



“ STOCK MARKET PREDICTION”

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ABSTRACT

The stock market has gained the attraction of the investors due to advanced applications, in which the forecasting may lead to successful market prediction. The prediction of the stock trends directly depends on investing and trading of stock data. The tools employed for the stock market prediction can monitor, predict, and regulate the market, which can be utilized for taking correct decisions. The stock market has to deal with multiple industrial stock data, which covers the whole financial market. With respect to the market status, the actions are adapted by the investors considering the sales and purchase. Several factors, which influence the status of the market, are estimations of incomes, a news release on profits, declaration of dividends, management changes, and so on. The research in stock trading issues led to the prediction of some aspects, which are considered by the experts for influencing the stock price. The prediction mechanisms based on the stock market play an important role to bring more persons and existing investors in common place. The accurate for predicting the stock market help the investors for making better decisions [1].



KEYWORDS : monitor, predict, and regulate, stock trading.

INTRODUCTION

The data mining tools can help the investors to predict trends and behaviors and help the institutions for yielding active solutions to make knowledge-driven decisions. The intelligent data analysis helps the tools to generate results with ease. The extraction of useful information is an effective way for mining data. Several data mining techniques and knowledge discovery from databases have been employed for analyzing the market trends. Here, the data mining is essential for predicting the stock market, which can search the hidden parts and increase the accuracy levels for analyzing the market trends using techniques, such as regression approach, Knowledge Discovery in Databases (KDD), fuzzy models for making effective investment decisions. depicts the functioning of the stock market prediction system. Illustrates the block diagram of the function of the stock market prediction system. Initially, the historical stock data are collected from various datasets [1].

Bombay Stock Exchange (BSE) dataset, Taiwan Stock Exchange Weighted Index (TAIEX), and so on, based on a technical index. Here, the technical index is defined as the relevance of the product to be utilized in a specific application. Then, the collected data is subjected to data pre-processing, for removing the noise and artifacts from the datasets. At first, the data needs attribute data are employed for selecting the significant features, which can be useful for predicting the stock trends. Then, the

selected feature is analyzed for extracting the knowledge using a large amount of data. The data analyzer provides improved analysis and user-friendly interface. Here, the data analyzer divides the obtained details into two classes, namely prediction details and current details, which are considered as a foundation for decision making. The prediction details, the current details, and the threshold values are subjected to the decision-making system. Using the threshold value, the pre-processing is done to declare profit or loss. Then, the alert notification is generated based on the status. If the investor is in profit, then the shares can be used for increasing the sale, and if in loss, then this share is given more attention for its development, and the NN is applied to make effective decisions [1].

FORECASTING :-

Autoregressive Integrated Moving Average (ARIMA) is one of the most common traditional mathematical models for time series fore-casting over the past decades that have enjoyed useful applications in forecasting social, economic, engineering, energy, foreign exchange, and stock problems. Jump and dip diffusion also is one of the conventional methods which utilized to forecast time series data, it was used to forecast gold prices. In addition, some researchers used linear regression models in forecasting process such as Forecasting commodity prices using artificial neural networks. Artificial neural networks are one of the most important types of machine learning models, which have been introduced and examined for forecasting commodity prices compared volatility forecasts from neural networks with implied volatility from S&P 500 Index futures options. Optimized multiple architectural factors and feature transformations of ANN using a genetic algorithm (GA) to overcome the limitations of the traditional back propagation algorithm. Experiments demonstrated outperforms of the discussed model over the conventional approaches for predicting the stock price index. Also, builds a Multilayer Perceptron Neural Network (MLP) with the help of the Liebenberg- Marquardt training algorithm to forecast oil prices [5].

ARTIFICIAL NEURAL NETWORK (ANN) :-

Regarding the performance of complicated tasks, such as recognition and prediction, the human brain performs remarkably better than digital computers due to its fascinating ability to learn. The human brain consists of hundreds and thousands of billions of nerve cells called neurons. Axons connect these neurons to other cells. The human brain performs computations in an interconnected network of neurons that communicate through electric pulses. Stimuli from the external environment or inputs from sensory organs are received by dendrites. An electric impulse is created by these inputs that travels through the neural network. A neuron can either send the message to another neuron to address the issue or not send the message and solve the issue itself. The idea of ANN was derived from how the brain can form accurate connections. The model was a simple switch with two inputs and one binary output [10].

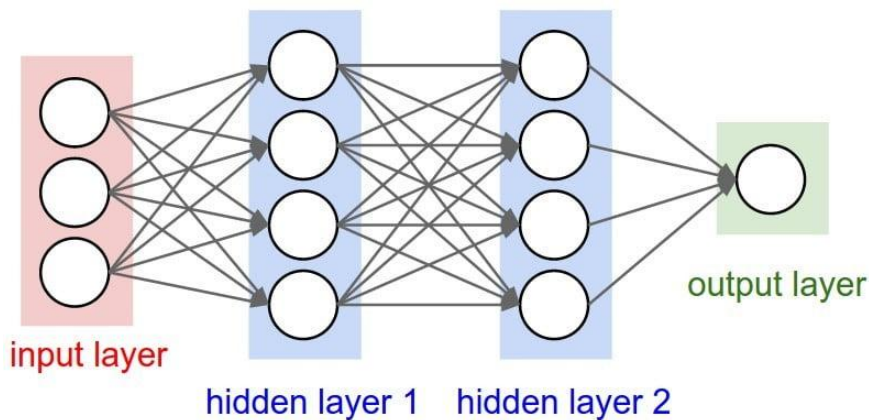


Figure 1.1: Artificial Neural Network.

The neuron receives its input from other neurons, and its output is either zero or one, i.e., active or inactive, based on the total weighted input. Subsequently, Rosenblatt discovered that a network of such modeled neurons could perform recognition and function with some destroyed neurons performing similarly to the human brain. ANN is a mathematical model that acts as neurons in the human brain. ANN has many usages in real life, such as predicting the stock market. ANN has two major features, i.e., the ability to learn how to perform its functions once it is properly trained and the ability to generalize, which is the ability to produce a reasonable solution to unobserved data. ANN is mainly used to solve three problems, including classification, noise reduction, and extrapolation. This layer is the first layer where the data/features are received. Some normalization techniques are applied to these inputs to limit the inputs to a certain range. The normalized inputs facilitate the work of the neural network, resulting in better precision. This layer can be a collection of layers depending on the application of the network. The responsibility of these layers is to recognize the pattern of a process or system [10].

SUPPORT VECTOR MACHINES (SVM) :-

Support Vector Machine (SVM), which subsequently in the same year became widely known in the machine learning community. SVM is a supervised machine learning technique that is used for both classification and regression problems. SVM is most widely used for binary classification problems. SVM continued to increasingly grow and became one of the most popular machine learning techniques. SVM has been utilized in several fields, including bioinformatics and handwritten recognition. SVM is also used in other applications, including medical diagnosis, weather prediction, stock market analysis, and image processing. Similar to all other machine learning techniques, SVM is a computational algorithm that learns from experience and examples to allocate labels to objects. For example, for SVM to distinguish between real and non-real credit cards, SVM needs to inspect a large set of real and non-real credit card images. The basic function of SVM is to separate binary labeled data based on a line achieving the maximum distance between the labeled data. Most machine learning techniques suffer from the so-called curse of dimensionality. The curse of dimensionality occurs when a model inspects a limited number of examples and has limited experience in the presence of several features [10].

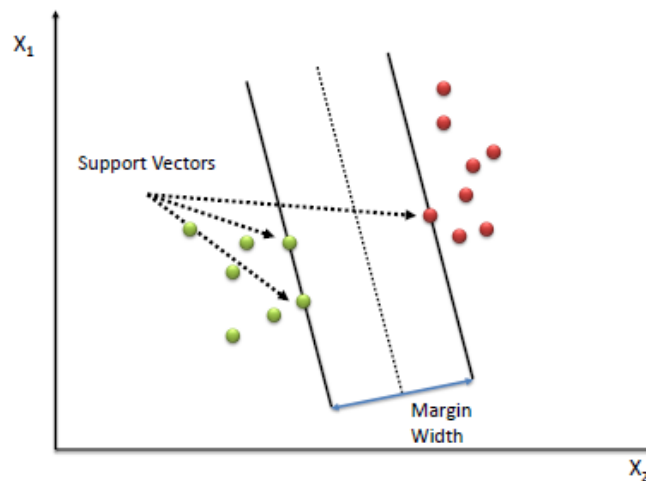


Figure 1.2: Support Vector Machines.

Such limitations could reduce a model’s performance. It has been proven that the SVM model is prone to the curse of dimensionality. SVM performs well and has good accuracy even with limited examples. Due to these fruitful advantages, SVM is distinct from other machine learning techniques. SVM uses the so-called kernels function to help separate labeled data. One of the advantages associated with using kernels in SVM is that SVM applies kernel definitions to non-vector inputs, i.e., inputs

without size or direction, which are particularly important in the medical field and critical to biological applications. Such an advantage allows SVM to label DNA and protein sequences. In addition, kernels can be defined based on a combination of different data types [10].

BAGGED DECISION TREES (BDT) :-

In Bagged Decision Trees (BDT), the possibility of over-fitting of individual tree is less concerned. For this reason, the individual decision trees are grown deep and the trees are not pruned. Bagged Decision tree has only two hyper-parameters, the number of trees and the number of samples. However, they may have many similarities which leads to a high correlation in predictions [15].

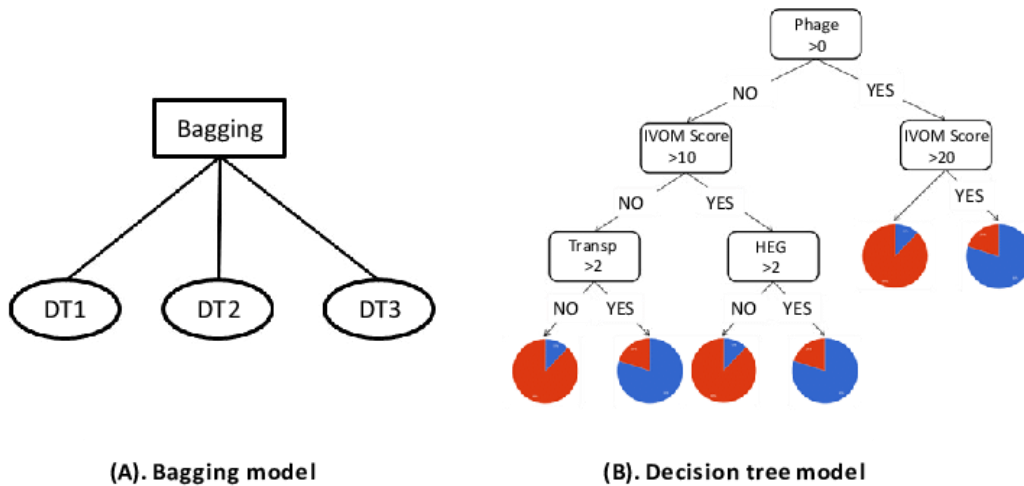


Figure 1.3: Bagged Decision Trees.

RANDOM FOREST (RF) :-

Random forest is another algorithm based on ensemble of classification trees which is developed. The only difference between RF and BDT is that RF takes one extra step. In addition to taking the random subset of data, it also chooses randomly a subset of X at each node and calculate the best split at that node only within the given subset of X. This structure provides uncorrelated or weakly correlated predictions. Also, there is no pruning step, which means all the trees of the forest are grown deep. RF has only two hyper-parameters, the number of variables in the random subset at each node and the number of trees in the forest. Moreover, RF ranks variables by the importance of a variable based on the classification accuracy, while considering the interaction between variables [15].

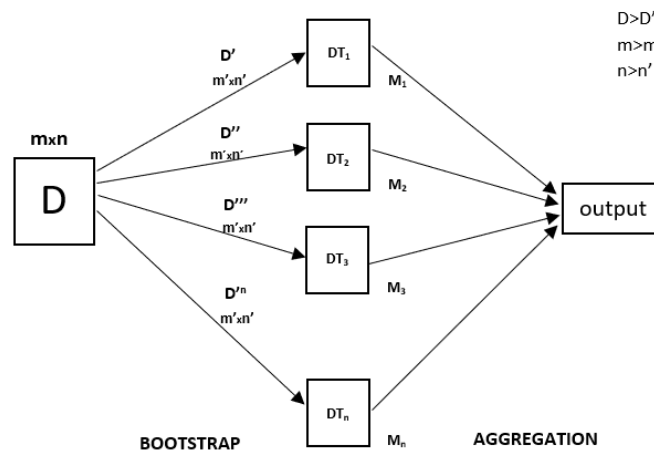


Figure 1.4: Random Forest (RF).

K-MEANS CLUSTERING BASED SEGMENTATION :-

For the segmentation of image K-means clustering method is employed in this work. Clustering is a process to group the image into clusters. The diseased portion is extracted from the leaf image by this clustering. In a leaf image when applying this clustering the clusters are expected for the diseased part and the non-diseased part. This technique is applied on the hue part of the HSV model of the background removed image. Only the pure color is present in the hue component; it doesn't contain any information like brightness and darkness. On the basis of analysis of histogram of hue components centroid value is fed to generate perfect segments in order to overcome the randomness problem of the cluster. Moreover, from the diseased part cluster the unwanted green portion is eliminated. From the background removed image for the hue component a histogram is created. Then, from the created histogram the hue values and the counts in every bin are extracted. On the basis of histogram and diseased image particular threshold value is found to differentiate the normal and the diseased portion [28].

GREY LEVEL CO-OCCURRENCE MATRIX (GLCM) :-

GLCM features are used to obtain a gray level distribution of the pixels. Energy signifies brightness brighter image will have low energy vice versa. Variance is directly proportional to the contrast of the image. Contrast specifies the contrast between the pixel and its neighbor. Correlation gives how pixel correlated to its neighbor. Entropy gives randomness in pixels that is used to distinguish the Homogeneity gives the nearness of intensity values. AngularSecondMoment gives uniformity in the pixel region. AutoCorrelation signifies the magnitude of similarity. ClusterProminence gives the asymmetry of the matrix. ClusterShade gives skewness of the matrix. Dissimilarity represents the average of difference distribution. Inverse difference and inverse difference moment give local homogeneity in the image. A high value is obtained for image on similarity. SumAverage and SumEntropy give mean and dissimilarity in gray level sum distribution [31].

GENETIC ALGORITHM :-

An appropriate neuron number and dropout rate of the fullyconnectedlayer could not only improve the effectiveness of classification but also prevent over fitting of the CNN. Different from the fullyconnectedlayer of original DenseNet121, this study used a classification layer for classifying objects, and GA was used to optimize the classification layer of optimized DenseNet121GA algorithm begins with a random chromosome of the population; based on the concept of the survival of the fittest, the population of GA implemented standard evolving operators, including evaluation, cross-over, and mutation, to further improve populations over a generation. Chromosomes in the population represent decision variables or solutions and could be encoded as substrings of binary digits or real numbers or integers. To further improve the performance of DenseNet121, this study utilized GA to optimize the full-connected layer of the DenseNet121, and then the discussed optimized DenseNet121 was validated on the Trash Net. In other words, this study used GA to optimally fine-tune the hyper-parameters of the fully-connected-layer of DenseNet121, and both of the neuron number and the dropout rate of the fully-connected-layer were deemed as the main decision variables in the discussed optimized DenseNet121. Shows the original DenseNet121 approach to be optimized using a GA [31].

DIABETES MELLITUS (DM) :-

Diabetes mellitus commonly known as diabetes. It is a group of metabolic disorders which are characterized by the high blood sugar. Diabetes can lead to many serious long-term complicated diseases like cardiovascular disease, stroke, kidney failure, heart attack, peripheral arterial disease, blood vessels, and nerves. Moreover, there were directly about 1.6 million deaths due to diabetes. Therefore; it is an alarming to us. The number of diabetic patients is Diabetes mellitus (DM) is commonly known as diabetes. It is a group of metabolic disorders which are characterized by the high blood sugar. Diabetes can lead to many serious long-term complicated diseases like car-bivascular disease, stroke, kidney failure, heart attack, peripheral arterial disease, blood vessels, and nerves.

Moreover, there were directly about 1.6 million deaths due to diabetes. Therefore; it is an alarming to us. The number of diabetic patients is as stroke, coronary artery disease, and cancer. Moreover, ML-based systems can be used as both feature selection techniques (FST) and classifiers. It also helps the people to accurately diagnosis of diabetes and the best classifier is the most important problems for accurate diabetes risk stratification. There were various ML-based systems used to classify and predict of diabetic disease like linear discriminant analysis (LDA), quadratic discriminant analysis (QDA), naïve Bayes (NB), support vector machine (SVM), artificial neural network (ANN), feed-forward neural network (FFNN), Ad boost (AB), decision tree (DT), J48, random forest (RF), Gaussian process classification (GPC), logistic regression (LR), and k-nearest neighborhood (KNN) and so on [32].

IMPLIED VOLATILITY :-

Volatility is an important risk indicator for financial assets. Implied volatility (IV) is the estimated volatility given a security’s price and is most commonly used when pricing options. High volatility means a large price swing, but the price could swing very high, very low, or both. Low volatility means that the price likely will not make broad, unpredictable changes. When the price is known, the implied volatility can be derived from the option pricing model because it is the only factor in the model that cannot be directly observed in the market. However, in most cases, the price is unknown, and the implied volatility can only be determined by other factors that can be observed from the market, including the strike price and the time to maturity. However, the DVF focuses on linear patterns, which are too simple to capture complicated implied volatility patterns. Later, several more complicated parametric models were discussed to estimate. It is still hard for these models to adequately capture the dynamics of implied volatilities. Realizing the limitations of parametric models, some researchers have utilized modern machine learning techniques to estimate the implied volatilities. One of the pilot studies utilizing machine learning techniques to estimate option volatilities was the work of. It applied neural networks (NN) to forecast S&P100 implied volatilities [34].

K-NEAREST NEIGHBORS CLASSIFIER :-

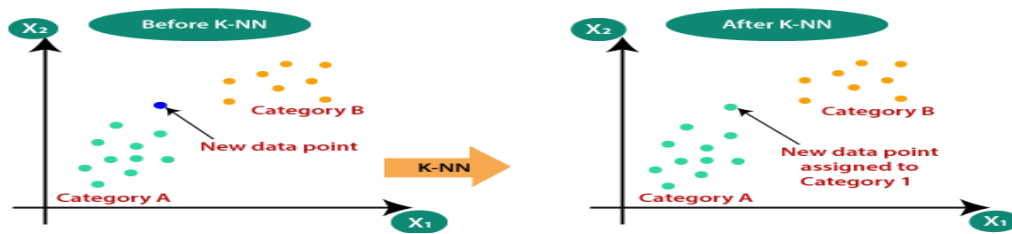


Figure 1.5: K-Nearest Neighbors Classifier.

FINANCIAL PORTFOLIOS :-

An investment in finance has two aspects Returns and Risks. The characteristics of investment can be stated in terms of return, risk, safety, liquidity etc. Additionally Mean-Variance calculations and Sharpe Ratio are used to validate the risk and returns calculated. Markowitz theory has the same validation for diverse stocks called the mean-variance optimization. All the above can be carried out much faster and with greater accuracy by applying predictive analytics in the finance domain and will examine what are the fundamental models available in the financial domain of Portfolio construction and management before trying to augment it with machine learning models. Early day had limited forms of data storage and the use of internet was meagre. But with the new era of internet and IOT there is a huge deluge of data which has to be processed. Predictive Analytics uses new and historic data to analyze and predict events. It uses various techniques borrowed from statistics, Data Mining, machine learning and artificial Intelligence to do predictions. Although predictive analytics has made its mark in various industries like Healthcare, Retail, Manufacturing, Sales & Marketing, Weather Forecast and

multiple such areas, in this paper, an eagle's eye view of Application of Predictive Analytics in Finance. The areas in finance where predictive analytics plays a key role are manifold [39].

ADAPTIVE FILTERS :-

Traditional adaptive filter is a linear filter that has a transfer function controlled by variable parameters and an optimization algorithm to adjust those parameters according the prediction error. Adaptive filters are applied in some cases because some parameters of the desired processing operation are not known in advance or are changing. Traditional adaptive filter uses feedback in the form of an error signal to refine its transfer function. The Least Mean Squares filter and the Recursive Least Squares filter are general types of adaptive filters. Because of the complexity of the optimization algorithms in adaptive filters, almost all adaptive filters are digital filters. As the advances in digital signal processing, the power of digital signal processors has increased, adaptive filters have become much more common and are now routinely used in devices such as mobile phones and other communication devices, camcorders and digital cameras, and medical monitoring equipment. Although traditional adaptive filters are successful in many applications. There are still some weaknesses need to be overcome, which can be summarized as they are linear filters in general, which cannot track fast changing nonlinear and nonstationary signals instantly. The computational loading of traditional adaptive filters will increase with the growing dimension of the input signals. This is a great challenge in real time and online applications. Furthermore, due to the increasing model dimension, the filter will be prone to over adaptation [41].

LIGHT GRADIENT BOOSTING MACHINE (LGBM) :-

LGBM is another gradient boosting framework that is based on decision tree algorithms. It was introduced in the Machine Learning community by a team of Microsoft's data scientists. The authors tried to increase the efficiency and scalability of other boosting algorithms when the feature dimension is high and data size is large. Their method grows the trees by applying the leaf-wise strategy, while other ensemble learning algorithms (like XGBOOST) use the level-wise or depth-wise strategy. LGBM benefits from two novel techniques, called Gradient-Based One-Side Sampling (GOSS) and Exclusive Feature Bundling (EFB). The computation cost is reduced due to these techniques. GOSS excludes a significant proportion of data instances with small gradients, just the rest being used to estimate the information gain. Thus, GOSS can obtain a quite accurate estimation with a much smaller data size [42].

SOLAR ENERGY RADIATION :-

The sun is an abundant, free, infinite, green, reliable, renewable, and sustainable energy resource. It also has a large potential to fulfill the energy demands of the world and it is projected that it will be widely utilized in the immediate. In order to determine the solar energy potential of a region, the solar radiation (SR) information of that region must be known. For robust planning, management and applications of investments in the solar energy field, a successful prediction of solar radiation amount coming onto the ground is one of the remarkable issues. In the case that the energy produced after the investments is sold commercially, it is important to make accurate particularly short-term solar radiation prediction both in the day ahead and intraday markets. Making accurate predictions directly affects the profit margin of the energy suppliers in these markets [44].

FOURTH INDUSTRIAL REVOLUTION :-

The fourth industrial revolution has significantly transformed the way financial systems work. Although each industrial revolution brought unique changes to the global scenario, the speed at which the fourth revolution is impacting the businesses is, by far, unprecedented. The swift adaption of technology is considered to be a complex and intricate phenomenon, with both opportunities and challenges that are put forth towards the financial sector. The innovative technologies, like artificial intelligence, big data, block chain and machine learning, are redesigning the payment solutions, investment management, and the risk assessment as well. On the flip side, issues of data security,

privacy, varied customer experience and regulatory compliance have also become considerably convoluted with the advent of technological advancements [45].

MACHINE LEARNING IN AGRICULTURE :-

Machine learning in the agricultural sector is a comparatively new concept. The implementation of machine learning in agriculture are being seen for a few decades but still, it has made a significant contribution to the field. The most helpful contribution in this field is the weather and rainfall prediction. It makes the farmers ready for the upcoming weather anomalies and protects their plants. The rainfall prediction helps the farmers to do the right amount of irrigation on their crops. It also makes them easier to prepare for droughts and atrocious conditions. The other applications of machine learning in farming include the study of soil and the prediction of the quantity of fertilizers and additional materials that are optimum for farming [48].

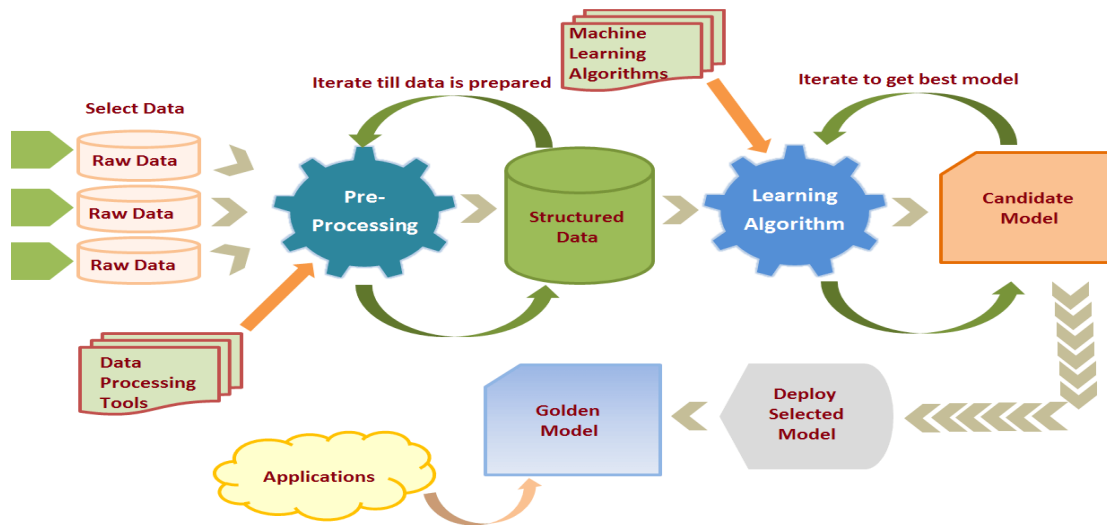


Figure 1.6: Machine Learning in Agriculture.

PREDICTING STOCK MARKET TRENDS :-

Researchers have used different machine learning algorithms to mine historical, social media, and news articles data to develop prediction models for stock markets. When social media and online news websites were less popular than they are at present, researchers had to rely on the usage of historical data to predict the stock market. For example, researcher used generalized regression neural networks and multilayer perceptron (MLP) neural network (NN) architectures over daily closing prices to forecast the movement of closing price in Kuwait stock exchange. He proved that NN can learn the relationship between input and output features for making predictions over the data on which the network is presented a machine learning model for stock market price prediction based on technical indicators and historical data of different stocks. A prediction model was also discussed by that used the firefly algorithm and support vector regression (SVR) to forecast the stock market price. used SVM to forecast the coming day’s stock market trend. They used global stock data as input features to SVM [50].

HEART FAILURE :-

Heart failure (HF) is a clinical syndrome characterized by dyspnea, fatigue, and clinical signs of congestion leading to frequent hospitalizations, poor quality of life, and shortened life expectancy. HF is a global pandemic that affects approximately of the adult population in developed countries around 26 million people worldwide, despite advancements in medical, device-based, and surgical management of

HF, outcomes remain non-satisfactory even in Western developed countries. Evidently, emphasis in investigating efficient research methodologies for HF management is one of the leading study directions that cannot be overlooked. Recently, machine learning (ML) algorithms have used computational methods to "learn" information directly from data, and their performance has been shown to improve proportionally with the number of high-quality samples. ML algorithms have been applied in different aspects of medicine, including earlier disease detection, improve diagnosis accuracy, identification of new physiological observations or patterns, development of personalized diagnostics and/or therapeutic approaches. The aim of this systematic review is to present the state of the art regarding the utility of ML techniques in comparison with conventional methods, in improving outcomes in HF patients [53].

EXTREME GRADIENT BOOSTING (XGBOOST) REGRESSION :-

XGBOOST is a recently developed machine learning technique that has been widely used in several fields. Being a well-organized, portable, and flexible approach will be suitable for numerous applications. As a technique that combines Cause Based Decision Tree (CBDT) and Gradient Boosting Machine (GBM) in one effective algorithm, it gained the ability to enhance the tree boosting approach to quickly and accurately process nearly all data types. With such unique capabilities, this algorithm can be efficiently utilized to develop forecasting models as regression and classification processes are implemented for the targeted dataset. XGBOOST is also used for processing big datasets with a considerable number of attributes and classifications. This algorithm also offers practical and proficient solutions for tackling new optimization problems, especially when efficiency and accuracy trade-offs are considered [55].

LONG-SHORT-TERM MEMORY NETWORKS :-

LSTM is a type of time RNN. It is specially devised to solve the long-term dependence problem of general RNN. It has been successfully used in various fields such as machine translation, speech recognition, image description generation, video tagging, and financial time series. All RNN has a chain form of the repetitive neural network module. It mainly includes forgetting gate, input gate, and output gate. The capital market includes money as well as the market, namely the financial market. So, financing refers to the process of economic operation; both supply and demand of funds use various financial instruments to adjust the capital surplus of activity. Financial markets are trading financial instruments, such as bonds, savings certificates, stock, etc. To seek greater benefits from it, generations of scholars and investors continue to explore the secrets and develop many prediction methods. Especially in stocks, because fluctuations in stock prices are influenced by many factors, including economic trends, economic cycles, economic structure, and other macro factors, as well as industry development, listed companies' financial quality, and other factors. Even great in part, it depends on the influence of investors' psychological games and other micro-factors. These factors are important in stocks. Researchers and investors are trying to find opportunities to gain profit in stocks [60].

HUMAN AGE CLASSIFICATION (HAC) :-

Human age classification (HAC) models are to estimate a person's age with information derived from his/her face image by using dedicated algorithms. The problem encountered during age classification is the shared similarities with other typical face image interpretation tasks in which the execution phase includes the method of face detection, locating characteristics of face, formulation of feature vectors and age classification. According to the age estimation system applicability, the classification result can be an estimate of the exact age of a person or the age group of an individual or even a binary result indicating whether the age of a subject is within a certain age range. Among those three variations listed above, the classification into age-groups is used in several applications. Despite this, it is important to have a rough estimate of an individual's age rather than his/her exact age. Another prominent problem encountered during age estimation is the range of ages considered. This parameter is important because different aging signs appear in different age groups; hence, the system

that is only trained with specific age groups may not be applicable to more diverse age ranges. The information depicted from the face has drawn the research attention in the image processing research field [61].

WHALE OPTIMIZER :-

Whales have many species such as humpback, finback, blue and Sei. Whales are considered as one of the smartest animals because they have common cells in their brains called spindle cells those cells can provide judgment, emotions, and social behaviors like humans. Therefore, unlike many animals, whales can learn, judge, think, and communicate. The humpback whales particularly have a unique hunting method called bubble-net feeding method. They create bubbles in circles path for hunting small fishes close to the surface. This hunting technique has two schemes, upward-spirals and double-loops. In the upward-spirals scheme the whales dive 12 m down then they start creating bubbles in a spiral shape around the prey while swimming up toward the surface while the other scheme has three different phases: capture loop, coral loop, lobtail [62].

GREY WOLF OPTIMIZER :-

The Grey Wolf Optimizer (GWO), a recently developed swarm intelligence (SI) algorithm, has proven to be a reliable optimization algorithm compared to conventional evolution-based algorithms. The gray wolf belongs to the Canidae family. It is considered a high-level predator and dwells at the top of the food chain. They live in a pack that comprises wolves on the whole. In gatherings, an exact predominance order is maintained. The pack is driven by alphas and trailed by betas, the subordinate wolves who are mindful to help the alpha in maintaining the dynamics of the pack. The beta wolf strengthens the alpha's orders all through the pack and offers input to the alpha. In the interim, the lowest rung among the gray wolves is the omega, who generally assumes the scapegoat's job. They are the last wolves allowed to eat from the prey. On the off chance that a wolf is not alpha, beta, or omega, the individual in question is known as a delta. Delta wolves act as scouts, sentinels, seniors, trackers, and guardians. The motivation for proposing the GWO algorithm for COVID-19 diagnosis is twofold. First, it is a very competitive optimization algorithm. It has been applied to various research fields, such as feature selection, economic load dispatch problems, and flow scheduling problems. In addition, the GWO algorithm benefits from avoiding high local optima, which leads to avoidance of overlapping features in the problem of feature selection. The main mechanisms of GWO, including social pecking order, following, circling, and attacking prey [64].

TRIPLET NEURAL NETWORK :-

The triplet neural network, referred in as back-end, defines a cost function to evaluate the embedding's provided by three instances of the same neural network with shared parameters. As input of this network three examples are used, an example from a specific identity, another example from the same identity e+ a positive example, and an example from another identity e- a negative example. In most of the existing systems using this approach the network architecture has been trained with the triplet loss function which maximizes the distance between the anchor and the negative example at the same time that the distance between the anchor and the positive example is minimized if it is greater than a margin. Unlike the previous systems, they decided to use a loss function which is more intuitive for the detection task, since this function allows us to optimize directly the AUC metric that measures the performance of their whole system. Furthermore, another important point to train correctly this kind of systems is the triplet data selection applied to choose which the examples that compose the triplets are. They decided to use a similar approach to the triplet sampling strategy discussed in which is usually called Hard Negative Mining instead of a random selection. This technique consists in selecting the anchor-negative pairs with the maximum similarity value hard negative for which the system triggers a false alarm, and the anchor-positive pairs with the minimum similarity value hard positive which the system cannot detect and produces a miss [68].

GRADIENT CENTRALIZATION :-

Gradient centralization (GC), which can not only smooth and accelerate the training process of DNN but also improve the model generalization performance. they analyze the theoretical properties of GC, and show that GC constrains the loss function by introducing a new constraint on weight vector, which regularizes both the weight space and output feature space so that it can boost model generalization performance. Besides, the constrained loss function has better Lipschitz Ness than the original one, which makes the training process more stable and efficient. A commonly used operation on gradient is to compute the momentum of gradient. By using the momentum of gradient, SGDM accelerates SGD in the relevant direction and dampens oscillations. Besides, L2 regularization-based weight decay, which introduces L2 regularization into the gradient of weight, has long been a standard trick to improve the generalization performance of DNNs. To make DNN training more stable and avoid gradient explosion, gradient clipping has been discussed to train a very deep DNNs. In addition, the projected gradient methods and Riemannian approach project the gradient on a subspace or a Riemannian manifold to regularize the learning of weights [69].

SKIN CANCER DIAGNOSIS [71] :-

The skin is the broadest organ in the body which protects the body against the heat, light, and infection. It also helps to control the body temperature and to store the fat and the water. One of the most important problems of skin in the body is its infection risk to skin cancer. Skin cancer starts from the cells - the main components that make up the skin - the skin cells grow and divide to form new cells. Everyday skin cells grow old and die and new cells take their place. Sometimes this systematic process does the wrong thing. New cells are created when the skin does not need them, and old cells die when they do not have to. These extra cells form a mass of tissue called a tumor. Melanoma is the most malignant and most serious type of skin cancer and is the reason for most deaths from skin cancer. The underlying cause of melanoma is unknown. But several factors, including genetic factors, ultraviolet radiation, and environmental contact are involved in causing the disease. Melanoma originates from skin melanocytes that have undergone malignant transformation. Melanocytes produce dark pigments on the skin, hair, eyes, and spots of the body. Therefore, melanoma tumors are mostly brown or black. But in a few cases, melanomas do not produce pigment and appear pink, red or purple [71].

CORN LEAF DISEASES RECOGNITION :-

The agriculture sector is adopting artificial intelligence and machine learning in diverse areas including disease detection, soil monitoring, weed controlling, diagnosing pests, computer vision and drones for crop analysis, and weather predictions. Agriculture is the most important sector of the Indian economy, accounting. The main source of income for a large population of India is agriculture. Hence, India is extremely dependent on crop productivity. Corn is a very common crop in India. Corn farming is essential in India because it has a high export potential and a vast population of farmers is dependent. Corn is being used in various sectors like cattle feed, poultry industry and food and beverage industries. It has become a primary food in many parts of the world, with its overall production exceeding that of wheat and rice. But in India, the yield of corn is almost half of the overall global average. One of the reasons for low corn yield is that it is subjected to many diseases which significantly reduce the overall crop yield. Certain leaf diseases remain a challenge for crop production, not only through scaling down the crop yield but also through the reduction in its nutritional value. Some of the prevalent leaf diseases include common rust, gray leaf spot, and leaf blight. These leaf diseases may look very comparable in their nascent phases, hence making it very difficult to detect through the naked eye. Detection of leaf diseases through visual observation requires a team of specialists and constant crop monitoring. Thus, making it very costly, time-consuming and less reliable. they can leverage deep learning techniques to conduct automatic, rapid and more precise leaf disease detection and classification. Several researchers have worked in this region to create a model that can predict the existence of leaf disease in corn plant [74].

HYPERSPECTRAL REMOTE SENSING IMAGE :-

Hyper spectral imaging technology that collects electromagnetic spectrum information from hundreds of continuous narrow spectral bands with the help of hyper spectral sensors has a strong capability to distinguish surface objects. Hyper spectral sensor captures hyper spectral image (HSI) which have fine spectral and spatial resolutions. It has been used in a wide range of applications including agricultural monitoring, environment analysis and prediction, climate monitoring, mineralogy, surveillance, physics, astronomy, chemical engineering, etc. HSI classification is a common task in these applications where assigning a class label to every pixel of HSI is done. HSI classification is a challenging task due to huge number of bands with strong correlations in the spectral and spatial domains and limited availability of the training samples. The huge number of bands generate 'curse of dimensionality' issue also called Hughes phenomenon. In order to address this issue, feature selection (FS) and feature extraction (FE) techniques are considered as preprocessing steps in HSI classification [75].

DIABETIC RETINOPATHY :-

Diabetic retinopathy is briefly a serious eye disease caused by diabetes mellitus, and that disease is a common cause of blindness, especially within developed countries. At this point, early diagnosis and treatment are crucial to prevent patients from being affected by the blindness condition, or at least to slow down the progression of diabetic retinopathy toward that. Because of that, mass screening of diabetic patients is highly desirable. However, manual grading always gives the right results because it requires a good experience and expertise. In time, much effort has been put into establishing reliable computerized scanning systems based on color fundus images. Currently, diabetic retinopathy detection from digital fundus images is still an open problem and it is needed to develop alternative solutions because of that. In addition to imaging and computer vision-based systems, the next step is the employment of intelligent diagnosis systems. Diabetic retinopathy from retinal fundus images. By employing both image processing and deep learning, one remarkable motivation of the study is obtaining improved results of diagnosis and contributing to the associated literature with a hybrid solution for diagnosis of a critical disease. Additionally, another motivation is to demonstrate that classification can be done easily with deep learning assisted by classical and simple image processing techniques, which are different from the ones used previously in the literature [76].

BLACK-SCHOLES OPTION PRICING MODEL

One of the most basic and powerful tools in financial mathematics is the Black-Scholes equation, which is used to find the prices of assets. The price of European call options can be determined as the solutions of Black-Scholes equation [1, 2]. Moreover, to model transaction costs arising in the hedging of portfolios [3, 4] and large traders' feedback effects [5-8], non-linear Black-Scholes equation have been derived. An option is defined to be a contract or security that gives the buyer or holder the right but not the obligation to buy or sell assets at a specified price called strike price and at a specified date called expiration date of the stock [9, 10]. In option pricing, if the price of the stock is higher than the strike price then the option tends to have higher value and so the option is exercised but if the price of the stock is less than the strike price then the option has less value and so the option is given to expire [77].

CRYPTOCURRENCY :-

Crypto currencies are a subset of virtual currencies that use cryptography for security. These are decentralized and open-source currencies and hence function on a peer-to-peer basis. Crypto currencies mostly use a very complex cryptographic algorithm that requires connected network of computers to conduct computationally expensive mathematical operations. Crypto currencies have a built-in implementation of cryptography in their design. At present, people are using crypto currencies to implement a new form of economy, because of its cheapness, online, and anonymous means of exchange. A list of crypto currencies and their prices can be found at which lists more than crypto

currencies of varying types. Crypto currencies feature certain computer protocols that are out of any government control. These currencies are unregulated and highly volatile. These currencies have aggressive swings in their prices, as it is largely based on public perception. It is therefore very hard to make related risk assessment at any moment. With the increase of the prices of crypto currencies, mining has also turned into a very advantageous business for the people. While the prices of crypto currencies have gone up since with great fluctuation, the enthusiasm of people to invest more and more in these virtual currencies stays more or less constant [79].

STOCK INDEX OPTIONS :-

Stock index, the most important indicator that reflects and predicts financial market fluctuations and global economic changes, is playing an increasingly important role in capital market. The total value and trading volume of global trading products of stock index options are increasing year by year. It is often used as a benchmark to measure the performance of investment funds, the basis of passive management that replicates its performance, derivative instruments involved in transactions, benchmark indicators for financial contracts, and refined risk management tools. Most collective investment funds are based on indexes. For example, the assets under management of US \$14.8 trillion are based on the MSCI (Morgan Stanley Capital International) Index. The option contract with stock index as the exercise type is stock index option, which has become one of the most active types in the international derivatives market. Stock index options have been listed on more than 40 exchanges in more than 20 countries and regions around the world, including major mature markets and emerging markets. In the first half of 2020, the global exchange option trading volume continued to grow, and the growth rate of stock index option derivatives was ahead. The rapid development of stock index options derivatives trading has accumulated a lot of data, and many important effective information is hidden among them [1] [37]. Therefore, the dynamic analysis of the time series of stock index option price is very important. It has gradually become one of the hot topics in the financial field, which is of great significance to the development of the financial market [82].

CLOUD PROVISIONING SERVICES :-

Compared with private clusters, model serving on public clouds is far more complex. Leading cloud platforms such as AWS, Google Cloud, and Microsoft Azure offer a variety of provisioning services that can be used for model serving. They briefly survey these services, with a main focus on AWS. With IaaS, cloud customers run virtual instances (VMs) of various configurations in terms of CPUs, memory, storage, network, and accelerators. Customers can then configure and deploy ML model serving software on running instances to serve model inference requests. IaaS cloud provides flexible pricing options to allow customers to choose between service guarantees and cost savings. Taking Amazon EC2 as an example, customers can run instances on-demand and pay for compute capacity by per hour or per second depending on the instance types. Alternatively, customers can run spot instances at steep discounts of the on-demand price, under the condition that a running spot instance can be interrupted indefinitely [83].

FINANCIAL RISK MANAGEMENT :-

FRM tasks are generally challenging, with continuously evolving yet sparse and complex data. Quantifying and managing risk plays an important role in any organization. As businesses, especially, financial institutions, grow larger and more complex, the need for sophisticated statistical models to correctly quantify and mitigate risk has become more important than ever before. For big companies with very large portfolios and sophisticated financial products, accurately evaluating the exposure of the portfolio to the dynamic financial market is becoming increasingly difficult with previously implemented statistical or simulation methods. To address this shortcoming, there is a lot of work that is going on that deals with the application of advanced machine learning methods to datasets for FRM. Driven by the industrial demand for intelligent risk management systems and academic goals for developing highly-applicable machine learning algorithms, a growing number of researchers are

exploring sophisticated ML approaches Transfer Learning, Deep Reinforcement Learning for tasks related to managing and mitigating financial risk. The depth of literature in solving specific FRM task is evolving rapidly [87].

ALZHEIMER DISEASE :-

The Alzheimer Disease is an irremediable, Neuro-degenerative and dynamic brain diseases that directly affect the individual's memory, learning, thoughts and behavior. Currently, AD is a third leading cause of death after cancer and heart disease in the world. So, the early detection of AD helps in delaying the disease progression and to take therapeutic measures. Several imaging modalities are in use for AD recognition such as MRI, positron emission tomography, computed tomography, ultrasound, histopathology, etc. that contains information about AD effects, structure and function. In clinical practice, MRI is the standardized imaging modality compared to other imaging modalities. However, the manual analysis takes more time for clinicians, because each MRI image consists of more information and millions of voxels. In recent years, there are many functional connectivity methods have been developed by the researchers for AD diagnosis. Some of them are game theory-based classifier, Artificial Neural Network (ANN), Support Vector Machine (SVM), Convolutional Neural Network (CNN). Each methodology has its own limitation such as game theory-based classifier is computationally expensive, SVM is adaptable only for binary classification, duration of the ANN is unknown and there is no specific rule for determining the CNN structure, where the network structure is achieved through trial and error [91].

AUTO ENCODER MODEL [94] :-

Auto encoder is an unsupervised learning approach that processes input images as model input through hidden layers and reconstructs the image as output. Meaning, it is a model that captures the features in the internal structure of the input images and transfers them to the output layer during the reconstruction phase. The overall structure and operation of this model are, the model consists of three layers. The Auto encoder model performs encoder and decoder operations. The encoder operation takes place between the input layer and the hidden layer. The decoder operation takes place between the hidden layer and the output layer. Here, the size of the data is increased by the decoder. In addition, the hidden layer is loaded with the features obtained as input. One of the contributions of the Auto encoder model is the reduced noise of the image. This can be clearly observed when it is applied to the whole dataset, which results in a performance increase in the classification. The reduction of noise means that new features are obtained from the image. Furthermore, another great advantage of the Auto encoder model is that it minimizes the error rate by using back propagation during image processing.

RECURRENT DEEP NEURAL NETWORKS :-

A recurrent neural network (RNN) is one that works faster. An input vector is received, and periodic updating on high-dimensional hidden state are done in every iteration for accurate results. In machine learning, training a deep architecture model has always acquired a challenging focus. On recent advents using a feed-forward neural networks, training a deep architecture layer by layer for perfection has been achieved. Generally, multiple intermediate hidden layers from 150 to even 500 hidden layers are used to train deep neural networks rather than single hidden layer. However, optimization of such deep neural networks often suffers for cost effectiveness and errors. So, while working with neural networks, they have to take special concern about error rate, flow along the hidden layers and learning rate. Many of the existing algorithms are devised based on two criteria such as first-order and second-order methods. Based on the previous studies, it was evident that RNNs remained challenging to train with SGD due to lessening gradient problem. In modern years, RNNs gained popularity due to numerous progresses made in their training [98].

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