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CORRELATION ANALYSIS OF FINANCIAL INDICATORS AND STOCK PRICE FLUCTUATIONS BASED ON ARTIFICIAL INTELLIGENCE SYSTEM

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Abstract: *The correlation analysis of financial indicators and stock price fluctuations utilizes an artificial intelligence system. In the Generative Adversarial Networks (GANs) artificial neural network, the middle layer contains a number of neurons equal to the training samples. Each neuron in the GANs network stores one training sample, referred to as a direct memory artificial neuron. By adjusting connection weights, the model more precisely approximates the nonlinear mapping of stock market price fluctuations, enabling accurate short-term predictions of stock prices. This research introduces a novel neural network model for constructing predictive models. In comparison to current methodologies, it demonstrates satisfactory performance[1]*

.I. Introduction

The stock market presents a complex and uncertain environment influenced by economic, policy, and market factors, posing various risks for investors. Over time, analysis methods such as fundamental, technical, and time series analysis have been developed. Given the dynamic nonlinear nature of the stock market, researchers have increasingly turned to neural networks for price prediction

Figure 1 illustrates a summary of a neural network approach for solving this challenge. Recent advancements in stock prediction methods focus heavily on nonlinear prediction techniques, with neural networks featuring nonlinear hidden neurons gaining significant attention. These networks are prized for their capability to approximate any continuous nonlinear function

By finely tuning connection weights, neural networks more accurately model the nonlinear relationships inherent in stock price fluctuations, enabling precise short-term predictions. Stock data is integrated into an efficient database system, where it undergoes extraction, cleaning, and aggregation as needed for data mining. Subsequently, the data is imported into a data warehouse for further preparation.

The neural network system is then employed to forecast short-term trends in indexes, sectors, and individual stocks A data mining clustering engine utilizes user-provided strategies to analyze stock clusters, generating informative and useful clusters. Analysis results are typically presented through graphical interfaces or documents, leveraging historical data for direct short-term predictions of index and individual stock trends.

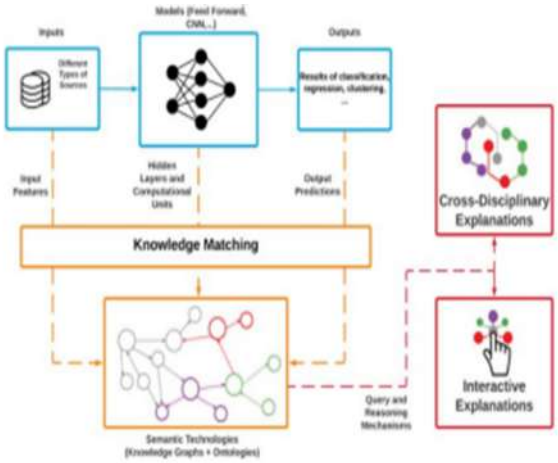

Fig. 1. The Neutal Network Summary

In subsequent sections, we will detail the design of the model and conduct simulations accordingly.[2-5]

II. Literature Survey

1)Correlation Analysis of Financial Indicator and Stock Price Fluctuation using AI System

Author**:** Prof. Namrata Ganesh Daware, Ms. Snehal Santosh Korke, Ms. Diksha BhagwanPartole, Ms. Deepali Vinayak Jagtap.

Using an artificial intelligence system, this paper correlate changes in stock prices with financial variables. There must be enough GAN artificial neurons in the intermediate layer of a GAN artificial neural network. Each GAN's artificial neuron, known as a direct memory artificial neuron, saves one training sample, with the number of training samples being determined to be equal to this number. For the most accurate short-term stock market price prediction, connection weights must be adjusted so that they more closely resemble the nonlinear mapping relationship that is reflected in stock market price swings. In this study, a brand-new neural network model was developed to build the predictions model's concepts. Performance is acceptable when measured against cutting-edge techniques[6]

2) A Bibliometric Analysis of Artificial Intelligence-Based Stock Market Prediction

Author:Farman Ali

The primary purpose of this study is to conduct a scientometrics analysis of stock market forecasts based on artificial intelligence. This research examined 1,301 publications that were published between January 2002 and June 2022. We investigated 183 journal articles among 1,329 papers. In addition to entering the keywords into Scopus, a comprehensive dataset of relevant research papers was compiled. These papers discussed the optimization of investment portfolios, artificial intelligence-based stock market forecasts, investor emotions, and market monitoring. We found the most prolific documents by affiliation, the most prolific author, the most cited papers, nations, institutions, co-authorship maps, inter-country co-authorship maps, and keywords occurrences in this study. Co-authorship analysis network maps and keyword occurrence linkages are generated using the VOS-viewer software. According to our findings, it is evident from the review that the body of literature is becoming more specific and extensive. Primarily, neural networks, support vector machines, and neuro-fuzzy systems are employed

to predict the future price of a stock market index based on the composite index's historical prices. Artificial intelligence techniques are able to consider challenges facing financial systems when forecasting time series. Our findings provide actionable guidance on how artificial intelligence can be used to predict stock market movements for market participants, including traders, investors, and financial institutions.[7]

3)Prediction of Stocks and Stock Price using Artificial Intelligence

Author: Priyanka Tupe-Waghmare

Prediction of stocks and the prices of the stock is one of the most crucial points of discussion amongst the researchers and analysts in the financial domain to date. Every stakeholder and most importantly the investor desires to earn higher profit for his investment in the market and try to use several different strategies to invest their money. There are numerous methods to predict and analyse the movement of the stock prices. They are broadly divided into – statistical and artificial intelligence-based methods. Artificial intelligence is used to predict the futuristic prices of stocks and use wide range of algorithms like – SVMs, CNNs, LSTMs, RNNs , etc. This bibliometric study focusses on the study based primarily on the Scopus database. We have considered important keywords, authors, citations along with the correlations between the coappearing authors, source titles and keywords with the use of network diagrams for visualisation. On the basis of this paper, we conclude that there is ample opportunity for research in the domain of the financial market[8]

4) Stock market prediction using artificial intelligence: A systematic review of systematic reviews

Author: Chin Yang Lin, João Alexandre Lobo Marques

There are many systematic reviews on predicting stock. However, each reveals a different portion of the hybrid AI analysis and stock prediction puzzle. The principal objective of this research was to systematically review the existing systematic reviews on Artificial Intelligence (AI) models applied to stock market prediction to provide valuable inputs for the development of strategies in stock market investments. Keywords that would fall under the broad headings of AI and stock prediction were looked up in Scopus and Web of Science databases. We screened 69 titles and read 43 systematic reviews, including more than 379 studies, before retaining 10 for the final dataset. This work revealed that support vector machines (SVM), long short-term memory (LSTM), and artificial neural networks (ANN) are the most popular AI methods for stock market prediction. In addition, the time series of historical closing stock prices are the most commonly used data source, and accuracy is the most employed performance metric of the predictive models. We also identified several research gaps and directions for future studies. Specifically, we indicate that future research could benefit from exploring different data sources and combinations, while we also suggest comparing different AI methods and techniques, as each may have specific advantages and applicable scenarios. Lastly, we recommend better evaluating different prediction indicators and standards to reflect prediction models' actual value and impact.[9].

III.System Analysis

The stock market is the fuzzy environment full of many uncertain factors. The existence of these uncertain factors makes people face various risks when investing in securities.The stock market is a very complex system, which is

affected by economic, policy and market factors.In existing system we are used linear regression algorithm for stock price prediction.

Disadvantages of exisiting system

1.Using linear regression algorithm we cannot predict exact stock price values.[10-12]

2.It involves very lengthy and complicated procedure of calculations and analysis..

Proposed system: This paper uses neural network to establish a mathematical model of stock prices, and uses this model to predict the fluctuation of stock prices. Through comparison with actual data, it is found that the prediction results are basically consistent with it.The stock market is a very complex system, which is affected by economic, policy and market factors.For such a complex dynamic nonlinear system, many researchers use the neural networks to predict stock prices. Advantages of proposed system:

1.Recurrent Neural Networks may provide better predictions than the neural networks used in this study, e.g., LSTM (Long Short-Term Memory).

2.A generative adversarial network (GAN) is a machine learning (ML) model in which two neural networks compete with each other to become more accurate in their predictions.

Algorithm**:**Artificial Neural Network[13-16]

IV.System Study

The field of behavioral finance has made significant strides in explaining fluctuations in stock prices within developed markets, attributing these movements to the spontaneous behaviors of investors. This theory has particularly excelled in elucidating stock market puzzles in Western developed economies [7-9].The analysis begins by defining initial data points, with selection criteria focusing on key factors essential for thorough examination [10-12]:

1. A robust property rights system and effective corporate governance provide the foundation for equity incentive systems to regulate operator behaviors through mutual checks and balances among stakeholders.
2. Executive market selection mechanisms ensure the quality of management while imposing long-term constraints on senior executive conduct. This system leverages reputation information and market-oriented selection processes.
3. Legal frameworks, regulatory structures, and management systems provide policy backing to form and reinforce mechanisms supporting effective equity incentives. Fig2 illustrates an AI-assisted system emphasizing liquidity-related indicators, often empirically estimated. Higher current and quick ratios generally indicate better liquidity and solvency, though excessively high ratios may suggest inefficient fund utilization, hampering operational efficiency.

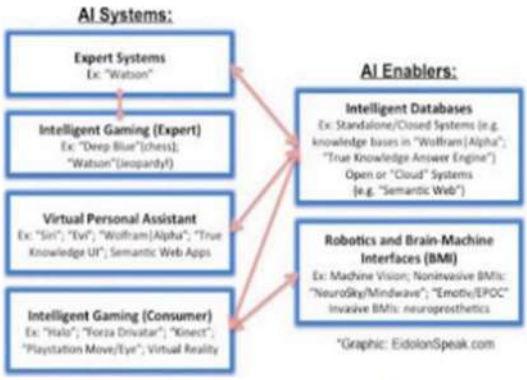

Fig. 2. The Financial Indicators with AI System

Formula-2 outlines principles guiding estimation, reflecting the complexity and varied nomenclature of financial indicators, each offering different degrees of insight into financial health. Consequently, factors are subject to correlation, prompting basic dimensionality reduction via factor analysis to condense related variables into independent common factors, thereby simplifying analysis across main dimensions.

Figure 3 details a prediction model test scenario, highlighting data mining models such as convolutional neural networks (CNN) for feature extraction, recurrent neural networks (RNN) for learning from rich data features, and data mining techniques analyzing network information resources for relevant market signals.

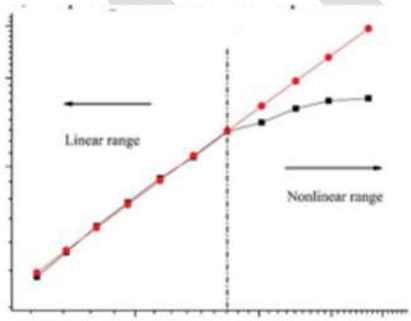

Fig. 3. The Prediction Model Robustness

Formula 1 presents the objective function, crucial for deep learning approaches in stock prediction research. The support vector machine (SVM) algorithm is preferred for its strong performance in classification and regression tasks, overcoming neural network drawbacks like overfitting.

Acknowledging noise in stock data, methods of predicting stock prices advocate feature expansion to encompass potential influencing factors and feature streamlining to focus only on critical variables [17].

The data mining clustering engine applies specific strategies for cluster analysis on stocks, refining training samples and enhancing the neural network's generalization capabilities. This approach enables precise short-term trend predictions for both clustered stocks and individual stocks.

Figure 4 introduces the GANs model, while the ID3 algorithm facilitates decision tree formation for comprehensive data item categorization based on defining attributes (Formula 5).

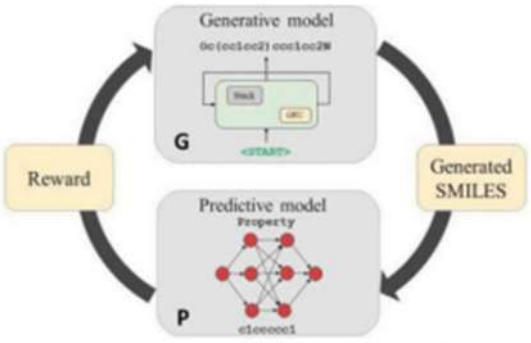

Fig. 4. The GANs Model Considered

Formula 6 structures the model, incorporating technical indicators to meet specific requirements, emphasizing feature data extraction and handling missing values through averaging methods to mitigate impact on experimental accuracy.

The SVM's ability to map input spaces to high-dimensional feature spaces via nonlinear transformation ensures efficient and adequate feature extraction, focusing on both numerical and textual aspects to understand operating and developmental capabilities within companies (Figure 5).

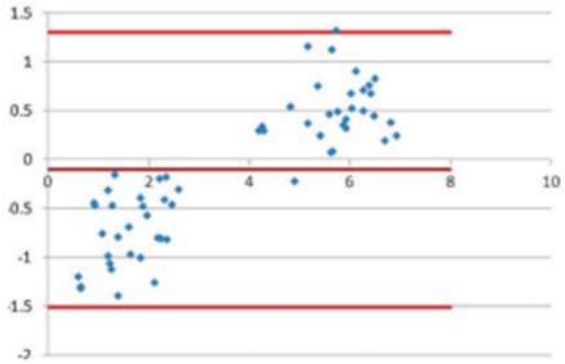

Fig. 5. Data Complexity Estimation Framework

The finalized prediction model utilizes Echo State Networks (ESN) for effective nonlinear system identification and time series forecasting (Formula 7), dividing stock market data into training, testing, and prediction sets to optimize gradient descent methods for weight adjustment and error minimization.

In conclusion, the clustering model informs strategies for predicting stock prices, ensuring optimal convergence and algorithmic performance within neural network applications [20-21].

V. Conclusion

Correlation analysis of the financial indicators and stock price fluctuations based on artificial intelligence system. For the optimization of the model, trying to use some different clustering algorithms in the combination with the echo state network, integrating the results and improving the echo state network algorithm from supervised to unsupervised learning is the future research direction. This paper uses neural network to establish a mathematical model of stock prices, and uses this model to predict the fluctuation of stock prices. Through comparison with actual

data, it is found that the prediction results are basically consistent with it. The experiment is conducted compared with the latest models. In the future, we will extend the simulation data sets to validate performance.[22].

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