

Bull's Eye: A Deep-Learning-powered Intelligent Financial Trading Application

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Abstract- In Financial Markets, for increasing financial gain, and to reduce losses, analyzing optimal timing to perform trade is important. To handle this, the Intelligent Financial Trading Application, “Bull's Eye,” powered by Deep Learning techniques, will forecast accurate sales points, to intensify the accuracy of trading.

This project incorporates Long Short-Term Memory (LSTM) and Transformer models with financial indicators like the Relative Strength Index (RSI) and Moving Average Convergence Divergence (MACD). Through this, we advance towards the recognition of elaborate temporal patterns in stock prices, giving us helpful information about buy and sell signals depending on historical data and the dynamics of the stock market.

By capturing prices and analyzing trends, Project ‘Bull's Eye’ provides a data-driven approach to provide precise insights to the investors, by encouraging successful management of risk and improving profit for the investors.

(**Keywords**—*Financial Trading, LSTM, Deep Learning*)

I. INTRODUCTION

The Forex Market is rapidly growing. The stock market is a fluctuating market which results in obstacles for traders and the investors to make financial decisions. Traditional approaches for analysing the stock market, which involve making linear assumptions, sometimes fail to capture the complex patterns and dependencies that are necessary for real-time trading. In response to this loophole, Machine Learning, specifically Deep Learning, has emerged as a powerful weapon for predicting and analysing stock market trends.

This report describes ‘Bull's Eye’, a predictive model developed to analyse optimal sales points. In conjunction with LSTM and Transformer models, and with technical financial indicators, “Bull's Eye” offers an advanced predictive framework that goes beyond the conventional approach. The application of financial indicators like RSI and MACD aids in refining the model analysis, improving the ability of the system to encounter even minute changes in stock market trends. The project empowers investors with reliable trade signals, which in turn results in reduced risk in investing, and

increases the chances for positive outcome even in a highly volatile market. This report portrays how AI-driven forecasts can transform dynamic investment strategies using tools like Deep Learning and financial indicators.

II. METHODOLOGY

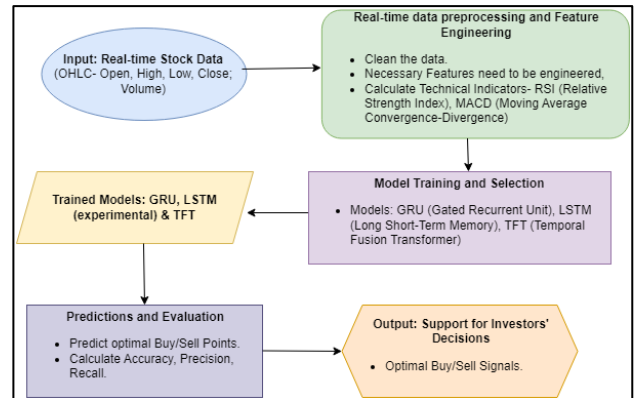


Figure. (1): Methodology Diagram for Bull's Eye.

The input data is OHLC Data for Forex Markets (Euro-USD), scraped from MetaTrader5. Python is connected to MetaTrader5, and the OHLC data is imported into a Pandas DataFrame. Next, the data is preprocessed, normalized and standardized. With the help of functions, the DataFrame is modified to display the corresponding RSI (Relative Strength Index) and MACD (Moving Average Convergence-Divergence) Technical Indicators based on the OHLC and Volume data. Following this, the data is split into training and test sets for training the Deep Learning Models: GRU (Gated Recurrent Unit), LSTM (Long Short-Term Memory) and TFT (Temporal Fusion Transformer) Models. The models are tasked with predicting optimal buy/sell points and generating accurate buy/sell signals on MetaTrader5. The following Technical Indicators are used:

$$RSI = 100 - \left(\frac{100}{1 + \frac{\text{Average Gain}}{\text{Average Loss}}} \right)$$
$$MACD = EMA_{\text{Fast}} - EMA_{\text{Slow}}$$

Figure. (2): Formulae for RSI and MACD Indicators

III. LITERATURE REVIEW

This literature review analyses the different Deep-Learning-based approaches and methods to accurately place buy and sell signals, on OHLC Data for Foreign Exchange Markets. It is observed that initial approaches focused on using CNNs (Convolutional Neural Networks). Later, ANNs and ML Algorithms were used with substantial accuracies. Eventually, RNN variants such as LSTMs and GRUs began to be used. Research highlights the role of optimization techniques such as PSO (Particle-Swarm Optimization) in enhancing accuracy and performance.

Table (1).: Literature Review for Bull's Eye: Intelligent Trading for Forex Markets

Sr. No.	Authors	Title	Method	Database	Result	Advantages / Dis-advantages
[1]	Svitlana Galeschuk, Sumitra Mukherjee	Deep Networks for Predicting Direction of Change in Foreign Exchange Rates.	<ul style="list-style-type: none"> -Utilises Deep CNNs to predict the direction of change in foreign exchange rates. -Compares CNNs against models like ARIMA, ETS, and shallow neural networks (ANN), as well as ML classifiers like Support Vector Machines (SVM). -Predicting the direction of change (up or down) , not the point estimates. 	<ul style="list-style-type: none"> -The dataset includes daily closing exchange rates for three major currency pairs: EUR/USD, GBP/USD, and USD/JPY. -It contains 1565 observations from 2010 to 2015, with training data from 2010-2013 and testing data from 2014-2015. 	<ul style="list-style-type: none"> Classification Accuracy in predicting the direction of change was calculated. -CNN Models achieved a high classification accuracy of over 75%. -ARIMA, ETS and ANN models showed lower accuracies-between 40% and 60%. -CNN outperformed other ML Classifiers, especially in short-term predictions. 	<ul style="list-style-type: none"> -CNNs excel at learning abstract features from raw time series data. This reduces the need for extensive feature engineering -However, CNNs require substantial computational resources and training time compared to simpler models. -They provide higher accuracy in predicting directional changes, which is crucial for developing profitable trading strategies. -However, complex architecture of CNN can lead to overfitting on smaller datasets.
[2]	Michael Ayitley, Peter Appiahane, Obed Appiah, Christopher	Forex market forecasting using machine learning	Uses a Systematic Literature Review	The dataset includes major currency pairs	Most commonly used assessment	-Provides a comprehensive analysis of ML techniques,

	Ninfaakang Bombie		(SLR) and meta-analysis approach to evaluate the effectiveness of ML models in forecasting the Forex market. It reviews 60 research papers from 2010 to 2021. The focus is on ML algorithms, and their evaluation metrics used for Forex predictions.	like EUR/USD, which is the most commonly traded pair globally. It is drawn from reputable sources such as Google Scholar, IEEE Xplore, ScienceDirect, and other digital libraries, covering various Forex prediction studies.	metrics are MAE, MSE, RMSE, MAPE. -EURUSD is the most traded in the world. -LSTM and ANN are the most commonly-used ML Algorithms for Forex Market Prediction. -Challenges and future scope to address these.	and how they can handle the volatile nature of the Forex market. -Since it is limited to publications from 2010-2021, it may exclude recent advancements in ML and DL models. -Offers insights into which models are most effective and guides future research. -The focus on only commonly traded pairs; potentially overlooks niche currency pairs.
[3]	Phuong Dong Nguyen et al.	Deep learning-based predictive models for forex market trends: Practical implementation and performance evaluation	Hybrid model with convolutional and LSTM layers, using multiple indicators and three-value labeling for trend prediction	Yahoo Finance, Metatrader5.	High accuracy (97%) with 15% profit in simulated trading.	-Focus on high profitability. - It is beneficial for the practical trading utility.
[4]	Arisara Pornwattanavichai, Saranya Maneeroj, Somjai Boonsiri	BERTFOREX: Cascading Model for Forex Market Forecasting Using Fundamental and Technical Indicator Data Based on BERT	Cascading model combining BERT for fundamental data (FD) and technical indicator (TI) analysis with autoencoder aggregation	Forex dataset (2003-2020), USD/EUR pair	Achieved high accuracy, sensitivity, and specificity in predicting forex trends; correct direction rate of 84.38%	-Captures latent relationships between FD and TI -Avoids vanishing gradient in sequence models.
[5]	Nia Nuraeni, Puji Astuti, Oky Irnawati, Ida Darwati, Danang Dwi Harmoko	High Accuracy in Forex Predictions Using the Neural Network	Neural Network enhanced with Particle Swarm	USD/IDR exchange rate data for 2019, 261 records	Neural Network alone achieved 90% accuracy;	High prediction accuracy with PSO; effective for time series forecasting.

		Method Based on Particle Swarm Optimization	Optimization (PSO)		Neural Network with PSO achieved 100% accuracy	
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IV. RESULTS AND DISCUSSION

Bull's Eye demonstrates the progressive potential of Deep Learning models in order to make the trading techniques more optimized in the financial markets that are unstable. By putting together advanced models like LSTM, GRU and Transformers with the financial elements such as RSI and MACD, this project strengthens the accuracy of trade timing predictions, providing investors with a strong, data-driven tool.

The usage of these models helps to secure complex temporal patterns in stock price dynamics, enabling precise buy and sell signal signals based on historical data.

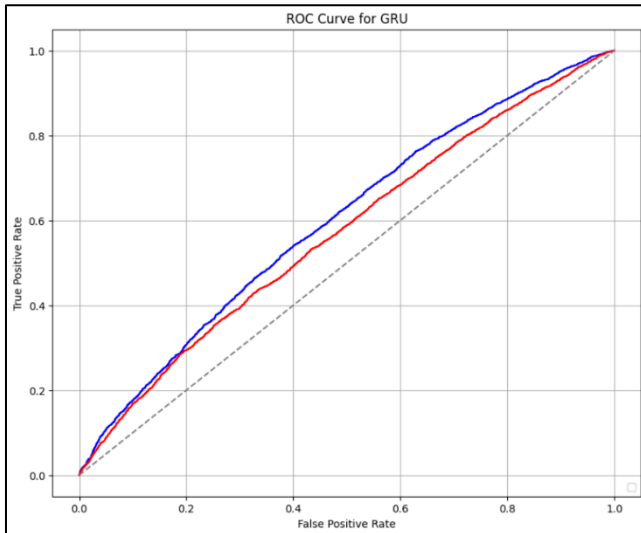


Figure. (3): ROC-AUC Curve for GRU (Gated Recurrent Unit) Model

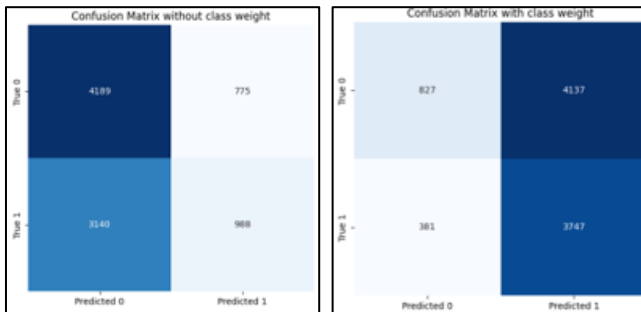


Figure. (4): Confusion Matrix for GRU Model (a) Without Class Weight and (b) With Class Weight

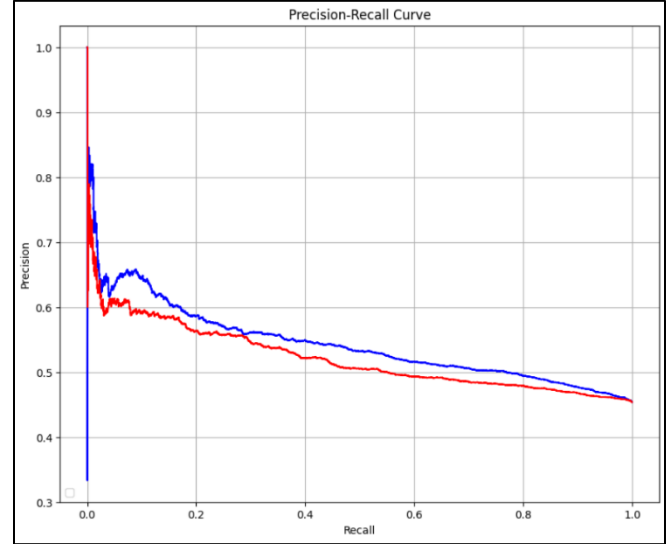


Figure. (5): Precision-Recall Curve for GRU

Classification Report for Ensemble Model (average of Model 1 and Model 2):				
	precision	recall	f1-score	support
0.0	0.53	0.46	0.49	1046
1.0	0.45	0.51	0.48	899
accuracy			0.49	1945
macro avg	0.49	0.49	0.49	1945
weighted avg	0.49	0.49	0.49	1945

Figure. (6): Classification Report for Ensemble Model which is the average of Model 1 (Weighted Model) and Model 2 (Model without class weights)

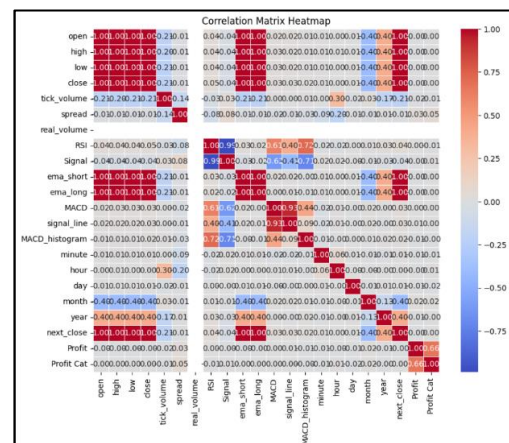


Figure. (7): Correlation Heatmap for all Features (Original and Engineered Features.)

VI. CONCLUSION

Bull's Eye has the capacity to refine analysis and detect subtle trends, it is designed to lower the risk and maximize profitability for investors. With the help of AI forecast, this project shows how deep learning and technical indicators can assist in new era investment strategies. The decision making can be enhanced using this approach and help investors to determine, understand and make way through the complexities of financial markets and make profitable trades even in unstable conditions.

'Bull's Eye' is a contemporary approach for developing rational financial trading applications, assisting the users to minimize risks and capture the trading opportunities with certainty.

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