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CryptoAnalytics - Survey Paper

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Abstract: CryptoAnalytics revolutionizes cryptocurrency trading by offering dynamic visualization and price prediction for up to 100 cryptocurrencies. Leveraging CoinGecko's API, it provides historical data for informed decision-making. Its user-friendly ReactJS frontend allows users to explore trends over various timeframes, from the last 24 hours to a year. By integrating a Long Short-Term Memory (LSTM) model, CryptoAnalytics predicts cryptocurrency prices, enhancing users' ability to navigate the volatile market. Seamlessly integrated with Flask, it facilitates real-time communication and customization, empowering users to select specific cryptocurrencies and prediction horizons. With CryptoAnalytics's insightful CryptoGraphs, users gain deeper insights into cryptocurrency trends, fostering informed decision-making and financial empowerment in the ever-changing crypto landscape.

Index Terms -- **Cryptocurrency, Flask, Coingecko API, LSTM, ReactJS.**

I. INTRODUCTION

CryptoAnalytics stands out as a groundbreaking initiative designed to empower individuals in navigating the dynamic realm of cryptocurrency. The platform provides a smooth interface for users to delve into and analyze trends within the cryptocurrency landscape. New users can access the platform's capabilities by registering through a dedicated registration page, while a login page ensures seamless access for registered users, incorporating robust authentication and security measures. This project merges machine learning prowess with a user-centric interface, offering valuable insights into the intricate world of crypto.

CryptoAnalytics's key feature is its capability to present in-depth historical data for a curated selection of the top 100 cryptocurrencies. Utilizing a machine learning model trained on extensive historical data sourced from CoinGecko's API, CryptoAnalytics employs advanced Long Short-Term Memory (LSTM) techniques to predict future prices for over 100 popular cryptocurrencies. The LSTM model processes this data, generating precise price predictions for each cryptocurrency showcased on the platform.

Through seamless integration with Flask on the frontend, CryptoAnalytics ensures real-time communication of predicted prices, delivering users with accurate and current forecasts. Users can easily access comprehensive data for a specific cryptocurrency by simply clicking on it, including information spanning various timeframes like 24 hours, 30 days, 3 months, and 1 year. This functionality empowers users to track and analyze price trends across different periods, equipping them with valuable insights to make informed decisions.

CryptoAnalytics goes beyond price prediction and visualization, offering a vibrant community forum where users can engage, share insights, and discuss cryptocurrency market aspects. The forum is a hub of information contributed by enthusiasts, providing diverse perspectives and keeping users updated on market trends.

Our platform presents historical data in an interactive format, allowing exploration of cryptocurrency price movements across various timeframes. This analysis empowers users with knowledge for informed investment decisions. CryptoAnalytics integrates advanced ML techniques and a user-friendly frontend to bridge the gap

between price prediction and data visualization, aiming to empower users with actionable insights. Whether you're a newcomer or an experienced investor, our intuitive platform facilitates seamless registration, login, and access to all features.

II. LITERATURE SURVEY

This research explores [1] the use of Long Short-Term Memory (LSTM) in forecasting cryptocurrency prices, leveraging technical indicators for market trend analysis. LSTM models, particularly applied to Bitcoin, Ether, and Litecoin, exhibit notable accuracy of 67.43%. Integrating coingecko's API for historical data, our project constructs a predictive model using LSTM, resulting in enhanced accuracy in cryptocurrency price prediction.

This paper discusses [2] the increasing importance of Bitcoin in the cryptocurrency market, prompting the adoption of machine learning-based time series analysis for price prediction. Techniques like ARIMA, FBProphet, and XG Boosting have been employed, with ARIMA emerging as the optimal model for Bitcoin price forecasting, boasting superior performance. While LSTM initially yielded lower RMSE and MAE scores, our experimentation highlights its effectiveness in improving accuracy for cryptocurrency price prediction, challenging the prevailing preference for ARIMA in the literature.

This study explores [3] short-term forecasting of cryptocurrency time series using machine learning (ML) techniques, focusing on methodological principles and algorithm efficacy analysis. Evaluating the 90-day dynamics of top cryptocurrencies (Bitcoin, Ethereum, Ripple), they employed Binary Autoregressive Tree (BART), Neural Networks (specifically multilayer perceptron, MLP), and Random Forest (RF) ensemble models. Comparative analysis indicates the adequacy of all models in describing cryptocurrency dynamics, with BART and MLP models achieving a mean absolute percentage error (MAPE) averaging 3.5%, and RF models within 5%. Despite LSTM yielding lower scores, this research extends predictions to 100 cryptocurrencies, broadening market forecasts beyond the major players.

This study examines [4] the predictability of twelve highly liquid cryptocurrencies across different frequencies using machine learning classification algorithms. By utilizing past price data and technical indicators, the effectiveness of support vector machines, logistic regression, artificial neural networks, and random forests in predicting price trends is evaluated. Results consistently show classification accuracy above 50% for all cryptocurrencies and timeframes, with support vector machines emerging as the top performer, achieving predictive accuracy of 55–65% on average. However, LSTM yields significantly higher accuracy than support vector machines and extends its forecasts to encompass 100 cryptocurrencies.

The surge in [5] cryptocurrency popularity presents both opportunities and challenges, particularly with market volatility hindering investment decisions. Existing price prediction methods often lack real-time effectiveness in forecasting price changes. To address these issues, a tailored machine learning approach, integrated with blockchain technology for security and Reinforcement Learning algorithms for price analysis, is proposed for a financial institution. While initially focusing on Litecoin and Monero, LSTM surpasses this approach due to its superior performance fueled by extensive historical data covering various cryptocurrencies.

This paper presents [6] advancements in utilizing Deep Neural Network (DNN) algorithms to predict Bitcoin prices, with the goal of mitigating financial risks and enhancing electronic business transactions. By leveraging transactional data and currency returns, the proposed method extracts relevant features and employs transactional planning to construct a network of nodes. These developments in deep learning algorithms show promise in advancing electronic businesses utilizing digital currency, achieving notable accuracy (53.4%) and correct prediction (MSE 1.02). However, LSTM demonstrates significantly higher accuracy than deep learning algorithms, while also extending forecasts to encompass 100 cryptocurrencies.

This study introduces [7] three types of Recurrent Neural Networks (RNNs) – Long Short-Term Memory (LSTM), Gated Recurrent Unit (GRU), and Bi-Directional LSTM (Bi-LSTM) – for predicting exchange rates of major cryptocurrencies like Bitcoin (BTC), Ethereum (ETH), and Litecoin (LTC). Comparative analysis using Root Mean Squared Error (RMSE) and Mean Absolute Percentage Error (MAPE) reveals that Bi-LSTM outperforms LSTM and GRU, demonstrating superior predictive accuracy. With MAPE values of 0.036, 0.041, and 0.124 for BTC, LTC, and ETH, respectively, Bi-LSTM emerges as the optimal algorithm for

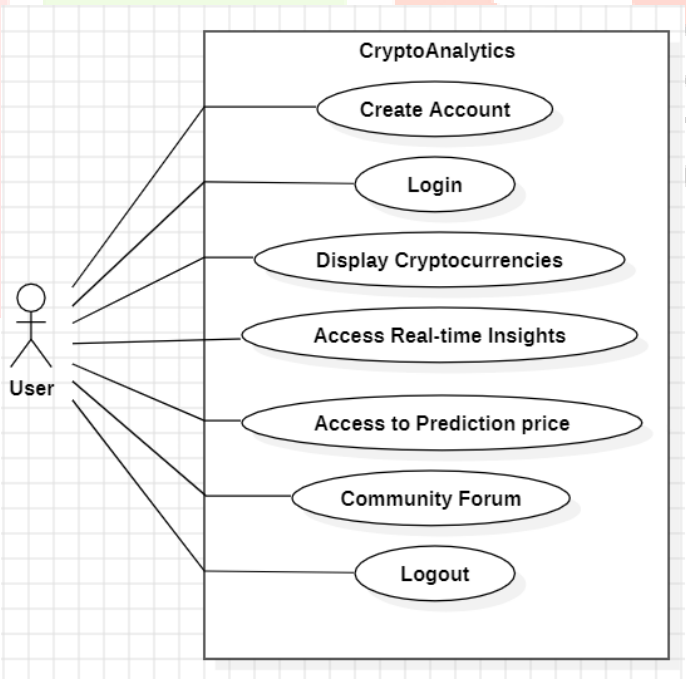
cryptocurrency price prediction. Indeed, the difference in MAPE values between LSTM and Bi-LSTM may be minimal, and LSTM's utilization of extensive historical data could potentially provide an edge in achieving higher accuracy. LSTM's ability to retain long-term dependencies in sequential data makes it well-suited for capturing intricate patterns present in cryptocurrency price time series data.

Another study introduces [8] a deep learning model for forecasting cryptocurrency prices, treating them as time series data. Long short-term memory (LSTM) cells are utilized within the neural network architecture to address the shortcomings of traditional artificial neural networks in handling long data sequences. The model specifically targets forecasting open prices of cryptocurrencies and has shown successful implementation on Bitcoin, Ethereum, Litecoin, and Bitcoin Cash prices, resulting in minimal prediction errors and accurate forecasted prices.

This study emphasizes the [9] importance of cryptocurrency price prediction for investors, aiding in strategic decision-making and risk management. Comparing deep learning methods like Recurrent Neural Network (RNN) and Long-Short Term Memory (LSTM) for Bitcoin and Ethereum price prediction, LSTM surpasses RNN. LSTM demonstrates lower Root Mean Squared Error (RMSE) and Mean Absolute Percentage Error (MAPE) values, achieving RMSE of 0.061 and 0.036, and MAPE of 5.66% and 4.58% for Bitcoin and Ethereum, respectively. These results underscore LSTM's superiority over RNN in cryptocurrency price forecasting, offering valuable insights for investors and researchers alike.

This paper utilizes [10] Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU) models, both integral to Artificial Intelligence, machine learning, and data science, to predict prices of Bitcoin (BTC), Ethereum (ETH), Litecoin (LTC), and Ripple (XRP). By assessing the accuracy of these models in forecasting time series data, the study aims to identify the superior performer among them for these cryptocurrencies. Incorporating technical indicators and lagged variables, the models undergo analysis with standardized and scaled attribute values. Diebold-Mariano tests indicate LSTM's superiority over GRU for BTC and ETH, while both models demonstrate comparable accuracy for LTC and XRP.

III. System Architecture



IV. Methodology

Module 1- User Authorization: The authentication and authorization module in the CryptoAnalytics application manages user registration and login securely. It involves creating an authentication service to handle user credentials, using Axios for backend API requests, and storing user data in a MongoDB database upon registration. Upon successful authentication, users are granted access to the application's features, and logging out clears authentication tokens and redirects users to the login page.

Module 2- Cryptocurrencies List: This module, following successful login, presents users with a comprehensive list of 100 cryptocurrencies on CryptoAnalytics's home page. It dynamically fetches cryptocurrency data from CoinGecko's API, using React and essential modules like useState, useEffect, axios, and Material UI components. The CoinsTable component structures the cryptocurrency table, with state variables managing data fetching, loading status, user search input, and pagination, while rendering a user-friendly table with coin details and Material UI pagination for navigating through results.

Module 3 - Overview and Historical Data of coin section: This module enhances user experience by providing detailed information and historical data for selected cryptocurrencies, accessible by clicking on individual coins from the home page list. It utilizes React, Material-UI, Axios, and React Router DOM to create a functional CoinPage component managing state variables, fetching coin data via API requests, and rendering a visually appealing and responsive interface with components like Typography and linearprogress from Material-UI. Additionally, it displays coin images, names, descriptions, rankings, current prices, market caps, and predicted prices fetched from the backend using Flask.

Module 4 - ML Model Integration with Flask: This module integrates a machine learning (ML) model for cryptocurrency price prediction into CryptoAnalytics using Flask, a lightweight Python web application framework. Its core function is to create an API endpoint allowing communication between the frontend and the ML model, retrieving predicted cryptocurrency prices for display in the Coin Overview and Historical Information section. The steps involve initializing Flask, defining routes for handling requests, extracting JSON data, invoking the prediction function with extracted data, and returning predicted prices as JSON responses, with error handling included.

Module 5 - Prediction Model: The Prediction Model module employs machine learning algorithms, specifically Long Short-Term Memory (LSTM), to generate price predictions for cryptocurrencies based on historical data. It encompasses data fetching from CoinGecko's API, preprocessing using MinMaxScaler, creating input-output sequences, constructing the LSTM model architecture, training the model, and orchestrating the prediction process. Additionally, it integrates with Flask to serve predictions via an API endpoint, providing users with informed insights for cryptocurrency investments and trading strategies.

Module 6 - Community Forum: The Community Forum module provides users with a platform to engage in discussions, share insights, and exchange knowledge on cryptocurrencies. It involves creating a React component named Forum with state variables to manage user input messages and messages from other users. Users can enter messages via a textbox, send them to the forum, and view messages from other users. Additionally, the module includes functions to handle user input, send messages to the forum, fetch messages from the MongoDB Database, and render the forum's message list for user interaction.

V. CONCLUSION

In summary, CryptoAnalytics emerges as a pioneering platform revolutionizing cryptocurrency price prediction and dynamic visualization. Through seamless integration of CoinGecko's API historical data and a user-friendly ReactJS frontend, CryptoAnalytics grants users unprecedented access to in-depth insights into the cryptocurrency market. With secure registration and login features, users can confidently explore the platform's extensive offerings, including 100 cryptocurrencies complete with detailed historical data and dynamic visualization tools, facilitating well-informed decision-making.

Moreover, CryptoAnalytics harnesses the power of machine learning techniques, notably the Long Short-Term Memory (LSTM) model, to elevate its predictive capabilities, delivering precise price forecasts for each cryptocurrency. Through Flask integration, the ML model seamlessly communicates predictions to the frontend, ensuring users receive real-time, reliable information. Additionally, the inclusion of a community forum page fosters collaboration and knowledge exchange among users, enriching the CryptoAnalytics experience. In essence, CryptoAnalytics epitomizes a comprehensive solution, empowering users with the indispensable tools and insights necessary to navigate and excel in the dynamic realm of cryptocurrency markets.

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