

ABSTRACT

Traffic congestion in urban areas is one of the main challenges in modern transportation management. This condition not only causes delays and time inefficiencies but also contributes to increased air pollution. The high level of traffic density necessitates a predictive technology-based approach to support fast and adaptive decision-making. This study aims to develop a video-based traffic density prediction system by integrating two main approaches: the YOLOX algorithm for vehicle detection and Long Short-Term Memory (LSTM) for time series forecasting. Traffic video data were collected directly from a pedestrian overpass (JPO), then processed through frame extraction and bounding box annotation. The YOLOX model was used to detect the number of vehicles per frame, and the results served as input for the LSTM model to forecast vehicle counts five minutes ahead. Evaluation results show that the YOLOX model achieved excellent detection performance, with $mAP@50$ (test) of 98.5% and $mAP@75$ (test) of 91.6%. Meanwhile, the LSTM model produced accurate predictions with an MAE of 0.0905 and RMSE of 0.1173. This system has also been successfully implemented as a web-based application, allowing users to upload videos and view prediction results visually. These results demonstrate that the developed system has the potential to support data-driven decision-making for more efficient traffic management in urban environments.

Keywords: *YOLOX, LSTM, Traffic Forecasting, Video, Deep Learning.*