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# Role of Machine Learning Techniques in Business Forecasting and Decision Making: A Review

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***Abstract – Machine learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer programs that can access data and use it learn for themselves. It enables analysis of massive quantities of data. Well-grounded forecasts help organizations compete in the dynamic and short-lived economy. In addition, they expand the leeway of organizations, since forecasts help them avert adverse trends in time or reinforce beneficial ones.***

***While it generally delivers faster, more accurate results in order to identify profitable opportunities or dangerous risks, it may also require additional time and resources to train it properly. Combining machine learning with AI and cognitive technologies can make it even more effective in processing large volumes of information. The objective of this paper is to discuss work done in past by various researchers in the field of forecasting using Machine Learning.***

***Keywords: Business Forecasting, Machine Learning, Decision Making***

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## INTRODUCTION

In today's world of extreme competition, cost reduction is of utmost importance for organizations, primarily in the retail and consumer product goods (CPG) industries. All the major players in these industries try to focus on cost-cutting and maintaining optimum inventory levels to gain a competitive edge. In addition to cost optimization, having just the right amount of inventory is also becoming important for consumer satisfaction especially in the perishable retail goods market. This is where demand forecasting helps these companies. Efficient and accurate demand forecasts enable organizations to anticipate demand and consequently allocate the optimal amount of resources to minimize stagnant inventory. This paper discusses studies already done in past by various researchers in the field of forecasting using Machine Learning.

## MACHINE LEARNING

Machine learning (ML) is a category of algorithm that allows software applications to become more accurate in predicting outcomes without being explicitly programmed. The basic premise of machine learning is to build algorithms that can receive input data and use statistical analysis to predict an output while updating outputs as new data becomes available.

Machine learning (ML) is the scientific study of algorithms and statistical models that computer systems use to progressively improve their performance on a specific task. Machine learning algorithms build a mathematical model of sample data, known as "training data", in order to make predictions or decisions without being explicitly programmed to perform the task

## BUSINESS FORECASTING

Decision making, the principal task of management, is challenging because most information received by managers is no longer current and the future, in which decisions take effect, is uncertain. In addition, conventional management information systems, such as data warehouses, are often limited to describing the past based on historical data.

To make effective decisions, managers rely on answers to relevant questions such as the following:

- In which direction do current trends point?
- Is the current situation an outlier or a sign of rising instability?
- Is there a crisis under way?

Well-grounded forecasts answer such questions and help organizations compete in the dynamic and short-lived economy. In addition, they expand the leeway of organizations, since forecasts help them avert adverse trends in time or reinforce beneficial ones. Machine learning based on data is a very important in modern intelligent forecasting technique; it mainly studies how to get rules that cannot be obtained by theoretic analysis from observed samples, then how to utilize these rules to recognize objects and predict future data or unobserved data. Hence business forecasting using various available machine learning algorithms is considered as most effective and efficient way to forecast.

## REVIEW OF LITERATURE

**Yin Yafeng , Liu Yue , Gao Junjun , Tan Chongli, (2009) "**A New Fuzzy Neural Networks Model For Demand Forecasting" , Demand forecasting is the premise of business tasks in an organization and the forecasting precision greatly affects security stock, benefit and aggressive intensity of the organization. In this paper, a novel hereditary calculation (GA) and back proliferation (BP) calculation based fluffy neural system (GABPFNN) show is proposed for interest forecasting, in which new sorts of fluffy principle producing and coordinating calculations are progressed to manage the trouble of fluffy neural system demonstrating, at that point GA and BP are utilized to upgrade the system. At long last, the model is connected for the interest forecasting of lager retail industry. The last examination result demonstrates the productivity of the model."

**Esmaeil Hadavandi, Hassan shavandi, Arash Ghanbari, (2010)** "A hereditary fluffy master system for stock value forecasting", Forecasting stock value time arrangement is vital and testing in reality since they are influenced by numerous exceptionally interrelated financial, social, political and even mental components, and these elements interface with one another in an extremely convoluted way. This article displays a methodology dependent on Genetic Fuzzy Systems (GFS) for building a stock value forecasting master system. Researchers utilize a GFS demonstrate with the capacity of principle base extraction and data base tuning for following day stock value expectation to separate helpful examples of data with a clear standard enlistment approach. Researchers assess capacity of the proposed methodology by applying it on stock value forecasting contextual investigation of International Business Machines Corporation (IBM), and contrast the results and past stock value forecasting strategies utilizing mean supreme rate mistake (MAPE).

**"Togar Alam Napitupulu, Liliana (2011)**, Artificial, "Neural Network Application in Gross Domestic Product Forecasting" Gross Domestic Product (GDP) is a benchmark for financial generation states of a nation. Assessments of monetary development in the coming year in a nation has vital jobs, among others as a benchmark in deciding business anticipates business substances, and the reason for contriving government financial strategy. Counterfeit Neural Network (ANN) has been progressively perceived as a decent forecasting instrument in different fields. Its temperament that can emulate the workings of the human mind makes it adaptable for non-direct and nonparametric data. Gross domestic product development forecasting systems utilizing ANN has been broadly utilized in different nations, for example, the United States, Canada, Germany, Austria, Iran, China, Japan and others. In Indonesia, forecasting of GDP is just done by government foundations, to be specific National Planning Board, utilizing macroeconomic model.

**Arash Ghanbari , Esmaeil Hadavandi , Salman Abbasian-Naghneh (2011)**, "Correlation of Artificial Intelligence based Techniques for Short Term Load Forecasting", "The previous couple of years have seen a developing rate of fascination in reception of Artificial Intelligence (AI) strategies to take care of various building problems. In addition, Short Term Electrical Load Forecasting (STLF) is one of the vital worries of intensity systems and precise load forecasting is imperative for overseeing free market activity of power. This examination appraises here and now power heaps of Iran by methods for Adaptive Neuro-Fuzzy Inference System (ANFIS), Artificial Neural Networks (ANN) and Genetic Algorithm (GA) which are the best AI procedures in this field. With the end goal to enhance forecasting exactness, all AI strategies are furnished with preprocessing idea, and impacts of this idea on execution of every AI strategy are researched. At long last, results of the methodologies are assessed and thought about by methods for the mean supreme rate mistake (MAPE). Results demonstrate that data preprocessing can fundamentally enhance execution of the AI strategies.

**Geraldo Glrardi, maria emilia Camargo (2012)** "Figure Production Volume: A Case Study", his paper means to utilize the estimate of the necessities with the end goal to get ready for the future needs of the customers and along these lines, help the gestors in the basic leadership process. In the business world, the arranging appended to the necessities, empowers the advancement of the assets associated with the beneficial task at whatever point looking for all the more intensely of the organization where the market is. In view of the data of the creation volume for three item for the time of January 2002 to December 2006, ARIMA demonstrate joined with

subjective techniques is utilized as a method for anticipating under time. The point is to pick a proficient technique for forecasting with the end goal to enhance the precision of the outcomes inside a satisfactory expense in the material organization where the investigation was produced. After the utilization of the strategy for forecasting the need in the material part of assembling of fabric, the outcomes were assessed with the use of the proposed system contrasting with the subjective method of forecasting utilized these days in the arranging of the organization".

**Mounir ben Ghalia, Paul p. Wang, (2014)** "Savvy System to Support Judgmental Business Forecasting: The Case of Estimating Hotel Room Demand", Forecasting is an instrumental apparatus for vital basic leadership in any business movement. Great conjectures can lessen the vulnerability about the future and, henceforth, enable administrators to settle on better choices. For all intents and purposes all factual forecasting methods rely upon the congruity of chronicled data and time arrangement and may not foresee a spasmodic change in the business condition. In many cases, this brokenness is known to directors who at that point must depend on their judgment to make estimate alterations. In this paper, the job of judgmental forecasting and take the problem of evaluating future inn room request as a down to earth business application is examined. Next, creators propose IS– JFK: a canny system to help judgmental forecasting and learning of administrators.

**Guanzhong Li (2014)** "Machine Learning in Fuel Consumption Prediction of Aircraft" , Proceedings of the ninth IEEE International Conference on Cognitive Informatics, ICCI 2010 Nowadays, as fuel is an essential asset for the entire world, researchers are attempting an assortment machine learning models for fuel stream expectation in industry, aviation particularly. Diverse machine learning models have been connected in various applications. This paper will examine these applications. Numerous helpful focuses have been found by correlation of those exploratory outcomes. ANN is utilized for expectation reason in this research paper."

**Soumesh Chandra Basu (2014)"** A New Machine Double-Layer Learning Method and Its Application in Non - Linear Time Series Forecasting" "Machine learning is a viable strategy, whose point is perceive obscure examples through learning from known examples. At present, Artificial Neural Network (ANN), Support Vector Machine (SVM) and Genetic Algorithm (GA) is the most famous machine learning strategies, yet they all have a few deformities and a few benefits. In this paper another machine twofold layer learning technique is advanced. It incorporates the benefits of ANN/SVM and GA. ANN/SVM is utilized to do inward layer learning with the end goal to get model's internal parameters, and GA is utilized to actualize external layer learning to secure model's external parameters. In this way the new learning strategy require complete twofold layers learning, by correlation with regular machine learning, the new technique has more grounded self-versatile capacity, and it can make up the inadequacies of single learning strategy and completely guarantee model's speculation capacity. At last, the machine twofold layer learning strategy is connected for nonlinear time arrangement forecasting, and precedents demonstrate the accuracy and legitimacy of the new technique.

**Se Hun Lim and Kyungdoo Nam** "Artificial Neural Network Modeling in Forecasting Successful Implementation of ERP Systems", International Journal of Computational Intelligence Research Vol.2, No. 1 (2006).

"Artificial Neural Network (ANN) is widely used in business forecasting.ANN is a powerful forecasting tool. It is suitable for solving complex problems. Recently, ANN has been applied in many varieties of business decision making, such as bankruptcy forecasting, customer churning prediction, stock price forecasting, business process innovations, and systems development. In this study, researchers investigated the usefulness of the ANN model in forecasting success when implementing Enterprise Resource Planning (ERP) systems.

**Patrick Meulstee, Mykola Pechenizkiy** "Food Sales Prediction: "If Only It Knew What We Know", IEEE International Conference on Data Mining Workshops, 2008

Sales prediction is an important problem for different companies involved in manufacturing, logistics, marketing, wholesaling and retailing. Food companies are more concerned with sales prediction of products having a short shelf-life and seasonal changes in demand. The demand may depend on many hidden contexts, not given explicitly in the form of predictive features. Even if some changes are known to be seasonal, predicting (and even detecting) when season will start and end remains to be non-trivial. In this paper we present an ensemble learning approach that employs dynamic integration of classifier for better handling of seasonal changes and fluctuations in consumer demands. We focus our research on studying how the business is currently operated, and how we can improve predictions for each product by constructing new groups of predictive features from (1) publicly available data about the weather and holidays, and (2) data from related products. We evaluate our approach on the real data collected by food wholesaling and retailing company. The results demonstrate that (1) our ensemble learning approach can perform better than the currently used

baseline, (2) we can handle seasonal changes with ensemble learning better if feature set for a target product is complemented with features of related product (having similar sales pattern), and (3) an ensemble can become more accurate if information about the weather and holidays is presented explicitly in a feature set.

**Arabinda nanda , Omkar Pattnaik, "**Neural Network Model Predicts the Time Series Data of Hourly Tides", Proceedings of National Seminar on Application of Soft Computing in Engineering Education 2010, Organized by Trident College of Engineering, Bhubaneswar
"Prediction of tides is very much essential for human activities and to reduce the construction cost in marine environment. Here application of the artificial neural network with back- propagation procedures for accurate prediction of tides. This neural network model predicts the time series data of hourly tides directly while using an efficient learning process called quick prop based on a previous set of data. Hourly tidal data measured at Paradeep port (Latitude: 20° 16' 60 N, Longitude: 86° 42' 0 E) -north east coast of India was used for testing the back-propagation neural network model Results show that the hourly data on tides for even a month can be predicted efficiently with a very high correlation coefficient

**Bjoern Krollner, Bruce Vanstone, Gavin Finnie**, "Monetary Time Series Forecasting With Machine Learning Techniques: A Survey", Proceedings, European Symposium on Artificial Neural Networks - Computational Intelligence and Machine Learning. Bruges (Belgium), 28-30 April 2010,

Stock list forecasting is indispensable for settling on educated speculation decisions. This paper overviews ongoing writing in the space of machine learning techniques and man-made reasoning used to conjecture securities exchange developments. The distributions are ordered by the machine learning procedure utilized, the forecasting time period, the info factors utilized, and the evaluation techniques utilized. It is discovered that there is an agreement between analysts focusing on the significance of stock file forecasting.

Strategy in stock expectation." Comparison of Very Shortterm Load Forecasting Techniques , k. Liu' s. Sub bar ay a, r.r. **Shoults m.t. Manry c. Kwan' f. L. Lewis' j. Naccarln**

Three viable techniques Fuzzy Logic (F'L), Neural Networks (NN), and Auto-backward model (AR) for momentary load forecasting have been proposed and talked about in this paper. Their performances are assessed through a reenactment study. The primer study demonstrates that it is doable to plan a basic, tasteful powerful forecaster to foresee the plain transient load drifts on-line.

**Anuj Sharma, Dr. Prabin Kumar Panigrahi**, "A Neural Network Based Approach for Predicting Customer Churn in Cellular Network Services", International Journal of Computer applications Volume 27– No.11, August 2011

"Promoting writing states that it is more exorbitant to draw in another client than to hold a current steadfast client. Stir expectation models are created by scholastics and specialists to adequately oversee and control client agitate with the end goal to hold existing clients. As stir the executives is a vital action for organizations to hold steadfast clients, the capacity to accurately foresee client agitate is vital. As the cell network administrations advertise winding up more focused, client stir the board has turned into a urgent undertaking for versatile correspondence administrators. This paper proposes a neural network (NN) based way to deal with anticipate client beat in membership of cell remote administrations. The aftereffects of examinations demonstrate that neural network based methodology can foresee client beat with precision over 92%.

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