**LITERATURE SURVEY**

## 1) Bird’s eye view localization of surrounding vehicles :Longitudinal and lateral distance estimation with partial appearance

**AUTHORS: E. S. Lee, W. Choi, D. Kum**

# On-road vehicle detection is essential for perceiving driving settings, and localizing the detected vehicle helps drivers predict possible risks and avoid collisions. However, there are limited works on vehicle detection with partial appearance, and the method for partially visible vehicle localization has not been explored. In this paper, a novel framework for vehicle detection and localization with partial appearance is proposed using stereo vision and geometry. First, the original images from the stereo camera are processed to form a v-disparity map. After object detection using v-disparity, vehicle candidates are generated with prior knowledge of possible vehicle locations on the image. Deep learning-based verification completes vehicle detection. For each detected vehicle, partially visible vehicle tracking algorithm is newly introduced. To track partially visible vehicles, this algorithm detects the vehicle edge on the ground, defined as the grounded edge, and then selects a reference point for Kalman filter tracking. Finally, a rectangular box is drawn on the bird’s eye view to represent vehicle’s longitudinal and lateral location. The proposed system successfully performs partially visible vehicle detection and tracking. For testing the localization performance, the datasets in a highway and an urban setting are used and provide less than 1.5 m longitudinal error and 0.4 m lateral error in standard deviation.

# 2) Robust vehicle detection by combining deep features with exemplar classification

**AUTHORS:**  **L. Cao, Q. Jiang, M. Cheng, C. Wang**

Very recently, vehicle detection in satellite images has become an emerging research topic with various applications ranging from military to commercial systems. However, it retains as an open problem, mainly due to the complex variations in imaging conditions, object intra-class changes, as well as due to its low-resolution. Coming with the rapid advances in deep learning for feature representation, in this paper we investigate the possibility to exploit deep neural features towards robust vehicle detection. In addition, along with the rapid growth in the data volume, new classification methodology is also demanded to explicitly handle the intra-class variations. In this paper, we propose a vehicle detection framework, which combines Deep Convolutional Neural Network (DNN) based feature learning with Exemplar-SVMs (E-SVMS) based, robust instance classifier to achieve robust vehicle detection in satellite images. In particular, we adopt DNN to learn discriminative image features, which has a high learning capacity. In our practice, the leverage of DNN has achieve significant performance boost by comparing to a serial of handcraft designed features. In addition, we adopt E-SVMs based robust classifier to further improve the classification robustness, which can be considered as an instance-specific metric learning scheme. By conducting extensive experiments with comparisons to a serial of state-of-the-art and alternative works, we further show that the combination of both schemes can benefit from each other to jointly improve the detection accuracy and effectiveness.

# 3) Detection and classification of vehicles for traffic video analytics

**AUTHORS** **: A. Arinaldi, J. A. Pradana, A. A. Gurusinga**

We present a traffic video analysis system based on computer vision techniques. The system is designed to automatically gather important statistics for policy makers and regulators in an automated fashion. These statistics include vehicle counting, vehicle type classification, estimation of vehicle speed from video and lane usage monitoring. The core of such system is the detection and classification of vehicles in traffic videos. We implement two models for this purpose, first is a MoG + SVM system and the second is based on Faster RCNN, a recently popular deep learning architecture for detection of objects in images. We show in our experiments that Faster RCNN outperforms MoG in detection of vehicles that are static, overlapping or in night time conditions. Faster RCNN also outperforms SVM for the task of classifying vehicle types based on appearances.

# 4) Development of a deep-learning based automatic tunnel incident detection system on cctvs

**AUTHORS** : **K. B. Lee, H. S. Shin, D. G. Kim**

In this paper, Object Detection and Tracking System (ODTS) in combination with a well-known deep learning network, Faster Regional Convolution Neural Network (Faster R-CNN), for Object Detection and Conventional Object Tracking algorithm will be introduced and applied for automatic detection and monitoring of unexpected events on CCTVs in tunnels, which are likely to (1) Wrong-Way Driving (WWD), (2) Stop, (3) Person out of vehicle in tunnel (4) Fire. ODTS accepts a video frame in time as an input to obtain Bounding Box (BBox) results by Object Detection and compares the BBoxs of the current and previous video frames to assign a unique ID number to each moving and detected object. This system makes it possible to track a moving object in time, which is not usual to be achieved in conventional object detection frameworks. A deep learning model in ODTS was trained with a dataset of event images in tunnels to Average Precision (AP) values of 0.8479, 0.7161 and 0.9085 for target objects: Car, Person, and Fire, respectively. Then, based on trained deep learning model, the ODTS based Tunnel CCTV Accident Detection System was tested using four accident videos which including each accident. As a result, the system can detect all accidents within 10 seconds. The more important point is that the detection capacity of ODTS could be enhanced automatically without any changes in the program codes as the training dataset becomes rich.

**5)** **Online Self-Supervised Multi-Instance Segmentation of Dynamic Objects**

**AUTHORS**: A. Bewley, V. Guizilini, F. Ramos, and B. Upcroft

This paper presents a method for the continuous segmentation of dynamic objects using only a vehicle mounted monocular camera without any prior knowledge of the object's appearance. Prior work in online static/dynamic segmentation [1] is extended to identify multiple instances of dynamic objects by introducing an unsupervised motion clustering step. These clusters are then used to update a multi-class classifier within a self-supervised framework. In contrast to many tracking-by-detection based methods, our system is able to detect dynamic objects without any prior knowledge of their visual appearance shape or location. Furthermore, the classifier is used to propagate labels of the same object in previous frames, which facilitates the continuous tracking of individual objects based on motion. The proposed system is evaluated using recall and false alarm metrics in addition to a new multi-instance labelled dataset to measure the performance of segmenting multiple instances of objectss.