

ABSTRACT

Inefficient fertilizer use can reduce agricultural productivity and negatively impact the environment. One of the main challenges is determining the right dose of fertilizer based on environmental conditions. This research aims to develop a fertilizer demand forecasting system using the PSO-LSTM model to improve fertilizer efficiency. This system has two main models, namely Random Forest to build a virtual NPK sensor, then PSO-LSTM to predict fertilizer doses. The inputs for both models are taken from environmental data such as temperature, humidity, and light intensity. PSO is used to optimize the hyperparameters of LSTM to make the prediction more accurate. The evaluation results showed that PSO-LSTM performed better than the Grid Search model, with RMSE of 1.20, MAE of 0.40, and R^2 of 0.82. Meanwhile, the Random Forest model has a Virtual Sensor NPK classification accuracy of 74%. Field observations conducted for 4 weeks showed that the forecasting system was able to produce more adaptive doses and produce better plant growth than conventional methods.

Keywords: *PSO-LSTM, random forest, machine learning, fertilizer forecasting*