# PREDICTIVE ANALYTICS FOR CRUDE OIL PRICE USING RNN-LSTM NEURAL NETWORK

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**Abstract** - Prediction of future crude oil price is considered a significant challenge due to the extremely complex, chaotic, and dynamic nature of the market and stakeholder's perception. The crude oil price changes every minute, and millions of shares ownerships are traded every day. The market price for commodity such as crude oil is influenced by many factors including news, supply-and-demand gap, labor costs, amount of remaining resources, as well as stakeholders' perception. Therefore, various indicators for technical analysis have been utilized for the purpose of predicting the future crude oil price. Recently, many researchers have turned to machine learning approached to cater to this problem. This study demonstrated the use of RNN-LSTM networks for predicting the crude oil price based on historical data alongside other technical analysis indicators. This study aims to certify the capability of a prediction model built based on the RNN-LSTM network to predict the future price of crude oil. The developed model is trained and evaluated against accuracy matrices to assess the capability of the network to provide an improvement of the accuracy of crude oil price prediction as compared to other strategies. The result obtained from the model shows a promising prediction capability of the RNN-LSTM algorithm for predicting crude oil price movement.

- **Index Terms** – RNN-LSTM, Chaotic, Stake Holder's

## I. INTRODUCTION

Crude oil has become increasingly important for the global economy, with nearly two-thirds of the world's electricity generation relying on crude oil and natural gas As an extraordinary commodity, raw petroleum trades involve a wide variety of international players, including oil producing countries, oil companies, suppliers of treatment plants, oil trading countries, and theorists. Due to the importance of the commodity to the development of a country, a sharp shift in the value of crude oil can lead to a turmoil in monetary action and the economy of a country.

The cost of crude oil can affect the economy of a country in two ways. A rapid rise in the cost of crude oil has antagonistic effects on financial growth and causes inflation to rise. By contrast, a drop in the cost of crude oil (such as in 1998) may pose serious financial shortfall challenges for oil exporting countries.

Various studies have been conducted to visualize the impact of crude oil price changes on the economy of countries. For instance, a study by Sari has summarized the impact of world crude oil prices on the Malaysian economy— specifically on the country's income as Malaysia is an oil producing country, and its economic

growth depends on the price of crude oil. Therefore, an accurate crude oil price prediction mechanism is needed to allow researchers and stakeholders to understand and predict future crude oil prices.

It is worth noting that the prediction of crude oil price is considered as a challenging and crucial topic given its high volatility nature. The crude oil spot value arrangement is perceived as nonlinear and non-stationary time arrangement. The crude oil spot value depends on various irregular variables such as weather, crude oil stock levels, GDP growth, political stability, and psychological expectations. Due to the challenging nature of the task, crude oil price prediction has become an interest to many institutions, businesses, and academic researchers.

## II Literature survey:

According to Miao et al., various influential factors may affect the crude oil price changes, including a supply and demand curve, the current financial market, commodity market, speculative factor, and geopolitical factor. Each of these factors consists of various determiners (sub-factors) that affect the commodity price. According to an article published on the Caltex website, the fuel (such as petrol) prices change is closely related to the cost of crude oil—and it has a long-term effect on the fluctuation of the commodity price. Additionally, the cost of crude oil alone has contributed to nearly 50 percent of the retail petroleum price. Subsequently, this means that the cost of crude oil is the primary determiner for the cost of fuel for the end-consumers.

Similar to many other products, crude oil prices depend on the supply and demand curves. In other words, if the demand is more than the supply, it means the oil market is currently in shortage condition, hence the price of oil increases due to its limited supply and availability. Conversely, if the supply is more than the demand, the oil supply and availability are in surplus; hence the price becomes cheaper as it is widely available, and it has only a few buyers. Equilibrium price exists when there are no surpluses or deficiencies in the market. Other factors, such as the supply-demand curve and competitive factors, have a short-term effect.

An incline in the interest and quantity line is negligible over a long value-run. According to Stevens, the situation is similar to an insect afloat on water supported by the surface tension of water— "surface tension supports a certain weight but above some weight, surface tension breaks, and the insect sinks."

## III. EXISTING SYSTEM

Many researchers have presented works related to future crude oil price prediction, yet, there is no one for-all model suitable to be used for predicting future crude oil prices in all conditions. Getting a crude oil price prediction with a hundred percent accuracy is almost impossible. Therefore, there is always a need to improve the accuracy of the nonlinear and non-stationary time series data sets using predictive analytics methods. Another challenge in predicting the future crude oil price is due to an external factor such as the supply-demand gap of the crude oil itself. The Organization of the Petroleum Exporting Countries' (OPEC) policy of production management, supply disruption, and risk of a major war in the Middle East can cause an unexpected demand or refusal for crude oil, therefore affecting its price. Hence, having a predictive system to assess the near-future crude oil price is a valuable bridge to the demand gap.

## IV. PROPOSED SYSTEM

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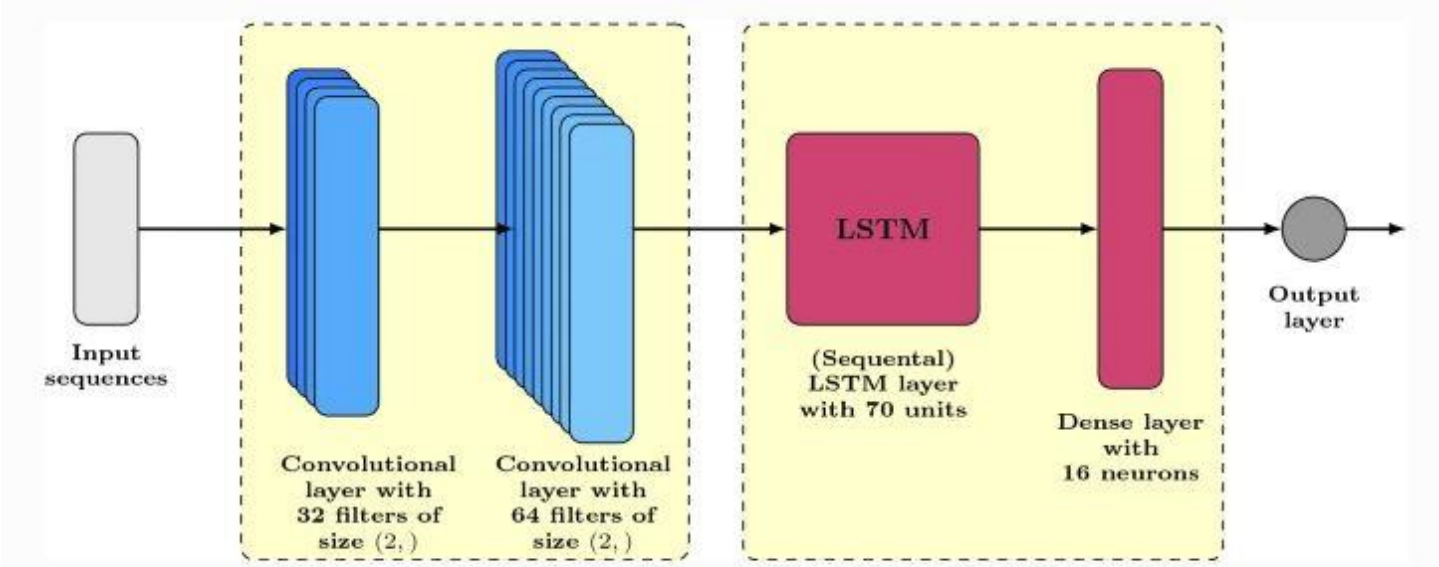
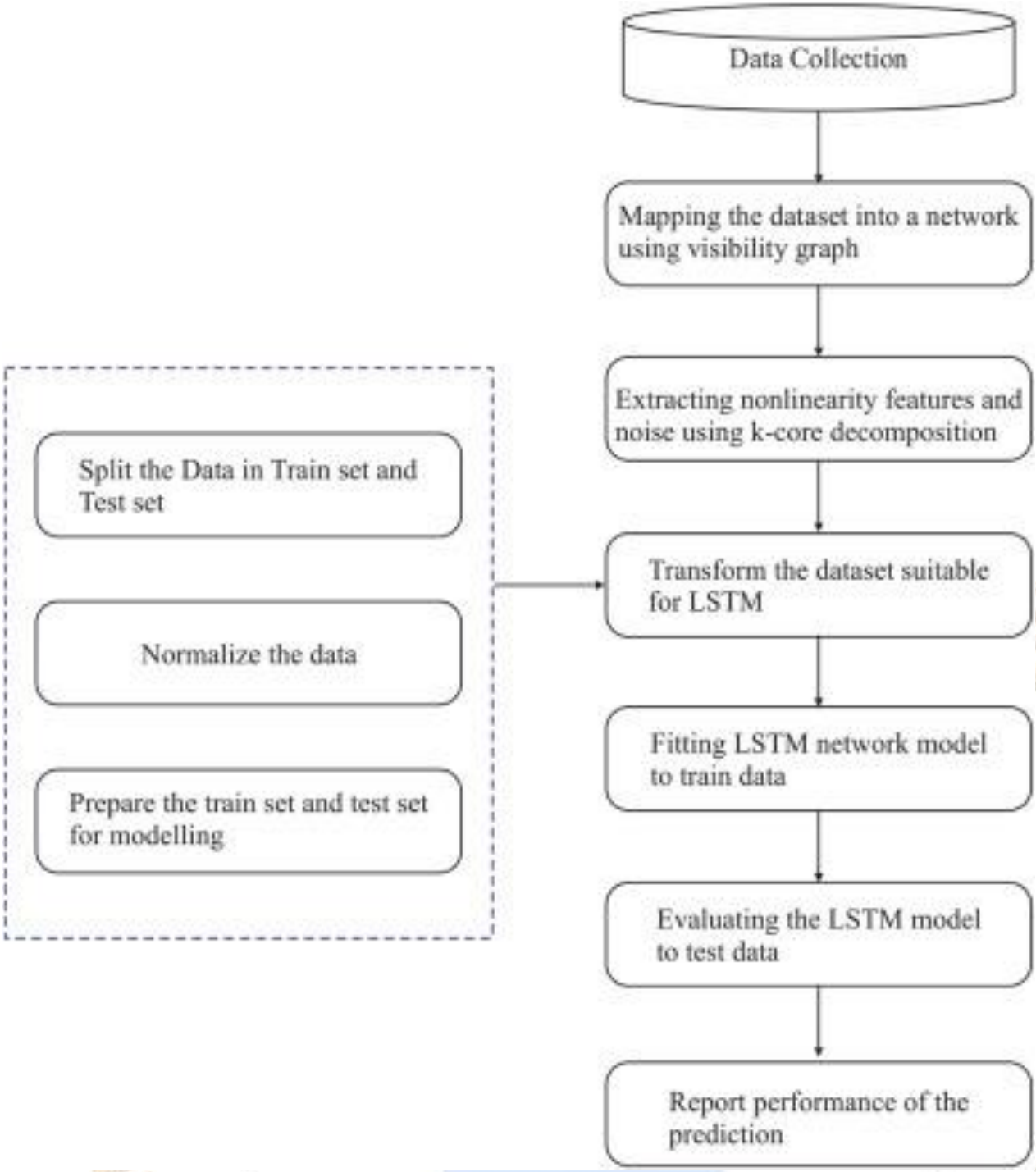
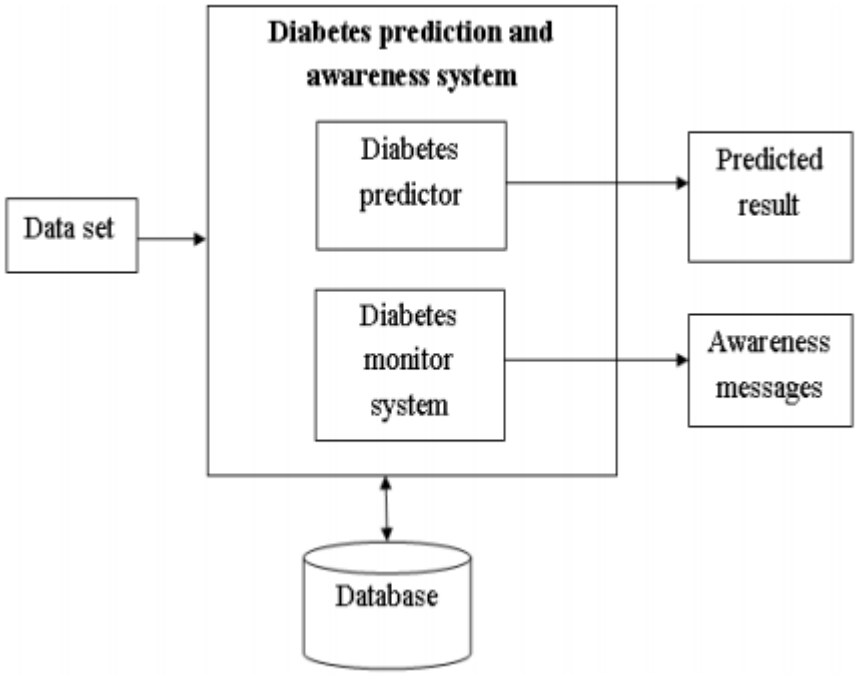
## V.SYSTEM ACHITECTURE




CNN-LSTM forecasting model architecture




**Block Diagram**




**Data Flow Diagram**

## VI. Result Analysis:

Based on the experimental result produced by the model, it is clear that the model is capable of predicting the crude oil price movement correctly for most of the time. The prediction is roughly in the range of 0 and 1. Note that the MSE produced for the testing sets for both WTI and Brent crude oil price prediction is in the 1/1000th scale, which indicates a meager error rate of prediction for the future crude oil price.

## VII. Conclusion:

Prediction of crude oil price is considered a challenging task due to the nature of the supply-demand curve, as well as various factors affecting the price volatility and demand in crude oil. Despite this condition, in the long run, the crude oil supply cost is the most significant factor in determining the crude oil price. The RNN-LSTM model developed using Python and TensorFlow-Keras library has successfully predicted the crude oil price movement accordingly using machine learning to handle the data analytics task to analyze the upcoming price trends. This method is a proof of concept for an online and on demand stream learning approach for crude oil price prediction. The integration of such architecture with artificial intelligence methods can provide a new ways of investigation and induction of no stationary information. The on-demand train and learning model capable of updating the model at whatever point as new oil value data becomes accessible. Thus, after some time, the model evolves steadily and can capture the pattern of oil price fluctuation. Updating the model requires a brief test period for each new information model, which does not allow the model to be re-prepared using the entire information database.

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