SPECIMEN FORMAT FOR THESES OF MONTH

Faculty	**:**	**Physical Sciences and Computational Sciences**
Department	**:**	**Computer Science**
Branch/ Area:	**:**	**Soft Computing**
Sub Subject Heading:	**:**	**Machine Learning**
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Title of the thesis	**:**	Modified Extreme Learning Machine Algorithm with Deterministic Weight Modification for Investment Decisions Based on Sentiment Analysis
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Designation of Supervisor	**:**	Professor
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Abstract within 300 words: Abstract: The trading of stocks contributes to the growth of the commodity economy by driving a significant quantity of capital into the stock market, which improves the organic configuration of corporate capital through capital concentration. Consequently, the stock market is seen as a measure of the financial activity of a nation or area. Specifically, since it can precisely depict the supply dynamics of the stock market, the trading price of the stock frequently acts as a measure of the price and quantity of the stock. Timely and precise stock price prediction and analysis are essential for both investor decision-making and the constancy of the national economy by increasing returns and decreasing risks. Consequently, researching stock projections can help depositors make wise decisions that will advance society and yield rewards for themselves.

The intricacy of financial time series presents challenges that ML can handle with its strong data processing skills. Consequently, there are a lot of opportunities for ML and finance together, but there hasn't been enough research done in this field. Furthermore, the stock market is not entirely objective and does not always follow scientific principles due to humans' emotional, psychological, and behavioral traits. Recent studies have also demonstrated that investor sentiment may play a significant influence in stock market investing.

The present study proposed a modified extreme learning machine (ELM) algorithm with deterministic weight adjustment to increase the precision and dependability of sentiment analysis-based investment decision-making. To capture investor mood, the approach incorporates financial

sentiment research from news articles, social media, and market patterns. With deterministic weight initialization (DWM), the ELM algorithm achieves more consistent model performance than standard ELM techniques that use random weight initialization. The suggested model is potent for sentiment-driven investing strategies since it shows improved prediction accuracy, quicker learning, and robustness in financial forecasting.

Major objectives : The main objective is to improve prediction accurateness of intraday closing price using neural network architecture based on sentiment analysis in stock market prediction. The secondary objectives are mentioned as follows,i) To identify the scaling factor of the marginal value of the stock ii) To reduce the computational complexity iii)To enhance the prediction accuracy iv) To enable an investor to purchase and sell stocks at the best possible times by providing them with more information v)To handle uncertainty and to manage the overfitting or underfitting.

Hypothesis: The process of projecting future movements or levels of a specific stock's price is known as stock price prediction. Predicting whether a stock's price will climb, fall, or stay mostly unchanged over a certain time horizon is a fundamental task in financial research and investing decision-making. Predictive modeling tools, historical data, and a variety of quantitative and qualitative elements are used in stock price prediction to produce projections. This study accomplishes the following by integrating sentiment analysis and ELM: The created prediction approach is appropriate for real-time stock forecasting since it is faster than classic deep learning models, has greater generalization than SVM and BPNN, integrates emotional market aspects to increase prediction accuracy, and has a lower computing cost.

i) Methodology :

The present research work used three research methods are considered such as ELM, deterministic weight modification (DWM), and convolutional neural network (CNN).

Phase-1

The ELM approach computes the output weights of SLFNs analytically and first initializes hidden node values at random. the weight and bias of the Extreme Learning Machine known as DELM, which was applied to stock price prediction, were adjusted using Deterministic Weight Modification .When the DELM was compared to some conventional and variant ELMs, the accuracy result was greater. Further, the historical datasets are considered such as open price, high price, low price, closing price, and adjusted close in this phase for stock price prediction.

Phase-2

The second phase of research work uses the ten different technical indicators such as Simple Moving Average (SMV), 10-day Moving Average, Momentum, Stochastic (K%), Stochastic (D%), Relative Strength Index (RSI), Williams (%R), Moving Average Convergence Divergence (MACD), Commodity Channel Index (CCI), Price Oscillator (PO) are used for predicting stock price using DWM-ELM.

Phase-3

The sentiment-based optimized ELM is applied to predict the stock price in the third phase of this research

i. To determine user sentiment on the stock,a CNN-based classification algorithmis used to calculate the sentiment index (SI).

ii. To identify factors affecting the share market with stockholder sentiment analysis or classification of opinion sentiment into bullish or bearish.

iii. To produce sentiment analysis in real-time that can forecast the value of the stock market and, using historical data, estimate the approximate share price.

iv. The DWM method is used to optimize the weights and bias of ELM to enhance the performance ELM method.

v. Six stockmarket datasets are used to analyze the performance of S-DELM

vi. Different performance analyzers like MSE,RMSE,MAE,MAPE and R-Square are considered for analyzing the strength of the S-DELM method

ii) Findings:

Phase I:

The DWM method is used to connect weights and bias of ELM for enhancing the performance the findings of optimized Extreme learning machine algorithm with deterministic weight modification using historical data is as follows In the training phase, the suggested technique obtained low MSE values when compared to other prediction algorithms. Such as 0.000738, 0.000129, 0.000875, 0.000758, 0.000691, and 0.000653 for S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. In comparison to previous related prediction algorithms. The recommended technique produced low RMSE values: 0.03240, 0.07628, 0.02607, 0.02190, 0.02429, and 0.02469 for the S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. In comparison to other related prediction algorithms. The recommended technique produced low MAE values: 0.0079,0.0084, 0.0051, 0.0058, 0.0063, and 0.0067 for S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. In comparison to other evaluated prediction algorithms. The recommended technique produced low MAPE values: 0.0024, 0.0079, 0.0046, 0.0008, 0.0057 and 0.0059 for S&P, Nifty 50, SBIN, ICICI, HDFC and MSFT respectively. When compared to other prediction algorithms, the recommended technique obtained high R-Square values: 0.9437, 0.9437, 0.9572, 0.9408, 0.9672, 0.9461, 0.9494 and S&P, Nifty 50, SBIN, ICICI, HDFC and MSFT, respectively. In the testing phase, the suggested technique obtained low MSE values when compared to other prediction algorithms, the recommended technique produced low MSE values: 0.00105, 0.00582, 0.00068, 0.00048, 0.00059, and 0.00061 for S&P, Nifty 50, SBIN, ICICI, HDFC and MSFT, respectively. In comparison to previous related prediction algorithms. The recommended technique produced low RMSE values: 0.02716, 0.01135, 0.02958, 0.02753, 0.02628, and 0.02555 for the S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. In comparison to other related prediction algorithms. The recommended technique produced low MAE values: 0.0102, 0.0752, 0.0119, 0.0122, 0.0138, and 0.0143 for S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. In comparison to other evaluated prediction algorithms. The recommended technique produced low MAPE values of 0.0068, 0.0053, 0.0031, 0.0037, 0.0039, and 0.0061 for S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. When compared to other prediction algorithms. The recommended technique obtained high R-Square values: 0.9437, 0.9601, 0.9785, 0.9495, 0.9782, and 0.9467 and S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively.

Phase II

Phase 2 of this research uses technical indicators as input to the optimized ELM with DWM which is termed DELM-T for predicting the stock market price. In the training phase, the suggested technique obtained low MSE values when compared to other prediction algorithms. Such as 0.000628, 0.001024, 0.000792, 0.000596, 0.000552, and 0.000587 for S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. The suggested technique obtained low RMSE values when compared to other prediction algorithms, such as 0.02505, 0.03253, 0.02814, 0.02441, 0.02349, and 0.02422 for S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. The suggested technique obtained low MAE values when compared to other prediction algorithms, such as 0.0098, 0.0652, 0.0115, 0.0099, 0.0134, and 0.0099 for S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. The suggested technique obtained low MAPE values when compared to other prediction algorithms, such as 0.0016, 0.0064, 0.0029, 0.0006, 0.0045, and 0.0053for S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. The suggested technique obtained high values when compared to other prediction algorithms, such as 0.9762, 0.9624, 0.9628, 0.9686, 0.9652, and 0.9541 for S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. Comparing the recommended method to other prediction algorithms during the testing phase, the MSE values were low: 0.000959, 0.000369, 0.000479, 0.000356, 0.000489, and 0.000467 for the S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. In comparison to existing prediction algorithms, the recommended technique produced low RMSE values: 0.03096, 0.06074, 0.02188, 0.01886, 0.02211, and 0.06833 for the S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. In comparison to previous prediction algorithms, the recommended technique produced low MAE values: 0.0098, 0.0652, 0.0115, 0.0099, 0.0134, and 0.0099 for the S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. In comparison to existing prediction algorithms, the recommended technique produced low MAPE values: 0.0063, 0.0049, 0.0024, 0.0025, 0.0026, and 0.0056 for the S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. When compared to other prediction algorithms, the recommended method produced high R-Square values: 0.9539, 0.9662, 0.9954, 0.9622, 0.9866, and 0.9621 for the S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively.

Phase III Findings:

The suggested Sentiment based Deterministic Weight Modification with Modified Extreme Learning Machine Algorithm technique obtained low MSE values in training phase when compared to other prediction algorithms, such as 0.000521, 0.000894, 0.000621, 0.000227, 0.000302, and 0.000487 for S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. The RMSE value of the suggested technique is low when compared to other prediction algorithms such as 0.02282, 0.02989, 0.02491, 0.01506, 0.01737, and 0.02206 for S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. The suggested technique obtained low MAE values when compared to other prediction algorithms, such as 0.0034, 0.0058, 0.0027, 0.0029, 0.0034, and 0.0043 for S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. The suggested technique obtained low MAPE values when compared to other prediction algorithms, such as 0.0004, 0.0058, 0.0004, 0.0004, 0.0003, and 0.0006 for S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. The suggested technique obtained high R-square values when compared to other prediction algorithms, such as 0.9998, 0.9997, 0.9999, 0.9998, 0.9956, and 0.9893 for S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. In the testing phase, when compared to previous prediction algorithms the recommended technique produced low MSE values of 0.00084, 0.00111, 0.000191, 0.000127, 0.000199, and 0.00156 for S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. When compared to the aforementioned prediction algorithms, the suggested technique achieved low RMSE values of 0.02898, 0.03331, 0.01382, 0.01126, 0.01410, and 0.03949 for S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. When compared to previous prediction algorithms, the recommended technique produced low MAE values of 0.0079, 0.0308, 0.0101, 0.0081, 0.0117, and 0.0096 for S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. When compared to the aforementioned prediction algorithms, the suggested technique achieved low MAPE values of 0.0058, 0.0037, 0.0016, 0.0011, 0.0011, and 0.0014 for S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. The recommended technique outperformed other prediction algorithms with values of 0.9958, 0.9983, 1, 0.9959, 1, and 0.9861 for S&P, Nifty 50, SBIN, ICICI, HDFC, and MSFT, respectively. As a result, the values obtained for MSE, RMSE, MAE, and MAPE are low compared to other prediction algorithms which show that the suggested S-DELM performance is better. The R-Square values of the proposed technique are high compared to other prediction algorithms which again proves that the proposed S-DELM method is producing better accuracy and low error rate.

Examiners

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