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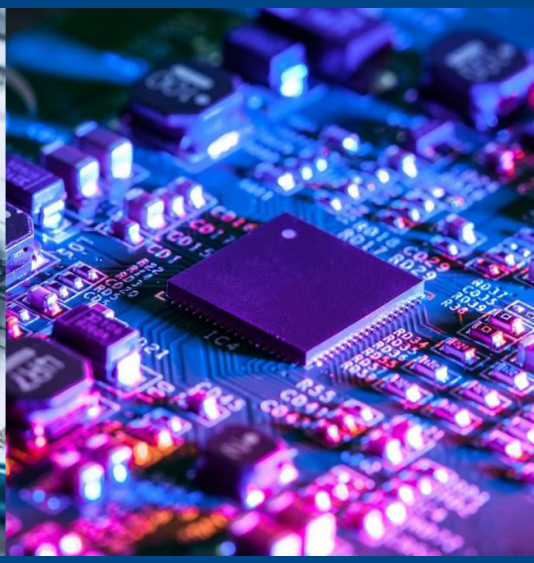

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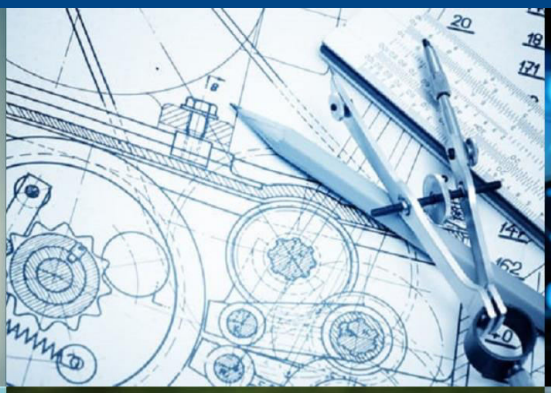

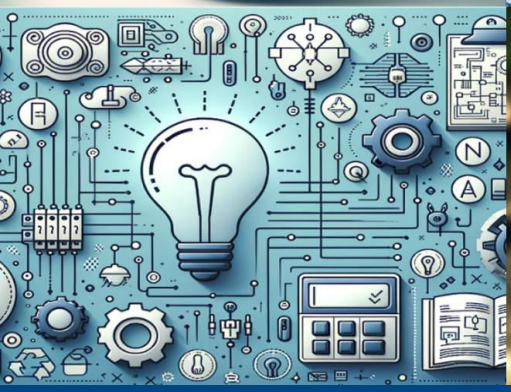

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Enhancing Decision-Making in Coffee Commodity Trading through AI and Big Data Analytics

Aiden Clark

Krishnaswamy College of Engineering and Technology, Tamil Nadu, India

ABSTRACT: Coffee is the second most traded soft commodity in the world, and its changing prices bring both chances and challenges for those in the market. To make good choices, traders, investors, and analysts need to handle data well and use the right tools. This article discusses how a large data system was built and put to use specifically for coffee trading. It gathers trade information from sources like the New York Arabica coffee futures market and data from COT reports through a smart ETL process. This data warehouse not only helps in organizing and studying trading information but also supports analysis and visual representation of data from January 2000 to October 2022.This project aims to set up a prototype system that manages large datasets effectively and shows key metrics, such as net positions and moving averages. This information can assist market participants in forecasting price trends and identifying potential risks. The outcomes indicate that the system can deliver reliable and timely information, enabling traders to create smarter, data-oriented trading strategies. Looking ahead, future studies will work on developing real-time applications, refining prediction models, and incorporating additional data sources to enhance market analysis.

KEYWORDS: Coffee trading, big data analytics, ETL process, data warehouse, market forecasting, informed decision-making, data visualization.

I. INTRODUCTION

Every day, people drink about 2.25 billion cups of coffee, making it one of the world's favorite beverages. It plays a big role not just in what we drink but also in the economies of countries that grow coffee. Take Vietnam, for instance; coffee accounts for nearly 10% of its total export income, coming in right after rice. Despite its importance, several things can influence coffee prices, like supply and demand, political events, weather changes, and currency rates. These elements create a tricky market where being careful with predictions and analysis is key to managing risks.

Traditional ways of looking at coffee trading data often fall short because of issues with data quality, storage limits, and real-time processing. The vast amounts of varied data collected over years of trading can overwhelm current technology. To tackle this problem, this study introduces a data warehouse solution specifically for coffee commodity trading. This system uses the latest information and communication technology along with data mining tools, creating a flexible setup that can collect, process, and analyse large volumes of transaction data.The main aim of this study is to create and set up a big data warehouse that helps collect, merge, and analyze information about coffee trading. First, we gather data from different sources and clean it up using an ETL process before placing it into an organized warehouse. Once that's done, we work on the data so users can carry out analyses like assessing risks, spotting trends, and making predictions. The final result is a unified platform that allows those in the market to make informed choices based on detailed and up-to-date market information.

II. LITERATURE SURVEY

This part of the text will provide the foundational ideas for our research. We will clarify the concepts surrounding the coffee derivatives market and give a brief overview of data warehouses and OLAP. Additionally, we will examine the current landscape of related work in these areas, specifically in relation to coffee trading markets.

FUTURE COFFEE COMMODITY TRADING DATA

Coffee is not just a beloved drink; it plays a significant role in the global economy. In recent years, its popularity has skyrocketed, with over 2.25 billion cups consumed each day. International coffee trade occurs between those who export and import, sometimes involving brokers. Since the 1960s, the market has been shaped by International

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Coffee Agreements managed by The International Coffee Organization. These agreements aim to promote a sustainable coffee sector and help reduce poverty in developing nations. Around the globe, there are various coffee exchange markets such as the London Robusta Coffee Market, the Arabica Coffee New York Market, and the Builders Merchants Federation Market in São Paulo, Brazil.

The rise of the derivatives market marks a significant shift in the financial landscape. As the modern economy evolves, financial innovations are emerging and diversifying, creating opportunities for the derivatives market to expand. This market is where contracts based on underlying assets are created and traded. A derivative is a financial product that derives its value from another, known as the base asset, which can be a bond, stock, currency, or commodity. The worth of these derivative assets fluctuates based on the price changes of their base assets. These financial tools help transfer unwanted risks to those willing to accept them.

In the coffee derivatives market, there are key contracts such as forwards, futures, options, and swaps. For our research, we will concentrate specifically on coffee futures contracts. These are agreements made on organized exchanges to buy or sell a specific product at a set price at a future date. The ICE exchanges in New York are the primary venue for trading Arabica coffee, while Robusta coffee is mostly traded on the LIFFE exchanges in London. Future prices on these exchanges vary according to supply and demand in each market. The Commodity Futures Trading Commission, an independent federal agency created in 1974, oversees this market for goods.

III. METHODOLOGY

The architecture of the convolutional neural network (CNN) was structured to extract relevant features for classification through multiple layers. These included convolutional layers for feature extraction, ReLU activation layers to introduce non-linearity, pooling layers to reduce spatial dimensions and retain essential features, and fully connected layers to combine learned features for the final classification. For training, the model utilized the Adam optimizer, known for its adaptive learning rate capabilities, and categorical cross-entropy as the loss function, ideal for multi-class classification tasks.

After data has been collected, the Extract-Transform-Load (ETL) procedure is carried out so as to prepare the data for analysis and storage. ETL workflow includes data extraction from multiple sources, transformation of data to match the data warehouse-defined structure, and the loading of data into a PostgreSQL-based data warehouse that is optimized for efficient performance. Data processing is done in stages. To maintain data quality in the end product and the consistency of the information, all raw data first goes through a cleansing and standardization phase within the staging area. Metadata is also created at this stage to assist with data traceability and enhance data control. To prevent repetition and ensure referential integrity, the cleaned and manipulated data is then stored in the ODS layer and further structured using a third-normal-form (3NF) model.

Last but not least, in the last stage of data handling, Power BI is applied to build visual dashboards which assist the analysts and the traders to interact with and comprehend the data. These dashboards include multiple trading metrics and visualizations such as moving averages, price trends, trading volumes and net holdings spread in various market players, hence assisting market forecasting and aiding trading strategies.

The organized approach used here guarantees effective integration of machine learning models in the future, therefore improving predictive analytics. Because there is a good structure for data movement and storage, this work lays the groundwork for instant trading applications thus enhancing the decision-making process within the coffee commodity market.

IV. EXPERIMENTAL RESULTS

The experimental results of this study showcase the effectiveness of the designed data warehouse and analytical dashboards in capturing and visualizing essential trading insights for coffee commodities. By analyzing New York Arabica coffee futures prices with applied moving averages (50-day and 200-day), the system highlights significant trends and potential market shifts. For instance, upward crossovers between short-term and long-term moving averages

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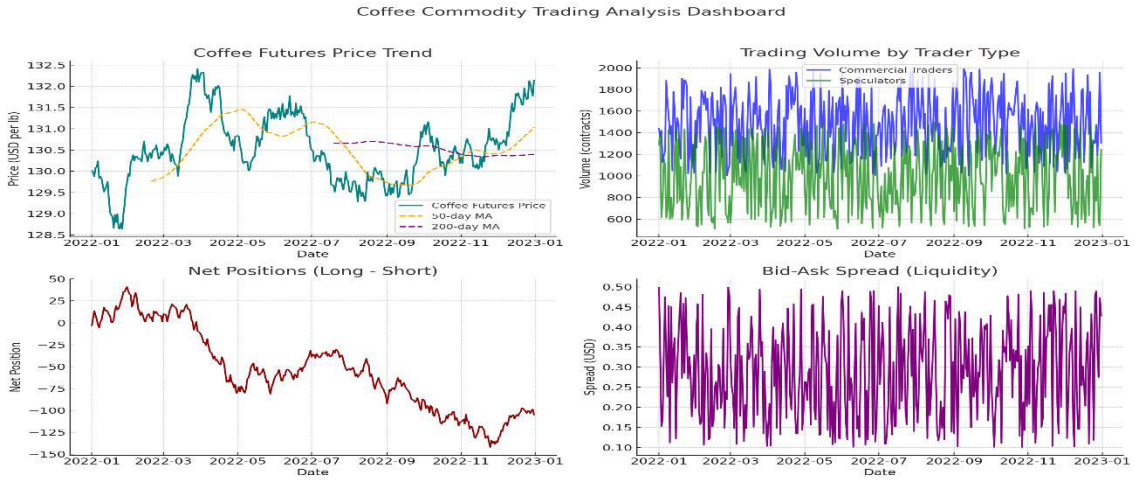
indicate bullish trends, while downward crossovers suggest bearish market conditions. This analysis smooths out daily fluctuations, helping traders observe broader price patterns.

Fig. 1 Model Performance



V. CONCLUSION

The warehouse and system of analytics can turn huge volumes of data into actionable insights for coffee commodity traders, as typified in the paper "Artificial Intelligence in Finance: Coffee Commodity Trading Big Data for Informed Decision Making". This approach gives deep market dynamics from combining net positions, trading volumes, bid-ask spreads, and prices of coffee futures. This gives the trader a power and insight into identifying and responding to movements in the markets.

The findings of the study are the use of moving averages and net position analysis for the indication of price patterns and market sentiment. While the Bid-ask Spread Analysis provides a measure of liquidity, which is basic to understanding price pressure, the capacity to analyse trading volumes based on trader types allows insights into the actions of market participants.

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