ABSTRACT

The development of automated sales technology through vending machines requires more accurate inventory management due to dynamic fluctuations in product demand. Inaccurate predictions can lead to stock shortages or stockpiling. This study aims to develop a vending machine product demand prediction model using the Long Short-Term Memory (LSTM) algorithm to improve inventory planning accuracy. The data used consists of historical sales data for food and drink categories, which is processed through preprocessing, data exploration, and time series modeling stages. Model performance was evaluated using Mean Absolute Error (MAE), Mean Squared Error (MSE), and Root Mean Squared Error (RMSE), and compared with the ARIMA and Support Vector Regression (SVR) algorithms. The evaluation results showed that the Long Short-Term Memory (LSTM) model provided the best prediction performance compared to the comparison models in both categories. In the food category, LSTM was able to reduce the MAE value by around 13.5%, the MSE by around 23%, and the RMSE by around 11.6%, while in the drink category, the resulting error reduction reached around 3.5% for MAE, 13% for MSE, and 6.3% for RMSE. These findings indicate that LSTM is effective in capturing temporal and seasonal patterns, making it suitable for use as the basis for a vending machine product demand prediction system.

Keywords: *Stock Demand, Vending Machine, LSTM, Deep Learning, Forecasting.*

ABSTRAK

Perkembangan teknologi penjualan otomatis melalui *vending machine* menuntut pengelolaan persediaan yang lebih akurat akibat fluktuasi permintaan produk yang dinamis. Ketidaktepatan prediksi dapat menyebabkan kekurangan maupun penumpukan stok. Penelitian ini bertujuan mengembangkan model prediksi permintaan produk *vending machine* menggunakan algoritma Long Short-Term Memory (LSTM) untuk meningkatkan akurasi perencanaan persediaan. Data yang digunakan berupa data historis penjualan kategori *food* dan *drink* yang diproses melalui tahap *preprocessing*, eksplorasi data, dan pemodelan deret waktu. Kinerja model dievaluasi menggunakan Mean Absolute Error (MAE), Mean Squared Error (MSE), dan Root Mean Squared Error (RMSE), serta dibandingkan dengan algoritma ARIMA dan Support Vector Regression (SVR). Hasil evaluasi menunjukkan bahwa model *Long Short-Term Memory* (LSTM) memberikan performa prediksi terbaik dibandingkan model pembanding pada kedua kategori. Pada kategori food, LSTM mampu menurunkan nilai MAE sekitar 13,5%, MSE sekitar 23%, dan RMSE sekitar 11,6%, sedangkan pada kategori drink penurunan error yang dihasilkan masing-masing mencapai sekitar 3,5% untuk MAE, 13% untuk MSE, dan 6,3% untuk RMSE. Temuan ini menunjukkan bahwa LSTM efektif dalam menangkap pola temporal dan musiman, sehingga layak digunakan sebagai dasar sistem prediksi permintaan produk *vending machine*.

Kata kunci: Permintaan Stok, *Vending Machine,* LSTM, *Deep Learning, Forecasting.*