Thesis Title	Classification of Motorcycle Riding Pattern Based on Computer Vision and Machine Learning
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ABSTRACT

Motorcycle accidents have become fatal road accidents in many areas, especially in developing countries. Many studies on vehicle detection have been published, but most of them focus on four-wheel vehicles. However, research on motorcycles is not sufficient, and no one has verified the detection efficiency of motorcycles. This research provided a comparison of CPU and GPU in the TensorFlow model and examined the performance of 34 different machine learning models in motorcycle detection under different conditions. The experiment included 13 video sets with a total of 672 frames. Three different views of the motorcycle (front, top, back) and different resolutions of the image were taken into account. Model efficiency was calculated by the quotient of detection accuracy and time. By lowering the resolution, efficiency has improved significantly on most models. The model that provides the most efficiency for front, and, and top is CenterNet HourGlass104 512x512 with efficiency above 300.

Another process is a new framework for using recorded video footage to detect abnormal riding in three dangerous cases: weaving, swerving, and drifting. The methodology consists of two main steps. First, we localized the motorcycle into a video frame using the best model from previous experiment. Next, obtaining centroid of the detected motorcycle and then using two linear regression models. Ordinary least

squares (OLS) and random sample consensus (RANSAC) have been tuned to find linearity. Riding patterns with high regression values tend to be normal riding. In the experiment, OLS worked well to distinguish between normal and abnormal driving. An OLS score or R-squared threshold of around 0.95. For classifying abnormal pattern, OLS can separate normal pattern and drifting pattern from the other two abnormal patterns by using R-squared score. Polynomial regression model was implemented to fit curve line such as swerving pattern and weaving pattern. OLS and Polynomial models could not classify sub-group of abnormal patterns such weaving (Big curve), and weaving (Small curve). Classification tree algorithm was applied to classify all the patterns. Therefore, 70/30 training and testing method, 10-fold cross validation were implemented. 70/30 training and testing method gave 70.5 % classification accuracy. 10-fold cross validation provided slightly higher classification accuracy than 70/30 method with 75.7% classification accuracy. Straight pattern, drifting (both big, and small curve) pattern, weaving (Big curve) was easily to be classified. On the contrary, swerving pattern was the most difficult to be classified.

Keywords: Abnormal Riding, Motorcycle Detection, Deep Learning, Machine Learning