Automated Vehicle Detection and Classification with Probabilistic Neural Network

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Abstract—The number of vehicles in the urban areas is rising at high pace. The critical issues are arising with the rise in the number of vehicles for the traffic analysis. The analysis of the vehicle running across the roads is usually done for the density analysis, traffic shaping and many other similar applications. The vehicle detection in the rushed areas produces the real challenge of independent component selection and classification, which requires the precise object detector with deep analytical ability based classification algorithm. In this paper, the unique method with probabilistic neural network (PNN) classification model along with the non-negative matrix factorization for the purpose of vehicular object localization and classification in the urban imagery. The proposed model is expected to solve the problems associated with the accuracy, precision and recall.

Keywords-- Probabilistic neural network, Non-negative matrix factorization, object detection, object classification.

I. INTRODUCTION

The techniques of automatic vehicle classification are very important, many real world applications can be accomplished based on these techniques such as motorway surveillance system, toll collection, breakdown road side, fare collection, etc. [10] Many classification models such as neural network, support vector machine or other models have been utilized for the classification of the vehicles, some of which are successful, but there are still some challenges such as change in illumination, image scale, image quality, image size and image color. The techniques based on computational intelligence methods such as genetic algorithms and neural networks have been introduced for the vehicle classification. Neural networks are the networks which work according to the human mind. The neural networks are based on the neurons of the human mind, as the neurons of the human mind work, similar is the work of the neurons of the neural network. Neural networks have the ability to learn and adapt the complex non-linear patterns and thus complex problems can be optimized using genetic algorithms. Various surveillance system employed these techniques. [1]

There is an increasing demand for traffic monitoring of densely populated areas. The flow of the traffic can be measured by fixed installed sensors like induction loops, bridge sensors and stationary cameras. [7] Traffic on smaller roads and on-road parked vehicles is not collected.New optical sensor systems such as Ikonos and Quick Bird provide images of 1-meter resolution or better take wide-area images of the entire road network. Hence with the help of these new optical sensor systems traffic monitoring and vehicle detection can be achieved considerable attention on international conferences. The presented approach focuses on the detection of single vehicles by extracting of queues of vehicles from satellite imagery. [4]

The vehicle fleets in continuous increasing as the population of the countries is increasing, so to monitor the vehicle fleets in an emerging necessity. [1] A number of cities especially in the developing countries use field based equipment such as cameras installed at fixed locations or weigh-in motion sensors on pavements to monitor traffic. Recently video imaging and airborne imaging is tested especially to provide more comprehensive view of traffic and to monitor traffic trajectories. Aerial photography has also been evaluated

and the newly available imagery at very high resolution provides a new opportunity and starts also to be considered. [9] The sensor of SAR images is independent from day/night and weather condition but it causes distortion, the presence of buildings that hides some roads and its analysis is very much affected by the experience of the interpreters. [5]

For fuel demand assessments, traffic management, traffic emissions estimates in crowded metropolitans areas prone to accumulate air pollutants, vehicle enumeration is required. On regular intervals vehicle enumeration is required to estimate the future vehicle fleet, as on regular interval basis the average of the vehicle fleet increased can be calculated, and thus the future vehicle fleet can be calculated. This future vehicle fleet is important for planning transport infrastructure. In crisis areas (areas of roads with hurdles or collisions) vehicle enumeration at different moments in time may provide insight on the severity of the crisis and/or how an area is affected and is recovering from a disaster. Satellite imagery provides information to ground measurements. Satellite imagery is a snapshot in time that covers relatively vast area. [7] For many cities in the developing world satellite imagery may be the only information that can be obtained with the given amount of time and budget. [2] Satellite imagery is also not intrusive and can be used to enumerate vehicles or estimate vehicles fleets for the countries which there is not any ground based traffic monitoring systems or that have experienced a disaster that prohibit access to area or measurement.

Recently, many researchers have proposed various techniques for detecting moving vehicles in variable bit-rate video streaming. A motion detection approach was proposed to control this situation by using the fisher's linear discriminant-based radial basis function neural network. An additional artificial neural networks called cerebellar-model-articulation-controller network was employed or motion detection. [2]

The Probabilistic Neural Network (PNN) through artificial neural network detect moving vehicles more precisely and more completely, from video streams, than can state-of-the-art-background subtraction method on account its ability to successfully adapt to bit-rate variations in video streams. [2]

II. LITERATURE REVI.EW

Lee et al. (2009) has worked on the convolution deep belief networks. This research worked for unsupervised learning of the hierarchical representations. This research paper produces a model which is translation invariant. This uses the top-down and bottom-up probabilistic inference.

Sayanan Sivaraman et al. (2013) has worked on vehicle detection, localization and tracking of the vehicles. This research help to solve the problem of lane movement which is based on vehicle tracking for driver assistance. This research provides the adequate accuracy for the detection of the vehicles. But this technique works only on the 11 fps videos thus speeding cars capture can be easily skipped.

Sayanan Sivaraman et al. (2013) has worked on the vision based vehicle detection. This research works on the problem of monocular and stereo-vision domains. This research also help analyzing filtering, estimation and dynamical models. But this technique is slower and path tracking is less accurate.

Sebastian Tuermer et al. (2013) has worked on the HOG based Vehicle Detection technique. This research helps for the detection of the vehicles in the dense traffic areas which have limited space. This research produce the results fast and accurate.

Thomas Moranduzzo et al. (2013) has worked on the automatic counting of the number of cars from the UAV images. This research gives the car counting algorithm. UAV images are very high spatial resolution images, on which this research based. This research produce the accuracy for counting the cars only in 2 cm.

Yi-Ling Chen et al. (2013) has worked on the urban video surveillance. This research has worked on the digital surveillance system in the video surveillance cameras of the urban areas. This research has produce high accuracy and the positioning accuracy (position where the vehicle is placed) is also high.

Chen et al. (2013) has worked on the target vehicle's detection and tracking in the city on the basis of the license plate number. This research uses the cloud computing technology for massive data analysis. This uses the pattern recognition technique in combination with data retrieval and analysis automatic from traffic video surveillance.

Pigou et al. (2014) has worked on the automatic sign language recognition. This research uses the convolution neural network (CNN), Microsoft Kinect and GPU acceleration. This research has a special feature of feature construction.

Thomas Moranduzzo et al. (2014) has worked on the catalogue based vehicle detection from UAV images. This research uses the technique of HOG with SVM for the detection of the vehicles from high spatial resolution images. This research provides higher accuracy of higher number of possible movements of direction (36 directions).

Chen et al. (2015) has worked on the probabilistic neural network based moving vehicle extraction. This research help to solve the problem of active traffic surveillance in the high and low bit rate video data. This research detects the moving vehicles from video stream based on probabilistic neural network.

III. FINDINGS OF LITERATURE REVIEW

The proposed method will use a combination of the Adaptive Shape based connected component (ASCOC) extraction with non-negative matrix factorization (NMF) based feature compression along with Probabilistic Neural Networks (PNN) for the features extraction and positioning for the vehicle detection. The proposed system would be designed to perform better than the bare neural network in the existing algorithm for the purpose of vehicle detection. The NMF will perform the image reconstruction and representation, which will improve the quality of the image. The proposed method will include the vehicle classification on the basis of various parameters and properties or vehicles such as color, type, shape or size. The proposed model utilizes the deep learning behavior based neural network to learn the objective in the repetitive manner with in-depth analysis which inspires the use of probabilistic neural network (PNN). Additionally the proposed algorithm would be capable of performing the classification of the detected vehicles in an image. Both of the techniques, existing and proposed would be developed in this research project.

IV. METHODOLOGY

The research project based on automatic vehicle detection and classification with intelligent computer based techniques will be developed using MALTAB simulator. The MATLAB version 11 or above will be used to develop the research project. At first, all the requirements of the algorithm design will be studied thoroughly. Then, the proposed algorithm design would be analyzed and corrected according to the notifications in the design analysis in the first phase. The corrected and modified algorithm in its initial phase would be then implemented in the MATLAB simulator. The first step of the proposed algorithm will be to detect the objects in the captured frame. Then, the image would be analyzed for the objects detected as vehicles in the given image. In this step, all remaining selections would be discarded. In the next step, then algorithm will be programmed to discard the objects unlike vehicles and will make the final selection with the vehicle like objects only. The visual properties based algorithm with knowledge based system would be utilized for the purpose of the vehicle detection in the first phase. To accurately classify and position of the vehicle, the automatic vehicle classifier must be aware about the actual location of the vehicle in order to classify the detection vehicle in the given image. The visual features are extracted using the non-negative matrix factorization (NMF), which are further used for the purpose of vehicle classification using the neural network. Then the object would be analyzed in the 3-D space for the classification purposes using the hybrid deep neural network (HDNN). Following, the classified vehicle is presented in the given presentation formation such as specified colour or coloured bounding box around the detected and classified vehicular object.

V. CONCLUSION

The proposed model is based upon the probabilistic neural network (PNN) classification model. The proposed model aims at solving the problem associated with the object detection and marking. The correct object detection and marking system can boost the overall performance of the object detection models. The probabilistic classification with multi-layer neural networks enables the learning system to recognize the objects from the multiple perspectives, which eventually increases the overall accuracy of the object classification systems. The proposed model has been designed for the purpose of vehicular object detection in the urban road imagery, which will be utilized for the linear classification across the images collected from the urban roads. The proposed model will improve the overall results of the proposed model against the existing models.

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