Review of various Artificial Intelligence Techniques and its applications

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Review of various Artificial Intelligence Techniques and its applications

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Abstract. With the upgrading needs of automation and prediction requirements in the industries, automation for improving the quality of the product and prediction of the product cycle to make product more economical. Now a days the use of artificial intelligence techniques becoming crucial to apply in the industries which makes the products more reliable, robust and economical. This paper deals and explains the different techniques of artificial intelligence. Also covers the review of the different applications of these techniques in the industries. This paper covers the review of Artificial intelligence techniques applied in the different fields like civil engineering, biomedical engineering, mechanical engineering, electrical and electronics engineering and many more.

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

1. Introduction

With the advancement in the automation industries machine learning techniques started playing an important role in reducing the actual cost, making the system more reliable and economical. Machine learning is a class of algorithms that permits software application to convert more exact in determining result without being unambiguously encoded. The basics of ML is to generate algorithms that can received input data and use arithmetical tools to predict an output, while upgrading outputs as new data becomes obtained. Machine learning deals to an intense arrangement of calculations or algorithms that can describe, adjust, learn, anticipate and dissect information, increasing our comprehension and our ability to foresee with exceptional exactness. Data experts decide which variable, or features, the model should examine and use to build up predictions. Once the training is completed the algorithm will apply what was learned to new data. One of the fundamental focal points or advantage of Machine learning systems are competent of separately resolving large non-linear troubles using datas from numerous 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 of master learning into the framework. Machine learning has wide use in current scenario as big data analysis became 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. Then again, with the ongoing advancement of the Internet of Things, remote interchanges, web based business, and keen assembling, the measure of information gathering has developed in an exponential way [4]. In [5], the authors used machine learning techniques such as ANN, categorical and regression trees and random forests (RFs) to solve the complexity of forecasting the pre-planting threat 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 pollution reduction and cost savings can be achieved

by an automated decision procedure based on the Bayesian structure for the identification of weeds in corn cultures. In [7] authors exhibited that field information, for example, soil dampness, climate, water system attributes, and resulting yield could be intertwined by means of ML procedures to give automated suggestions to water system. Machine learning can be classified as supervised, unsupervised and reinforced type, where in supervised learning we have predefined outputs while in unsupervised learning we don't 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 zone of deep learning which contains model iterating over several attempts to complete a procedure Steps that deliver great results are remunerated and steps that create undesired results are punished until the algorithms grasp the optimal process. Merits and Demerits of some of them have been listed by authors in [8]. Despite the major recent improvements in Machine Learning and the successful application in numerous areas. Machine Learning method has some primary restrictions when use idealistically in a solely data-driven manner. The exactness of the guesses and their uncertainties created by the Machine Learning techniques robustly depend on the data quality, model representativeness and the reliance between the target and input variables in the composed data's. Data with high noise levels, erroneous data, incidence of outliers and biases in data and scarce datasets can greatly reduce intellectual power models. 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, many schemes can be used, such as the integration of expert data into the covariance function, the detection of emissions, the transfer of learning and the choice of the model by computerized cross-checking. The purpose of this review is to express the competence of various machine learning methods to effectively solve these various but closely related tasks. An overview of current research in various fields of industry is presented, in which various methods of machine learning are used. Some technical features of the machine learning methods used in the studies 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.

$$P= f(Q) \quad (1)$$

The goal is to approximate the display function so well that when you have new input data (Q), you can define the output variable (P) for the data. Controlled learning in the context of ML is a type of scheme in which both input and output are provided. Input or output data are labelled for providing is learning basis for processing future data. Supervised learning generates algorithm with known data to support future judgments. Supervised learning system are mostly related with retrieval based ML. In [9], the authors applied SVM-based classifier with methods of content intellectual analysis and prototypes of the semantic dialect to detect untrue reviews facilitated on Amazon.com. In [10], the authors tested controlled learning strategies, such as SVM, decision tree and logistic regression, to distinguish fraud from spontaneous online communication. Supervised learning problems can be clusters in classification and regression problems. The problem with classification is that the output variable is a class such as red or blue, a syndrome, or a no syndrome. The regression problem is that the output variable is an actual value, for example, dollars or weights [10] [11] [12].

2.1 Classification Algorithms

Classification is technique of supervised learning in which the desired output is already defined and comparison of different features of several commodities is carried out. 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.

TABLE I. 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 Guillain-Barre 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	Based on this ideal framework, we will analyze all aspects of risk and improve the risk assessment process.

		algorithm.	
[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
[22]	Nearest Neighour	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 most commonly used method for defining connection between a dependent variable and one and new illustrative variable. This method is also known as pattern recognition technique. This method works on the problem where the output variable is real value. Linear Regression, SVR, GPR, Ensemble Methods, Decision Trees and Neural Networks are the techniques which come under this algorithm. The various applications of this technique is shown in table 2.

TABLE II. 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]	Linear Regression	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]	GPR AND SVR	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	As a outcome, about 2% of the novel Characteristics were nominated to construct

		4-way organisation of Alzheimer's disease and mild cognitive injury	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 anticipating of household based energy consumption	The outcomes show a significant development in the simplification capacity, as well as the relief 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, there is no need to tag data to detect or classify spam and genuine reviewers over a website comments in unsupervised learning. Unsupervised learning does not need to be trained with result data. On the other hand, deep learning approach which is an iterative approach is used to review data and arrive at conclusions. Unsupervised learning algorithm is very useful for solving complex processing task such as image recognition and speech to text conversion. The main reason of using this algorithm is that it requires massive amount of training data like Big data. The application of

unsupervised learning is self-driving car, facial recognitions and robots etc. In [32] authors employed unsupervised text mining strategies to distinguish basic attributes of countless insiders. In [33] authors developed an inclusive scoring method to calculate the degree of overall spam behavior of each reviewer. Unsupervised learning problems can be gathered as clustering and association problems. Clustering problems are basically where the inherent groupings in the data are discovered.

3.1 Clustering Algorithm

Clustering methods are not directly prognostic 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 create hypotheses, revealing how data is combined together with group-specific functions. There are several different clustering algorithms, each of which has its 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 large data sets can reduce quality and productivity. 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 III. 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	We detect that parameter selection is the conclusive factor in terms of accuracy and speed of junction of our proposed

		hierarchical differences of convex roles clustering	algorithms. The presentation of the future algorithms highly depends on the primary values set to the consequence and smoothing parameters, λ0 and μ0; and their particular growing/decaying factors σ1 and σ2.
[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 positive can show that the number is more suited to chatting on the multi-stage large fire.
[41]	Gaussian mixture models	GGRaSP: R-technique 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 model	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 control-free 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
[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. Conclusion

In this review paper total 47 paper are reviewed of different engineering discipline. Effectiveness in various applications is shown. This paper shows the advantages of Machine learning over other techniques in the market. Firstly an introduction about the machine learning is given than further the division of it in different categories is explained such as supervised and unsupervised learning algorithms and application of these algorithms with their further division is shown in the tables. It is found that most widely used techniques among the classifier algorithms are SVM and NN techniques SVM used in medical industry to find differentiation between destructive and chronic periodontitis using microbial summaries, NN used in civil industry in estimating road capacity etc. Similarly, linear regression and ensemble technique in regression and ANN and HMM in clustering techniques. All the algorithms such as supervised or unsupervised have different merits and demerits over each other when we talk about the applications for example if anyone wants to do weather forecasting than regression techniques will be very effective than other techniques like clustering and classification similarly if we talk about induction motor fault diagnosis classification techniques will be very effective like NN. Presently with the advancement in the machine learning techniques presently 2D/3D Convolutional Neural Network which comes under deep learning strategies becoming very effective and reliable because of removal of the feature extraction and calculation step.

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