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Study of Vehicular Traffic Using Hybrid Deep Neural Network

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ABSTRACT: The Vehicle detection is method to detect the vehicles in the image or video data. The vehicle detection is the branch of the object detection, where the vehicle is the primary object. The vehicle detection can be performed on various kinds of the vehicle data obtained from the horizontal, aerial, parking or road surveillance cameras. In this paper, the vehicle detection and classification method has been proposed by using the hybrid deep neural network over the image data and video obtained from the aerial and satellite images to determine the vehicle density. The non-negative matrix factorization (NMF) will be utilized for the feature extraction and compression for the purpose of vehicle detection and classification. The 2nd level feature compression will be performed to create the quick response vehicle detection and classification system. The proposed model will be programmed to detect the maximum vehicles visible as full or partial object in the image. The vehicle density reporting, vehicle movement reporting and upside & downside reporting for highways will be performed to achieve the goal of the vehicle detection and classification. The aim of this research is to produce the robust algorithm to detect and analyze the vehicle features in the images and videos with higher accuracy and precision**.**

KEYWORDS: Vehicle detection; compressed feature extraction; ANN object detection; Multi-class detection; Classification.

I. INTRODUCTION

Object Detection is a process which finds instances of real world objects like faces, vehicles (bicycles, cars, buses, etc), and pedestrians, buildings in images or in videos. It uses extracted features and the learning algorithms for recognizing the instances of object category. Applications that uses object detection process are image retrieval, security, surveillance, automated vehicle parking systems. Object detection uses various models: Feature based object detection, SVM classification, Image segmentation.

Vehicle detection plays a very important role in the traffic highway, surveillance control and urban traffic planning [1]. Vehicle detection on road process is used for vehicle tracking, counts, each individual vehicle average speed, traffic analysis and also categorization of vehicle [3].

Vehicle detection and enumeration from satellite imagery requires pre-processing. Very high resolution satellite sensors provide imagery with different viewing angles, different atmospheric conditions that in urban areas can be affected by pollution and illumination conditions. In addition, when multi-temporal imagery is analyzed scene spectral characteristics may also have changed [12]. The aim of this work is to assess the potential of very high resolution satellite imagery for vehicle detection and enumeration from two satellite imagery – Ikonos and Quick Bird and compare the two data sources, develop procedures of image pre-processing that can increase the performance of the classifiers, test automated feature extraction procedures over two satellite images of Baghdad. This work is part of a study aiming to detect and enumerate vehicle fleets over large metropolitan areas and compare them through time to derive a societal activity index .The main advantage of vehicle detection technique is that, it is reliable and cost effective.The applications of vehicle detection are as follows -

- *On road vehicle detection-* The existence of large metal objects like cars or trucks have been detected even in the situation when the vehicle is not in motion.
- *Automated car wash detection-* An automated car wash system prefers to be in standby mode until the car wash didn't detect any vehicle so that power consumption is low.

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- *Drive-through vehicle detection and business indication*-Restaurant drive through require reliable vehicle detection system. Because drive-through sensors are generally located outside to warn them about customer arriving. There are number of factors like wind, rain that can detect the reliability of detection system.
- *Car wash status*-In car washes, indicators lights are often used to indicate to the customer that which stage is currently running.
- *Railroad crossing road*
- *Traffic monitoring(speed and direction)*
- *Parking meters*
- *Parking space detection*

Rest of the paper is organized as follows: Section 2 discusses the Literature survey that is an account of what has been published on a topic by accredited scholars and researchers. Section 3 discusses the role of neural network in vehicle detection Section 4 research gaps have been discussed in which we make comparison between the existing model and the proposed model. Section 5 is the Problem formulation and methodology which discusses the need and significance of proposed research work and planning of the proposed model. Section 6, the last section is the Conclusion and future scope discusses the summary of the research in proposed project and the future scope of the proposed research

II. LITERATURE SURVEY

Yi-ling Chen et al. [1] have developed an intelligent urban Video Surveillance System for Automated vehicle detection and Tracking in Clouds and the installation of digital surveillance system in video surveillance cameras is done to obtain the image or vehicle data containing the vehicles. There is a need of human inspection for detecting the threats. Problems of potential security are detected with the help of automated methods. The technique used to detect and track vehicles when uncontrolled environment is there, is Snake Eye. In this existing system the improvement in result is high accuracy and positioning accuracy is also high.

Thomas Moranduzzo [2] has developed the detecting cars in UAV (unmanned aerial vehicle) images with a catalog-based approach. In this existing system, it works with screening operation in which asphalted areas are identified to make the detection of cars faster and robust. Concurrently, filtering operations are carried out in horizontal and vertical to extract HOG features. Then the orientation value which is actually the car points that is calculated by searching the highest value of similarity measure in 36 possible directions. And the last step is to avoid duplicacy, as UAV images has very high resolution so there is a possibility that a car is identified more than one time so in the end points belong to same car are merged. The technique used in this is HOG & SVM. The achievement of this system is higher accuracy of higher number of possible directions (36 directions) of movement.

Sayanan Sivaraman [3] has developed the integrated lane and vehicle detection, localization and tracking. This system developed the Synergistic approach to combine the lane and vehicle tracking for driver assistance. The result of this system is obtained by the performance of lane tracking and vehicle tracking is improved. Vehicle detection has achieved adequate accuracy.

Sebastian Tuermer [4] has developed Airbone vehicle detection in dense urban areas using HOG features and Disparity Maps. The objective of this paper is to describe the integrated real time processing chain. This chain then utilizes multiple occurrences of objects in images. The input data contains two subsequent images, exterior orientation data, a global DEM and a round database. Similar areas are excluded by region growing algorithm. then the classification of remaining parts of input data is taken place which is based on HOG features. The faster and the accurate results are produced.

Sayanan Sivaraman [5] has developed Looking at vehicles on the road: A Survey of vision-based vehicle detection, tracking and behavior analysis. It defines the on road vision based vehicle detection, tracking and behavior analysis. It also describes the branch of vehicular research which refers to the spatiotemporal measurements, trajectories and features to distinguish on road behavior. The improvement is achieved with high accuracy with effective spatiotemporal measurements and trajectory tracking.

Thomas Moranduzzo [6] has developed Automatic Car Counting method for unmanned aerial vehicle images. In this, the first step is the screening of asphalted zones so that the area where car is detected is restricted and false alarms are reduced. After that feature extraction is done. At last, the key points belongs to same car is coupled to achieve “one key

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point-one car". The result of this is positioning accuracy for counting the cars is 2cm which is obtained with the help of real UAV scene.

Chen, Bo-Hao and Shih-Chia Huang [13] has developed probabilistic neural networks based moving vehicle extraction algorithm particularly for intelligent traffic surveillance systems. In this paper moving vehicles has been detected only in low and high resolution. Result of detection is accuracy analysis.

III. ROLE OF NEURAL NETWORK IN VEHICLE DETECTION

Using neural network one can also learn and reconcile complex non-linear patterns. Neural network possesses artificially intelligent bio-inspired algorithm that can be useful for feature extraction. Neural network is a feedback network where the feedback is further forwarded to neural network. In this network individual neurons are tiled in that manner so they react to overlapping regions visually. Neural network are influenced by biological processes. In neural network, in order to reduce amount of preprocessing, multilayer perceptions are designed. They are used for image and video reorganization. They act as a power tool for many vision problems.

A. HYBRID DEEP CONVOLUTION NEURAL NETWORK

The hybrid deep convolution neural network (HDCNN) is the form of advanced and in-depth analysis based neural network to analyze the data in more detail. The deep neural work term relates with the multi-layered analysis like the human brains [13]. The involvement of higher number of layers in the deep neural network makes it possible to analyze the data from the multiple dimensions. The convolution neural network is defined as the convolution or iterative behavior of the data analysis. The convolution neural networks analyze the data by analyzing it again and again in the iterative manner over the given set of layers (Single-layer model in most of the cases) to better learn the data. The convolution neural network inherits the ideas of learning the objective by repeating it again and again to gain the perfection the given topic. The hybrid behavior is enabled by adding up the specific data feature extraction model along with the neural network [1]. The amalgamation of the convolution behavior with deep neural network over the specifically extracted features is notified as the hybrid deep convolution neural network or HDCNN

The proposed method will use a combination of the non-negative matrix factorization along with Hybrid Deep Convolution Neural Networks 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 proposed model will be using the amalgamation of Non-Negative Matrix Factorization (NMF) and Hybrid Deep Convolution Neural Network (HDCNN). The NMF will perform the image reconstruction and representation, which will improve the quality of the image. The proposed solution using HDCNN will perform its operation on the reconstructed image of higher quality, and will produce improved vehicle detection results than the existing algorithm, which is solely based upon HDCNN

IV. RESEARCH GAPS

- The existing model is based upon the vehicular detection methods using the probabilistic neural network. The accuracy of the existing model has been recorded lower nearly at 61.75% measured by similarity and 69.38% measured by F1-Measure error. The accuracy of the system can be improved using the deep neural network along with the feature compression for the faster processing.
- The block estimation procedure along with neural network makes the whole process slower, because of the slider window fashion based object detection and classification. The speed of the system can be improved by using the block feature compression method using the vehicle shape specific localized feature descriptor for optimization of the elapsed time.
- The existing model is 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 kind of vehicle classification. The system does not create the vehicular analytical framework for the vehicular detection, classification and time based analytical study.

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IV.PROBLEM FORMULATION AND METHODOLOGY

In the existing solutions, the neural network has been used for the vehicle detection in the high and low-bit rate CCTV videos [1]. The authors have used the neural network is a form of neural network has been used to evaluate the targeted objects from the high resolution satellite images [1] [3] Neural Networks is an artificially intelligent bio-inspired algorithm which can be used for the feature extraction as per described in the base paper. Neural network is a type of feed forward neural network where the individual neurons are tiled in such a way that they react to overlapping regions in a visual field [13]. Neural networks were inspired by biological processes and are interpretation of multilayer perceptrons which are designed to use minimal amounts of preprocessing [1] [13] They are widely used models for image and video recognition, being a power tool for different vision problems. The basic problem of the existing scheme is this that the existing scheme is capable of vehicle detection only [1]. The existing scheme does not perform any classification on the obtained vehicle data. The vehicle data can be classified on the basis of various parameters, such as vehicle type, color, shape or size [1] [5].

At the first step, the literature review will be conducted on the concerned neural network techniques for the vehicle detection and image reconstruction. The techniques will be shortlisted for the creation of the hybrid model for the vehicle detection based on the neural network techniques. The problem formulation would be formed after finding the research gaps in the existing vehicle detection models. The proposed model would be framed and finalized using the repeated rounds of algorithm improvement and theoretical debugging. The proposed and existing models would be implemented in the MATLAB simulator and the results would be collected in the form of various performance parameters. The collected results would be analyzed in-depth and the conclusion would be prepared to project the final results of the proposed model.

VI. CONCLUSION AND FUTURE SCOPE

The proposed model has been aimed at solving the problem of vehicle detection and classification for the purpose of vehicle density analysis over the highways and other areas in the cities. The major idea of this research is to develop the highly precise vehicle detection and classification model by using the neural network and important feature descriptor. The proposed model is aimed at helping the administration to build the adaptable traffic shaping strategies for the crowded highways in the urban areas. The proposed model results would be evaluated using the performance measures of the precision, accuracy, recall etc. In the future, the proposed model will be realized and implemented to achieve the goal of the vehicle detection and classification**.**

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BIOGRAPHY

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