Prediction of CO2 Emission Levels in Indonesia Using the Long Short-Term Memory (LSTM) Method

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ABSTRACT

Climate change and global warming are global issues that have become a major concern for many countries, including Indonesia. One of the main causes of this phenomenon is the increase in CO2 emissions. Carbon emissions are a key contributor to climate change, along with other greenhouse gas emissions. Excessive CO2 emissions can significantly raise the Earth's surface temperature. This study aims to predict CO2 emission levels in Indonesia using the Long Short-Term Memory (LSTM) method, a type of artificial neural network designed to handle time series data with long-term dependencies. The data used in this study consists of historical CO2 emissions in Indonesia from 1889 to 2023. The model was developed through several stages, including data preparation, data cleaning, modeling, testing, and evaluation using MAE, RMSE, and MAPE. Based on multiple experiments with different parameter settings, the best result was obtained with an 80% training and 20% testing data split, combined with a time step of 10 and 50 epochs. This configuration produced an MAE value of 202,411,114.04, an RMSE of 227,687,452.87, and a MAPE of 16.41%, indicating that the CO2 emissions prediction using the LSTM method achieved good accuracy.

Keywords: *Climate change, global warming, CO2 emissions, prediction, Long Short-Term Memory (LSTM).*