1. Communication Phase

Project Title: FOREX PRICE PREDICTION - Forecasting Directional Movement using LSTM

Minutes:
Time: 7:00 PM - 8:30 P.M
Date: March 22, 2024

Members Present:
B. Syam Sai Krishna - AM.EN.U4CSE21016 (Project Lead)
Purnima Rangavajjula - AM.EN.U4CSE21046 (Scrum Master)
A.S.V Prasasya – AM.EN.U4CSE21067 (Business Analyst)

Discussion:

- The meeting focused on outlining the scope and requirements for forecasting directional movement using LSTM (Long Short-Term Memory) models.
- Participants discussed the potential applications of LSTM in financial forecasting and other fields where time series data analysis is crucial.
- The discussion also delved into the advantages and challenges of implementing LSTM models for directional movement forecasting.

Scope Requirement List:

- Data Collection: Define the sources and types of data required for training the LSTM model.
- Preprocessing: Determine the preprocessing steps necessary to clean and format the data for LSTM input.
- Feature Selection: Identify the relevant features that influence directional movement and extract them from the dataset.
- Model Architecture: Specify the architecture of the LSTM model, including the number of layers, units, and activation functions.
- Training Strategy: Define the training strategy, including the loss function, optimizer, and batch size.
- Validation Method: Determine the method for validating the performance of the LSTM model.
- Evaluation Metrics: Select appropriate evaluation metrics to assess the accuracy and reliability of the model predictions.
- Implementation Plan: Develop a roadmap for implementing the LSTM model, including timeline and resource allocation.
- Future Scope: Discuss potential enhancements or extensions to the LSTM model for improving directional movement forecasting accuracy and reliability.

2. Planning

Problem Statement

Forecasting directional movement in Forex (foreign exchange) data is a challenging task due to the inherent complexity and volatility of the currency markets. Traders and investors need accurate predictions of whether a currency pair will move up or down in order to make informed decisions and maximize profits. Traditional time series forecasting techniques often struggle to capture the nonlinear and dynamic nature of Forex data, making it difficult to achieve reliable predictions.

Innovation

The Innovation in this approach lies in the utilization of LSTM neural networks to capture the complex temporal dependencies and nonlinear patterns present in Forex data.

Unlike traditional statistical models, LSTM networks are capable of learning and remembering long-term dependencies, making them well-suited for forecasting sequential data with irregular patterns, such as currency exchange rates.

Methodology

Data Preprocessing and Feature Engineering:

- Collect historical time series data related to the target variable (e.g., stock prices, weather conditions).
- Preprocess the data by removing outliers, filling missing values, and normalizing the features.

Model Architecture:

- Design a LSTM-CNN (Convolutional Neural Network) architecture for capturing both temporal patterns and spatial relationships in the data.
- The CNN layers extract spatial features from the input sequences, while LSTM layers capture temporal dependencies.
- Incorporate attention mechanisms within the LSTM layers to emphasize the most relevant information for directional movement prediction.

Training Strategy:

- Implement a learning approach, where the model simultaneously predicts the direction (upward or downward) and magnitude of movement.
- Define a custom loss function that penalizes incorrect directional predictions more heavily than errors in magnitude prediction.

Ensemble Modeling:

- Train multiple LSTM-CNN models with different initializations and hyperparameters.

- Aggregate the predictions of individual models using a weighted average or a stacking approach to improve overall performance and robustness.

Model Interpretability and Explainability:

- Implement techniques for interpreting and explaining the predictions of the LSTM-CNN model, such as attention visualization and feature importance analysis.
- Provide users with insights into the factors driving directional movement forecasts, enabling informed decision-making and risk management.

Back-testing and Evaluation:

- Conduct extensive back-testing of the LSTM-CNN model on historical data to assess its performance in real-world scenarios.
- Evaluate the model's accuracy, robustness, and consistency using appropriate metrics, considering both directional and magnitude predictions.

Deployment:

- Deploy the trained LSTM-CNN model in a production environment, integrating it into a decision support system or trading platform.

Each week plan full may 1st week

March 25 – March 29th, 2024

Resources

- Historical time series data for training and validation
- Computational resources (e.g., GPU servers) for model training
- Relevant research papers, tutorials, and documentation on LSTM models and directional movement forecasting

Deadlines for each work

March 25th: Data preprocessing and feature engineering completed
March 27rd: LSTM-CNN model architecture finalized and implemented
March 29th: learning strategy and thresholding mechanisms integrated
Ensemble modeling and model interpretability features implemented

Division/contribution of each member

Team Lead:

- Coordinate project activities and ensure adherence to timelines
- Lead data preprocessing and feature engineering efforts
- Contribute to model architecture design and hyperparameter tuning
- Oversee model evaluation and performance assessment

Business Analyst:

- Gather and document business requirements for the forecasting system, including user stories and acceptance criteria.
- Analyze market trends and competitive landscape to identify opportunities and challenges for the forecasting model.
- Validate model outputs against business expectations and provide feedback for refinement and improvement.

Scrum Master:

- Facilitate daily stand-up meetings to ensure all team members are aligned on project goals, tasks, and progress.
- Remove impediments and obstacles that may hinder the team's progress towards achieving sprint goals.
- Maintain the project backlog, prioritizing tasks based on their importance and urgency.

Weekly Status Report (from 25-03-2024 to 29-03-2024)

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Product Owner:

Team Members:

	Roll Number	Name
1	AM.EN.U4CSE21046	R. Purnima
2	AM.EN.U4CSE21067	A. Sai Veena Prasasya
3	AM.EN.U4CSE21016	B. Syam Sai Krishna

Question	Week:				
	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
What did you do last week?	Collected research papers regarding the topic	Started investigating the papers collected	Went through the papers for a keen understanding on the topic	Summarized the understanding from the papers collected	Collecting the data from various sites and references of historical price data for the USD/JPY currency pair from the Dukascopy website.
What will you work on next week?	Preprocess the raw data by applying technical indicators such as moving averages, relative strength index.	Analysis of data after applying various methods of preprocessing.	Apply Bollinger bands on the raw data for preprocessing.	Divide the data into training, testing and validation datasets.	To begin the implementation of LSTM model using TensorFlow to predict the directional movement of currency pair.
Do you have any obstacles?	No major obstacles encountered.	Difficulty in selecting the appropriate technical indicators for preprocessing the data.	Challenges in understanding and implementing Bollinger bands effectively on the raw data.	Facing issues in determining the optimal division of data into training, testing, and validation datasets.	Struggling with the initial implementation of the LSTM model using TensorFlow due to technical complexities.

Product owners' signature

Task Updates:

- The preprocessing of the Forex data is complete, and the technical and macroeconomic indicators have been applied.
- Implement data collection from various forex data sources such as APIs or databases.
- Develop scripts to preprocess and clean the collected data, handling missing values and outliers appropriately.
- Explore different feature engineering techniques to extract relevant features from the raw data.
- Model Selection and Development:
- Research and select appropriate machine learning or deep learning models for forex price prediction.
- Implement baseline models such as linear regression or ARIMA for initial testing.
- Experiment with more advanced models like long short-term memory networks (LSTMs) transformer models.
- Fine-tune hyperparameters and optimize model performance using techniques like grid search or Bayesian optimization.