Deep learning-based helmet wear analysis of a motorcycle rider for intelligent surveillance system

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Abstract— Automatic helmet wear analysis of a motorcycle rider is a promising video surveillance application, as the helmets are indispensable for saving the lives of humans from head injuries during road accidents. This article presents an intelligent video surveillance system for automatically detecting the motorcyclists with and without safety helmets. If the motorcyclists are found without the helmet, his/her license plate (LP) number is recognised to initiate further actions such as deduction of penalty amount from one's account linked with the vehicle license and Aadhar Number (Applicable to Indian Scenario) by the traffic police and the legal authority. First, the foreground objects are segmented, using Gaussian mixture model (GMM) and then labelled. Afterwards, the proposed system adapts faster region-based convolutional neural network (faster R-CNN) for the detection of motorcycles in the labelled foreground objects to ensure the presence of motorcyclists. Subsequently, faster R-CNN is also used for the detection of the motorcyclists with and without helmet. Finally, the LP number of the motorcyclists without the helmet is recognised, using character-sequence encoding CNN model and spatial transformer (ST). The proposed framework is evaluated, using the performance metric and mean average precision (mAP) on the surveillance dataset and it outperforms the state-of-the-art algorithms.