Original Article
ISSN (Online): 2582-7472

ShodhKosh: Journal of Visual and Performing Arts
June 2024 5(6), 574–581

ARTIFICIAL INTELLIGENCE IN FINANCIAL FORECASTING: TECHNIQUES AND APPLICATIONS

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ABSTRACT

The capacity of artificial intelligence to swiftly evaluate massive amounts of information and implement high-frequency trades (HFT) has made AI a valuable tool for human operators. The most important studies that use innovative techniques to predict patterns of financial assets are analysed in this article, along with an assessment of their usefulness and potential applications in investing in intricate financial sectors. These structures investigate connections and factors that impact trading performance via the application of machine learning and deep learning algorithms. Forecasts are calculated from either linear or nonlinear methods and often include sentiment evaluation or trend identification from internet-based participants. The majority of papers that have been examined have shown that their artificial intelligence can be used to trade financial markets successfully.

Keywords: Artificial Intelligence (AI), Financial Forecasting, ANN, SVM, Fuzzy Logic

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DOI
10.29121/shodhkosh.v5.i6.2024.1817

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

1. INTRODUCTION

Financial markets are uncertain and challenging places to trade because of the rapid input of data and the impact on mental and economic factors. Artificial Intelligence (AI) has been used by investigators and practitioners to assist investors individually in making trading choices or to automate the whole investing procedure. This study assesses the potential developments of recent improvements in AI-based algorithmic trading strategies. A standard algorithmic trading framework can execute an extensive amount of transactions using high- frequencies trading (HFT) in a matter of milliseconds, correctly evaluate various types of data, and generate purchase or sell indications using machine learning (ML) or deep learning (DL) using artificially intelligent neural networks (ANN). Technical assessment, fundamental inquiry, and opinions of investors serve as the foundation

for AI trading structures. The most cutting-edge research articles on trading algorithms are reviewed in this paper, demonstrating which approach mixes were fruitful in enhancing trading outcomes and which helped enhance trading outcomes by combining the mentioned data inputs and procedures into a combined system.

2. AIM AND OBJECTIVES

Aim: The study aims to explore techniques and applications of Artificial Intelligence in Financial Forecasting.

Objectives:

- To explore the AI technologies in Financial Forecasting.
- To understand the AI applications in financial prediction.

3. LITERATURE REVIEW

AI technologies in Financial Forecasting:

Artificial neural networks (ANN):

Figure 1

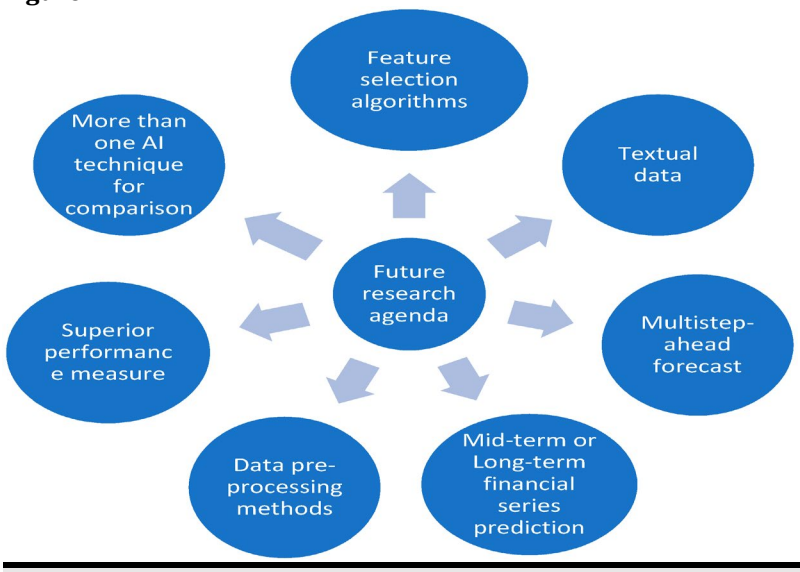

Figure 1 AI in Stock Exchange

Financial systems may benefit greatly from the widespread use of artificial neural networks (ANNs), which are popular for simulating complicated and chaotic systems. Feeding forward neural networks (FFNN) with several hidden layers is a particularly often used variation, known as the multi-layer perception network (MLP). These connections are trained by reverse propagation methods for learning, including the gradient reduction technique. Researchers say that the best way for forward-feedback artificial neural networks to learn is to use the Levenberg Marquette method. We add short-term memories to Elman neural network structures (ENNs), which are based on basic recurrent neural networks (RNNs) (Ruiz-Real, *et al*. 2021). This is done with the help of an extra environmental layer. In radial basis function neural networks (RBFNNs), there is a single hidden layer made up of RBFs. These networks are forward-feedback systems. Some people have used them to guess stock prices, exchange rates, trends, and tips. It can keep an eye on old answers and figure out time-based trends thanks to Time Delayed Neural

Networks (TDNNs), which are multi-layer FFNNs with latency parts. However, TDNNs are not often used for business purposes right now.

Support Vector Machine (SVM):

An automated learning technique called Support Vector Machine, or SVM, uses both nonlinear and linear procedures to foresee and classify things. As a consequence, there are far fewer mistakes in the tested information since it permits inaccuracy in the original data. Uses for SVM include bitcoin price anticipating, currency exchange, and stock exchange projections. It has been discovered to operate better compared to different techniques for classification and is possibly better than the Radial Based Gaussian (RBG) SVM prediction framework.

SVM-based algorithms are often employed for predicting changes in the prices for monetary resources, however, they operate on the premise that historical connections between financial instruments and repeating economic factors may be utilized for forecasting upcoming price patterns. While these assumptions hold in a typical marketplace, they become unproductive when "Black Swan" events occur that sometimes catch the market off guard (Apsilyam, *et al*. 2024). Thus, to increase the reliability of SVM-based algorithms for forecasting financial instrument price movements, superior models that integrate SVM with additional categorization techniques must be created.

Long Short-Term Memory (LSTM):

Artificial intelligence (AI) and deep learning employ long-short-term memory (LSTM), an artificial recurrence neural network (RNN), to anticipate monetary asset prices. Due to its ability to analyse sequences of information in parallel, it is the perfect instrument for timely classification, interpretation, and forecasting. LSTMs are helpful for financial instrument trading strategies because they may learn effectively by recalling and ignoring necessary past data. LSTM simulations have been employed to predict merchants' stock prices, real-time market fluctuations, and Bitcoin's value forecasting. Using LSTM systems, they demonstrated a median reliability of 55.9% in forecasting changes in market prices and a daily profit of 0.64%. LSTM neural network simulations have drawbacks in terms of forecasting time delay when used to forecast price trends in China's stock exchange (Pallathadka, *et al*. 2023). When it comes to economic price projections, LSTM has a benefit in that it can forget things that the algorithm's creator thinks are irrelevant and must be ignored eventually to provide accurate forecasts. The system's capability to make forecasts may be harmed by this difficult job while the importance of any one data point to forecasts may vary as time passes.

Fuzzy logic:

A collection of engaging parts with a clear layout that can handle data and simulate difficult real-world issues is known as a fuzzy mechanism. When standard methods' estimation potential is restricted because of their nonlinear nature and unpredictable features, they are frequently employed in financial forecasts. Regulations, the fuzzyifier, intellect, and fuzziness reduction are the four primary components of fuzzy analysis, a method of thinking that mimics the way humans make choices (Ahmed, *et al.* 2022). Uses for fuzzy structures include dealing in currencies, price of shares forecasts, digital currency market forecasting, medium-term optimum monetary asset distribution, and stock price forecasting. These demonstrate to be more accurate in predicting and more effective than conventional models when it comes to simulating index instability with leaps. To enhance trading outcomes, fuzzy if-then procedures are additionally used.

Any investing rule may be used, however, it all relies on the trader's favourite moment period. Swing investors study weeklong and daily bars; daily traders study smaller time frames and make judgments based on the acceleration of those brief time frames. Fuzzy systems' fairly straightforward and capacity to incorporate data from various places give them an edge in forecasting financial instrument price patterns (Malali, and Gopalakrishnan, 2020). They need to be modified appropriately, however, since they might not be as capable of reacting to shifting economic circumstances.

Application of AI in financial forecasting:

Many years have passed since the development of financial projections, thanks in large part to the work of Cowles, Fama, and Samuelson. According to the Effective Market Hypothesis (EMH), monetary time series exhibit a pattern of chance, which limits the possibility of forecasting and producing higher returns. Nonetheless, an important body of research indicates that it is acceptable to forecast these periods and provide extra profits. Further parts of interest involve financial risk evaluation, bankruptcies and company failure, and non-traditional work such as multimodal investment directional prediction.

Figure 2

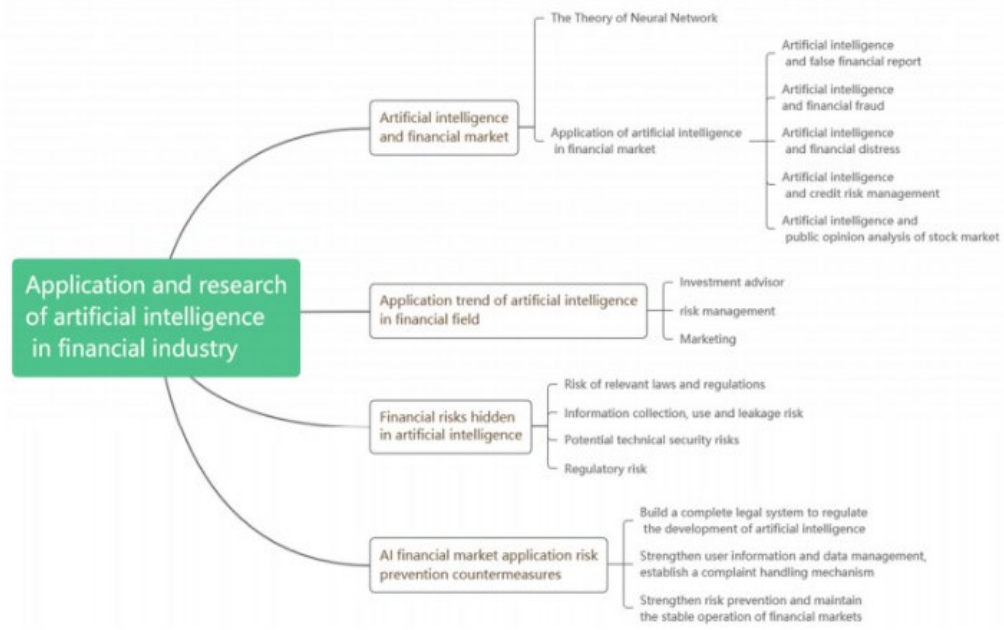

Figure 2 AI in Financial Industry

Predicting currency exchange rates:

Time-series data that show the value of exchange between two distinct currencies during a certain period are called rates of exchange for (Kumar, *et al.* 2021). The frequently examined rates of exchange for forecasting in the research studied are those between the US and the Deutch Mark (DM), the US dollars and the British Pound (£), and the US$ and the Yen (¥).

Systems that assist in making decisions:

According to the reviewed literary works, recommendation engines that assist in investing in stocks or changing currencies are the most often used decision-support tools in financial activities. These kinds of systems may provide purchase,

sell, or stay indications, enabling the consumer to make trades appropriately. When contrasting to an honest price (or stock index) projected, such models are more helpful to non-specialists because they recommend an approach of actions instead of requiring them to determine the anticipated worth of the time sequence they are analysing and understand it to make an investment decision.

Predicting the stock price and index:

For investors looking for maximum gains on the futures market, index trading and market prediction are essential tools. NASDAQ, NYSE, Dow Jones's Manufacturing Standard, and S&P-500 are examples of frequently used indexes. Sensex and Nikkei are two more well-known indexes. A small amount of study has looked at additional markets, such as Japan and India, but the majority has concentrated on US equities and indices. Few people give thought to the marketplaces across Africa and the Americas (Ferreira, *et al.* 2021). Individuals with an advanced awareness of the economic markets, like mutual fund directors and brokerage firms, may benefit from predicting stock prices since it enables them to make well-informed trading choices.

With validation on three main stock indices—the BSE-Sensex, FTSE 100, and the Standard & Poor 500—this work proposes a unique approach for predicting monetary time series. The efficacy of the approach in producing favourable outcomes irrespective of timescales or volatility in the stock market is shown via three rounds of validation. Objective and input information are included in the datasets for training and testing.

4. METHODOLOGY

Most of the information for this study comes from other sources. In order to meet the goals of the study, current books and research results are gathered, looked at, and put together. The secondary data will come from reliable online databases and books, such as PubMed, IEEE Xplore, Google Scholar, and others (Kumar et al., 2024) along with academic journals. Based on the main topic of the study, rules will be made for what to include and what to leave out. This will make sure that the data is clean and useful. How AI methods can be used to make business predictions. When the researcher looks for literature, they will use terms like "artificial intelligence," "financial forecasting," "algorithmic trading," and specific AI methods like "neural networks," "support vector machine," and "fuzzy logic." There is a lot of literature that needs to be read carefully. Important trends, ideas, and results will be looked for in terms of how to use AI to make financial predictions. The study's goals are to find out what the different AI methods used in financial forecasts can do and how they work. Along with what has already been learned, this study adds important new details to the subject so that people can get a full picture of how AI is used to make financial forecasts.

5. DISCUSSION

Implications of AI Techniques in Financial Forecasting:

It was found that five different kinds of networks could help with predicting money. LSTM networks, support vector machines (SVMs), artificial neural networks (ANNs), and fuzzy logic are some of these items. They're good because they can quickly deal with a lot of data, spot hard trends, and change with the market. It has been shown that RBFNNs and MLPs can spot trends in the stock market, exchange rates, and the market as a whole. SVMs are being used more and more to keep an eye on price changes and trends. That's because they know how to deal with and

organise info that is hard to guess. LSTM networks are a type of deep learning that can also look at data that is arranged by time and figure out how things from different times are connected. In business, this means that time records can be used to guess facts. People have used fuzzy logic to model tough problems in the real world and make more accurate predictions than other models. This is because it can deal with uncertainty and flaws. This shows that AI methods could help the stock market make decisions faster and better, giving buyers more options. Investors can lower their risks, get a better handle on their portfolios, and take advantage of new market possibilities by using models that are based on AI.

Figure 3

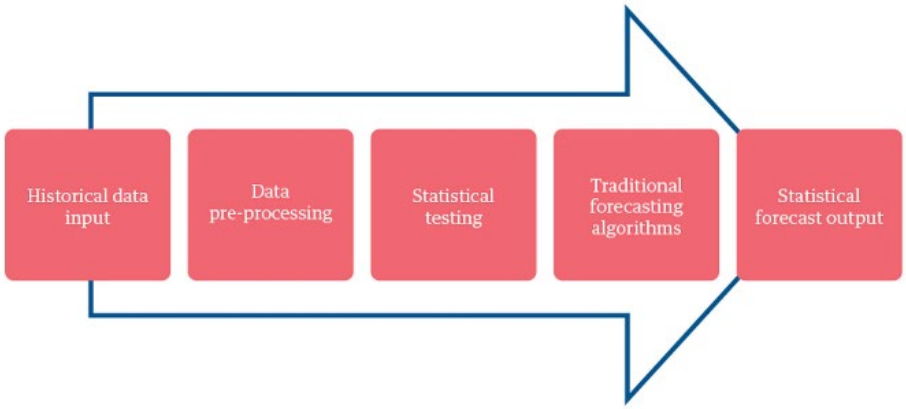

Figure 3 Forecasting through AI in Finance

Limitations and Challenges:

Finance companies could use AI to help people guess what will happen with their money, but there are some problems that need to be fixed first. To begin, using old data to build AI models might be biassed and miss "Black Swan" events. These are market events that come up out of the blue or are not typical (McCarthy, 2020). It is very important to use real-time data and change AI models to keep up with changes in the market. Second, AI models are hard to understand because they are long and hard to read. Because of this, it's not clear how they come up with their figures. For the most part, AI models are more accurate than old ones. However, investors may not believe and understand them because they are kept secret (Tschider, 2020). People might not want to adopt them because of this. To work, an AI method needs a lot of data and computer power. Small companies or companies that don't have a lot of money might find it hard to start up. AI-based prediction models are just good for a few buyers because they cost a lot to set up, gather data for, and staff with professionals.

Future Directions:

There are several ways to study AI-based financial predictions and make them better over time. To begin, there needs to be a better way to see how useful and accurate AI models are across a range of market situations and asset types. It will be easier for businesses and the government to trust and use AI models if they are clearer and easier to understand. People can also make better and more accurate financial estimates with the help of AI and other analysis tools, such as economic models and basic analysis (Mokhtari *et al*., 2021). Mixed models, which take the best parts of AI and old-fashioned methods, might help make more accurate guesses and lower the number of mistakes made by models. Aster *et al*. (2021) says, individuals need to deal with the moral and legal issues that come up with financial forecasts

based on AI in order to get people to trust and be responsible with it. A few of these are algorithmic bias, market fraud, and loss of data privacy. Business, academic, and government groups should work together to make rules and guidelines for the smart and safe use of AI in the stock market.

Overall, AI techniques have the potential to completely change how financial planning is carried out. However, people need to first deal with the issues and restrictions that come with them in order to fully enjoy their advantages. It is possible for AI-based forecasting models to help investors make smarter investment choices and better understand how complex markets work by promoting study, openness, and responsible deployment.

Aspects	Summary
AI Technologies	- ANNs, SVMs, LSTM, and fuzzy logic are used in financial forecasting.
AI Applications	- Applied in predicting currency exchange rates, decision-making, and stock price forecasting.
Implications	- AI techniques enhance decision-making and empower investors in financial markets.
Limitations	- Challenges include reliance on historical data and lack of model interpretability.
Future Directions	- Focus on robust evaluation metrics, integration with other tools, and addressing ethical considerations.

6. CONCLUSION

The use of advanced quantum computers and larger amounts of information in new ways to anticipate prices more quickly and accurately promises well for algorithmic trading platforms in the future. The whole feelings among people profiles which brain scanning and eye monitors will offer will increase the precision of predictions even further. Deeper trading algorithms techniques in finance still could lead to greater disagreement between humans and computers since users believe AI to be more objective than people. It takes a careful equilibrium between people and robots to properly combine the benefits of each system.

CONFLICT OF INTERESTS

None.

ACKNOWLEDGMENTS

None.

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