ABSTRACT

VEHICLE SPEED ESTIMATION BASED ON CONSECUTIVE FRAME APPROACHES USING REGRESSION MODELS AND DEEP IMAGE HOMOGRAPHY ON MONOCULAR VIDEOS

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22/507077/SPA/00888

Vehicle speed detection is widely developed because it is essential in applying speed limit regulations for traffic management. In this research, the vehicle speed estimation model consists of four main steps involving vehicle detection using YOLOv8, vehicle tracking using ByteTrack, converting the distance from the pixel domain to the road plane in the real-world domain using a deep image homography transformation network and scale factor estimation, and vehicle speed estimation using consecutive approach improved using the regression model. This research proposed a novel vehicle speed estimation model based on a consecutive frame approach, improved using regression models and a deep image homography transformation network for transforming the monocular image into a bird's eye view image, which can automatically estimate the intrinsic and extrinsic camera parameters for optimizing the result of measurement in real-world conditions. This study provided a new primer video dataset, which was taken on the pedestrian bridge of the Faculty of Veterinary Medicine of Universitas Gadjah Mada and the Ambaramarga pedestrian bridge. This dataset contains accurate speed information obtained by a system based on a speed gun.

Based on the experimental study, the proposed vehicle speed estimation model performs well. The first proposed model using Multiple Linear Regression performed best in RMSE of 2.37897 km/h and MAE of 1.68977 km/h. By analyzing the comparison of the regression model to improve the first proposed method, we conclude that the second and third proposed models perform the best results in RMSE, performed by ElasticNet Regression of 2.27370 km/h with the improvement of 4.42% and in MAE performed by Lasso of 1.44304 km/h with the improvement of 14.60%.

Keyword: Vehicle Speed Estimation, Homography Transformation, Computer Vision.