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Study of Various Vehicle Detection Techniques –A Review

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ABSTRACT- the Vehicle detection is used to identify the vehicles in any video or image file. The process of detection of vehicles includes the object detection by considering the vehicles as the primary object. By taking the images form aerial or horizontal view and from road or parking using surveillance cameras, the detection process can be initiated. In this paper, authors proposed a novel algorithm to identify the density of vehicles by using the vehicle detection and classification algorithm by implementing the hybrid deep neural network over the huge dataset of video and images that are obtained from the satellite images. For feature extraction Non-negative Matrix Factorization (NMF) and compression is used. Where, compression is used to increase the response time for detection and classification. Proposed system is able to identify the vehicles as partial object or full object in any given image. This will provide the vehicles density their movement reports and upside or downside reports of highways to the researcher. Proposed system will help them to detect and classify the vehicles with the main objective to produce the robust system by accessing the given image video frame with higher precision and accuracy.

Keywords- Image analysis, artificial neural networks (ANN), vehicular classification, vehicle density evaluation.

I. INTRODUCTION

Vehicle detection and classification plays crucial role in traffic monitoring and management. The application of vehicle detection and classification is very vast. Vehicle detection is used on roads, highways, parking or any other place to detect or track the number of vehicles present on the spot. This will help the surveillance to judge the traffic vehicles, average speed and category of vehicle. There are number of object detection techniques are available to detect and classify them. Object Detection is a method that finds instances of world objects like pedestrians, faces, vehicles and buildings in pictures or in videos. It uses extracted features and therefore the learning algorithms for recognizing the instances of object class. Applications that uses object detection method are image retrieval, security, surveillance, automatic vehicle parking systems. Object detection uses numerous models: Feature primarily based on object detection, SVM classification, and Image segmentation. There are many classification algorithms that are being utilized for the main aim of the vehicular detection and classification. Primarily we are using the probabilistic, non-probabilistic or square distance based object detection and classification mechanisms. The classification technique like Support Vector Machine (SVM), co-forest , k-nearest neighbor, neural network, random forest etc are being utilized for the vehicular detection and classification. Using neural network one may also learn and reconcile advanced non-linear patterns. Neural network possesses artificially intelligent bio-inspired mechanism that may be helpful for feature extraction. Neural network is a feedback network wherever the feedback is forwarded to neural network. During this network individual neurons are tiled therein a manner so that they can visualize the overlapping regions. Biological processes are the root of neural network. In order to reduce amount of preprocessing, multilayer perceptron's are designed. Basically used for the recognition of

image and video. They are used as the powerful technique for many image problems. The neural work term relates with the multi-layered analysis like the human brains. To make it possible there are number of layers present to analyze the dataset from the multiple dimensions. The neural network also possesses the convolution or iterative behavior of the data analysis. The fusion of multiple techniques behavior is enabled by neural network by adding up the particular data feature to extract the features. By combining the complicated behavior with the deep neural network to the particular extracted features is notified because of the hybrid deep complicated neural network.

1.1 Applications of vehicle detection:

- Vehicular density evaluation in the urban areas for the traffic shaping
- Automatic parking system to decide which vehicle type if allowed
- For automatic counting and information gathering about the vehicles coming in or going out of the parking lots
- Aerial surveillance of the vehicular objects in the urban areas
- Vehicle tracking on the roads across the countries

In this paper, the model can be based upon the amalgamation of the neural network with non-negative matrix factorization along with other image processing techniques such as image de-noising and vectorization has been used for the purpose of the vehicle detection and classification. The neural network has been proposed to fulfill the requirements of vehicular classification over the imagery data. Neural network learning is the sub-branch of machine learning methodology, which is entirely based upon the high-level data abstractions fundaments of the neural classification with model architecture with complex structure or other non-linear transformations in the composition of multiple objects. The learning of model can be using multi-layered neural network has been applied over the various image processing application, data mining, object recognition, NLP, ASR, etc, where this approach has been performed remarkably well, which is the inspiration behind the use of the neural network in our research project of vehicular detection model.

II. LITERATUTE SURVEY

Yi-Ling Chen et. al. [1] proposed an intelligent and novel Video Surveillance System for self driven vehicle detection technique and Tracking in Clouds and the installation of surveillance of video surveillance cameras is done to keep the vehicle dataset containing the vehicles. For detecting any suspicious threat, human interaction is needed. There are lots of other potential security problems that are detected using the help of automated methods. The methods used to detect and classify the vehicles when uncontrolled environment is there. Proposed models performance can be evaluated by improvement in accuracy.

Thomas Moranduzzo. [2] Has proposed the UAV (unmanned aerial vehicle) detection technique for images with a catalog-based approach. Existing systems work with monitoring operation that some areas are classified to make the detection of vehicle faster and robust. Concurrently, to extract features of HOG, filtering operations are used in vertical and horizontal. Then the orientation value of possible 36 directions which is actually the vehicle points that is computed by searching the highest value of similarity measure and in the end avoids duplicity, as unmanned aerial vehicle images data has very high pixel resolution so there may be a possibility that a car may be identified more than once. So, in the end of HOG extraction same car are merged. The accuracy performance of proposed system is higher number of possible 36 directions of movement.

Sayanan Sivaraman.[3] has proposed an Integrated lane method for vehicle tracking, detection and localization. Porposed sytem developed the Synergistic approach to fuse the vehicle tracking and lane for the assistance of driver. The result of proposed model is obtained by the improved performance of vehicle and lane tracking. Detection of vehicle has achieved an adequate accuracy level.

Sebastian Tuermer [4] has proposed Airbone vehicle detection in very dense urban location by using the HOG features with Disparity Maps. The main objective of proposed model is to analyze and describe the chain of integrated real time processing. The input dataset consist the two subsequent images, a global DEM, exterior orientation data and a database. Similar or overlapped areas are extracted by region growing algorithm. After then the remaining parts classification of input data is conducted that is based on features of HOG. This will produce the faster and accurate results.

Sayanan Sivaraman [5] has proposed a model for looking at vehicles on the road. Authors discusses the detection of vehicle based on vision, behavior analysis and tracking. They defines the algorithm for on road vision based detection of vehicle and also the classification algorithm. They classify the branch of vehicles which further refers to spatiotemporal measurements and trajectories tracking. The proposed model achieved improvement with high accuracy that is effective with and trajectory tracking and spatiotemporal measurements.

Thomas Moranduzzo [6] has proposed an algorithm for Automatic Car Counting method for UAV images. Proposed system includes multiple steps i.e. the first step is used for the asphalted zones screening. So that the particular area where vehicle is detected is restricted and may reduce the false alarms. By using this method feature extraction is done more accurately and effectively. In the end, the key points extracted from vehicles belongs to same vehicle is fused together to achieve “one key point-one car”. The accuracy result of positioning for vehicles counting and the cars within 2cm can be obtained using real UAV scene.

Chen, Bo-Hao, and Shih-Chia Huang [7] have proposed neural networks primarily based on extraction of moving vehicles for surveillance to intelligent traffic. Proposed model uses the moving vehicles that can be detected in any resolution range.

Authors & Year of Publication	Techniques Proposed	Problem addressed	Advantages	Disadvantages
2015. Chen, Bo-Hao, and Shih-Chia Huang[7]	Probabilistic neural network based moving vehicle detection .	Active traffic surveillance in the high and low bit rate video data.	Vehicle detection in video data can be classified as NP-hard problem. The proposed model solves the latter problem effectively.	Block estimation procedure along with neural network makes the whole process slower. Does not perform the active density analysis.
2013. Sayanan Sivaraman[3]	Vehicle Detection, Localization & Tracking	Lane movement based vehicle tracking for driver assistance	Adequate accuracy for vehicle detection	Technique works on 11 fps video only. It must be able to work on high speed cameras. Otherwise speeding cars captures can be easily skipped
2013. Sayanan Sivaraman [5]	Vision Based Vehicle Detection	monocular and stereo- vision domains, analyzing filtering, estimation and dynamical models	spatiotemporal measurements & trajectory tracking is effective for higher accuracy	Vision based vehicle detection technique is slower. Trajectory tracking is less accurate.
2013. Sebastian Tuermer [4]	HOG Based Vehicle Detection	Vehicle detection in the dense traffic areas in the limited space	Produce the results faster and accurate.	HoG Descriptor is not efficient to detect the objects with the similar color to the background.
2013. Thomas Moranduzzo [6]	Automatic Car Counting from UAV images	Car counting algorithm from high spatial resolution images.	Positioning accuracy for counting the cars is only 2 cm.	High False Positive Ratio. False positive ratio is Improved but still not worth.
2013. Yi-Ling Chen et. al. [1]	Urban Video Surveillance	Digital Surveillance system in the video surveillance cameras	High Accuracy. Positioning accuracy is also higher.	Slow process. Low frames per second in the video.
2014. Thomas Moranduzzo [2]	Catalogue based Vehicle detection from UAV images	HoG with SVM based vehicle detection.	Higher accuracy of higher number of possible directions of movement (36dir	Positioning error is higher at 38 cm. High False positive ratio.

III. RESEARCH GAPS

- The existing model evaluates the overall density of the vehicles but does not classify them in order to evaluate the traffic more effectively over the urban roads.
- The existing model for the vehicle detection lacks in analyzing the density over the roads after classifying and identifying the specific type of the vehicles in order to prepare the traffic shaping and planning to reduce the congestion across the busy roads in the urban areas.
- The busy tunnels, where the congestion occurs almost every day, the traffic shaping method can be applied to allow the computed number of vehicles per day in order to reduce the traffic.
- The block-wise processing for the estimation of the vehicular class with neural network makes the whole process slower and tedious due to the inclusion of the slider window function. The execution time can be reduced by using the reduced feature component with fast classification.
- The existing models are capable of vehicular detection only and does not produce any of the time series based vehicular traffic density and analysis. The exiting model does not perform any vehicle classification based on the size like whether the vehicle is heavy or light. The system does not create the vehicular analytical framework for the vehicular detection, classification and time based analytical study.

IV. CONCLUSION

The vehicle detection and classification are the models utilized primarily for the vehicular traffic surveillance, data collection and relevant applications. The vehicular detection and classification models require the hierarchical approach for the template matching based object detection with probabilistic or non-probabilistic classification algorithms. There are several challenges which occur for the implementation of the state of the art system for the vehicular classification and modeling. In this paper, we have proposed the new age model for the vehicular detection and classification with high density vehicular database. The proposed model is being developed over the low frame rate cameras which two or three frames per second. The proposed model will evaluate the vehicular type and classify them properly in order to evaluate the traffic density categorized in the vehicular type. The study obtained from the proposed model would be utilized for the traffic management policy making by analyzing the rush hours and the reasons behind the congestion during the rush hour. The optimal steps could be taken during the rush hours, such as the heavy weight carriers can be stopped from entering the congested highways to maximize the average traffic movement speed. The proposed model is expected to improve the performance of the vehicular classification over the performance measures of precision, accuracy and recall. In the future, the proposed model would be realized to achieve the goal of vehicular classification and the detection in the captured frames from the traffic surveillance cameras.

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