ABSTRACT

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Vehicle movement counting and classification is one of the critical components for traffic intersection monitoring and management. Cameras can be used to determine the vehicle movement counts (left-turning, right-turning, and through movements). Typically, cameras are installed with the view focused towards a particular approach and there is no overlap or very low overlap between the different camera views. Therefore, vehicles need to be re-identified across multiple cameras to detect the complete movement trajectory of the vehicle. The state-of-the-art re-identification approaches based on CNN visual similarity can be used to generate the vehicle movement counts at a traffic intersection. However, their performance is impacted due to high traffic volume with visually similar looking images. In this study, we proposed combining visual similarity obtained using Convolutional Neural Networks (CNN) and temporal similarity (vehicle re-appearance time across cameras) using logistic regression (LR) model to perform vehicle re-identification. The logistic regression model has been used in two stages (without and with hard-negative mining) combining visual and temporal similarity. The results showed that using the hard-negative mining based LR model, the Top@1 results improved by 22% and Top@5 results improved by 8.48%, compared to the results obtained using

only visual similarity measure for generating the rankings. Further, a movement classification model is also developed to segregate different types of vehicle trajectories captured in the camera views, so that the representative images pertaining to different vehicle movement category can be generated effortlessly. We tried two different types of supervised learning approaches: Random forests, and Long Short-Term Memory (LSTM) networks. A performance comparison between both types of models using various evaluation metrics suggests LSTM networks are comparatively better for segregating the vehicle movements.