ABSTRACT

The fluctuation in shallot prices, influenced by seasonal factors, distribution systems, and market dynamics, makes price forecasting an important issue in agricultural data analysis. The data used in this study are time series data with nonlinear characteristics and seasonal patterns, so classical approaches are often unable to represent complex temporal relationships. This study develops a price prediction model for shallots in North Sulawesi using a Gated Recurrent Unit (GRU) optimized with Particle Swarm Optimization (PSO) and Adaptive Particle Swarm Optimization (APSO) to obtain optimal hyperparameter configurations. The optimization process is carried out on several parameters, namely units, learning rate, batch size, and dropout, through a search mechanism based on particle convergence behavior. Model performance is evaluated using Mean Absolute Percentage Error (MAPE). The results show that GRU-APSO is the best model with a configuration of 128 units, a learning rate of 0.01, a batch size of 40, and a dropout of 0.00. The GRU-APSO model achieves a MAPE value of 0.9567%, which is lower than the baseline model (1.093%) and the GRU-PSO model (1.428%). The best model is able to generate shallot price predictions for the next five periods with a relatively stable movement pattern. These results indicate that the integration of GRU and APSO is effective in improving prediction accuracy for time series data in the agricultural sector and has the potential to become a reliable alternative approach for commodity price forecasting.

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Keywords: Shallot Price Prediction, North Sulawesi, GRU-APSO, GRU-PSO