

ABSTRAK

Kecelakaan lalu lintas merupakan permasalahan serius yang berdampak pada keselamatan masyarakat serta menimbulkan beban sosial dan ekonomi yang signifikan, khususnya di wilayah kerja PT. Jasa Raharja Cabang Lhokseumawe. Keterbatasan informasi prediktif mengenai jumlah kecelakaan menyebabkan pengambilan kebijakan sering bersifat reaktif. Penelitian ini bertujuan untuk mengembangkan model peramalan (*forecasting*) angka kecelakaan lalu lintas berbasis *machine learning* menggunakan pendekatan *K-Means Clustering* dan *Recurrent Neural Network* (RNN). Data yang digunakan merupakan data historis kecelakaan lalu lintas periode 2022–2024 yang telah melalui tahapan pra-pemrosesan dan agregasi mingguan pada tingkat kecamatan. *K-Means Clustering* diterapkan untuk mengelompokkan kecamatan berdasarkan pola jumlah kecelakaan mingguan, dengan jumlah *cluster* optimal sebanyak dua *cluster* berdasarkan nilai silhouette score. Selanjutnya, model RNN dibangun secara terpisah pada masing-masing *cluster* untuk memprediksi jumlah kecelakaan mingguan. Evaluasi model dilakukan menggunakan metrik *Mean Absolute Error* (MAE), *Mean Squared Error* (MSE), dan *Root Mean Squared Error* (RMSE). Hasil penelitian menunjukkan bahwa model RNN pada *cluster* dengan pola kecelakaan yang relatif stabil menghasilkan tingkat akurasi yang lebih baik dibandingkan *cluster* dengan pola kecelakaan yang fluktuatif. Secara keseluruhan, kombinasi metode *clustering* dan RNN mampu memberikan prediksi yang cukup akurat.

Kata Kunci: Kecelakaan Lalu Lintas, *Forecasting*, *Machine Learning*, *K-Means Clustering*, *Recurrent Neural Network* (RNN).

ABSTRACT

Traffic accidents represent a critical issue that significantly affects public safety and generates substantial social and economic impacts, particularly within the operational area of PT. Jasa Raharja Lhokseumawe Branch. The lack of predictive information regarding accident occurrences often results in reactive policy making. This study aims to develop a machine learning–based forecasting model for traffic accident rates using a combination of K-Means Clustering and Recurrent Neural Network (RNN). The dataset consists of historical traffic accident records from 2022 to 2024, which were preprocessed and aggregated on a weekly basis at the district level. K-Means Clustering was employed to group districts according to weekly accident patterns, resulting in two optimal clusters based on silhouette score evaluation. Subsequently, separate RNN models were developed for each cluster to forecast weekly accident occurrences. Model performance was evaluated using Mean Absolute Error (MAE), Mean Squared Error (MSE), and Root Mean Squared Error (RMSE). The results indicate that the RNN model achieved higher prediction accuracy for clusters with more stable accident patterns compared to clusters exhibiting higher fluctuation. Overall, the proposed combination of clustering and RNN demonstrates strong potential in producing accurate traffic accident forecasts.

Keywords: *Traffic Accidents, Forecasting, Machine Learning, K-Means Clustering, Recurrent Neural Network (RNN).*