ABSTRACT

Prediction of crude oil prices is a crucial research area in the global economy. West Texas Intermediate (WTI) crude oil is one of the major commodities widely traded in the international energy market. The accuracy of price predictions is essential in assisting policymakers, energy companies, and investors in developing better strategies to navigate market volatility. Therefore, the development of crude oil price prediction models based on deep learning, such as Long Short-Term Memory (LSTM), has become relevant, as LSTM is a neural network architecture designed to handle long-term dependencies in time series data. However, the performance of LSTM models heavily depended on the selection of optimal hyperparameters. Improper hyperparameter selection could lead to overfitting or underfitting, thereby reducing prediction accuracy. Thus, a hyperparameter optimization strategy was necessary to improve model performance. This study implemented an LSTM model with hyperparameter optimization to enhance the accuracy of WTI crude oil price predictions. The tuning process was conducted by adjusting various hyperparameter combinations to identify the optimal configuration that resulted in minimal prediction error. The study utilized four tuned hyperparameters with a predetermined LSTM architecture. Based on the tuning results, the combination of a window size of 30, a learning rate of 0.0010, a batch size of 128, and a dropout rate of 0.1 demonstrated the best performance in capturing the price movement patterns of WTI crude oil. The results indicated that the LSTM model with hyperparameter optimization was capable of providing accurate WTI crude oil price predictions, achieving a Mean Absolute Percentage Error (MAPE) of 1.1292%. This finding confirmed that the optimized model effectively captured WTI crude oil price patterns and delivered highly accurate prediction results.

Keywords : Price Prediction, Crude Oil, West Texas Intermediate, Long Short-Term Memory, Hyperparameter Tuning