve the best results, "all the skills required for the Turing test also allow an agent to act rationally." (Russell and Norwig 4) Patrick Winston, Ford Professor of Artificial Intelligence and Computer Science at MIT, defines AI as "algorithms enabled by constraints that support models targeted at the loops that lead to thinking, perception and action." ties together." While these definitions may seem abstract to the average person, they help focus the field as a field of computer science and a blueprint for including machines and programs, along with machine learning and other subsets of artificial intelligence. prepares. give.

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5. Results and Discussion

Artificial intelligence can be divided into different categories based on the machine's ability to use past experiences to predict future decisions, memory and self-awareness. IBM came up with Deep Blue, a chess program that can identify pieces in a chessboard. But he does not have the memory to predict future actions. Although this system is useful, it cannot be adapted to any other situation. Another type of AI system that uses past experiences and has the bonus of limited memory to predict decisions. An example of such an AI system can be found in decision-making tasks in the case of self-driving cars. Here observations help in quick actions, which are not stored permanently as observations change frequently. With advances in technology, it may be possible to have machines with an understanding or consciousness where machines sense the current state of things, which can be used to predict what is to be done. But such systems do not exist.

5.1 Techniques of Artificial Intelligence

5.1.1 Machine Learning

This is one of the applications of AI where machines are not explicitly programmed to perform certain tasks; Rather, they automatically learn and improve from experience.

5.1.2 NLP (Natural Language Processing)

It is the interaction between computer and human language where the computer is programmed to process natural languages. Natural language processing to derive meaning from human languages.

5.1.3 Automation and Robotics

Automation aims at achieving monotonous and repetitive tasks by machines that improve productivity and achieve cost-effective and more efficient results. Robotic process automation is programmed to perform a high amount of repetitive tasks that can adapt to change in a variety of conditions.

5.1.4 Machine Vision

Machines can capture visual information and then analyze it. Here cameras are used to capture visual information, analog to digital conversion is used to convert the image into digital data, and digital signal processing is employed to process the data.

5.2 Applications of Artificial Intelligence

Below are the various applications of artificial intelligence.

- AI is used in the finance industry, where personal data is collected, which can be used to provide financial advice.
- AI is used in the field of education, where grading systems can be automated, and students' performance can be assessed based on which learning can be improved.
- AI is used for better diagnosis in the field of health care, where techniques are used to understand natural language and answer questions asked. Also, computer programs such as chatbots are used to help customers schedule appointments and simplify the billing process, etc.
- AI is used in business to automate repetitive tasks by humans with the help of robotic process automation. To enhance customer satisfaction, machine learning algorithms are integrated with analytics to collect information that helps us understand customer needs.
- AI is used in smart home devices, security and surveillance, navigation and travel, music and media streaming and video games, etc.

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5. CONCLUSION

In this review paper, a total of 47 papers of various engineering subjects have been reviewed. Effectiveness is shown in various applications. This paper shows the advantages of machine learning compared to other techniques in the market. First an introduction is given about machine learning, further it is divided into different categories like supervised and unsupervised learning. The applications of these algorithms along with their further division are shown in the tables. It is found that the most widely used techniques among classifier algorithms are SVM and NN techniques. SVM is used in the medical industry to find the difference between destructive and chronic periodontitis using microbial summary, NNs used in civil industry in assessing road capacity etc. Similarly, in linear regression and integration techniques, in regression and ANN and HMM clustering techniques. All algorithms like supervised or unsupervised have different merits and demerits on each other, When we talk about applications, for example, if one wants to predict the weather, regression techniques will be very effective as compared to other techniques like clustering and classification. Similarly (10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20), if we talk about induction motor fault diagnosis then classification technique like NN will be very effective. Presently with the advancement in machine learning techniques, 2D/3D convolutional neural network which comes under deep learning strategy is becoming very important. Effective and reliable due to feature extraction and removal of computation phase.

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