**Title of the Research:**

Detecting and Counting different Vehicles in the real time Traffic Signal using deep learning

**Objectives:**

With the vigorous growth of economy and the improvement of living standards, numbers of vehicles are increasing continuously and sharply. Vehicles have made people’s lives more comfortable and convenience, but meanwhile traffic congestion has also become a very serious problem. To alleviate traffic congestion and improve transportation operation efficiency, accurate and timely traffic flow information is strongly needed for individual drivers and Traffic Management Departments. Based on the above problems, the objective of this research revolves around the following problem statements:

1. Detect the different Vehicles passing the traffic signal
2. Identify the computing time to evaluate the faster computation algorithm
3. Tracking of the Special Vehicles and Emergency Vehicles to surpass the traffic congestion if required
4. Prioritizing the Green Signal Time to accommodate traffic directions having no vehicles

**Introduction:**

Traffic is one of the most important word that makes a commuter tense whether commuting to the office or for any urgent work. This has become one of the most important factor of any government body to take care of this existing and ever increasing problem of the traffic congestion. This has called for the implementation of the smart trafficking systems which will not only try to optimize the flow of the traffic in one particular direction by controlling the time of the green light rather to check for the history of the number of vehicles being allowed to pass in the part history with the very minimal congestion. From the statistica.com, the total number of vehicles being sold in the year 2016 has increased by 111% in comparison to the year 2015 and this is likely to follow the similar trend. In this work we present a very unique and systematic approach towards the solution for the connected traffic system (CTS) along with the Optimizing the Congestion Time of the Signal (OCTS). After a thorough research for using the surveillance cameras as one of the agent to tract the vehicles for the main reasons of the congestion, some of the important factors that has been taken into the account are the individual trained Convolutional Neural Networks (CNN) for the object detections. The performance and the computation time for the individual detection of the vehicles and types of the vehicles puts a major break-through in our analysis.

**Related Work:**

When looking into the measure of dealing with the Smart Traffic Management System (STMS), many works has been done in order to take care and avoid such scenarios. In Tseng, Fan-Hsun, et al., there has been a considerable amount of work that has been done in the part of the congestion detection [1]. In this paper a SVM based real time traffic congestion was predicted (SHRTCP). This tried to forecast the car speed for the next instances trying to predict the traffic congestion. One of the most important factor in the smart cities for the futuristic approach is the use of some of the advanced management techniques like the use of Advanced Traffic Management Systems (ATMS) and Advanced Traveler Information Systems (ATIS) [2]. The major purpose of the use of the ATMS and ATIS is to control the traffic and to improve the overall traffic management systems. Some of the things that has been taken care are the reducing the emissions, noise and the travel times which are some of the challenging factor of any Traffic Management Systems (TMS). Apart from the computer vision based models that try to detect the roads and decide the number of the vehicles which in turn try to find the congestion. In this paper, we try to define a multi staged system that can be beneficial in deciding the time for which the green light should be on for a particular direction but also try to optimize the whole congestion taking into account all the direction that the particular traffic system should take. The Connected Traffic Management System (CTMS), trues to mimic a traffic police who decides the management of the traffic at a particular traffic junction. Most of the algorithms that are used for the analysis of the traffic management system are the deep neural networks for the detection of the number of the of the individual vehicles and other objects that are present in the road that makes the system to count the objects and then predict the number of the vehicles that are going to be present on road in next few instances [3]. According to the research, a very few amount of experiment has been done towards the traffic management system using the multi-model deep neural networks with the attention mechanism which acts as one of the major backbone for the recurrent neural networks to learn the pattern and the sequence of the traffic evolution. The pattern which might look as a very simple in nature might depend on a number of factors such as the weather, political and economic conditions of the region [7]. As a most challenging part of the traffic flow, some of the major features that can be taken into the consideration for the non-free flow situations can be summarized as speed, density, journey time etc. [3]. As the basic module of our adaptively and jointly multimodal deep learning model, a CNN-GRU based and attention mechanism-supported hybrid structure is proposed to solve the traffic flow forecasting problems, which can learn the long temporal dependencies and spatial-temporal correlation features of each traffic related sequence data. This work aims to improve the multi-level feature learning ability by using a multimodal deep learning architecture, which is crucial to make it more robust and flexible in handling traffic flow forecasting problems [8].

A lot of traffic management research has been done in order to have a very smooth and lesser congested traffic. The researchers have done a lot of research not only in the field of detecting the congestion using the computer vision through the surveillance cameras rather a lot of work has been done towards the deep learning and agent based systems. A traffic forecasting model was proposed that used computer simulation of the transportation system [11].

**Proposed Plan:**

**Dataset:**

Several datasets have been released for object detection challenges. Researchers publish results of their algorithms applied to these challenges. Specific performance metrics have been developed to

take into account the spatial position of the detected object and the accuracy of the predicted categories. The whole analysis will start with developing the object detection module on the standard datasets available over the internet. Some of the standard datasets are:

1. Pascal 2 Dataset: It consists of 10000 images with 20 different categories
2. COCO Dataset: It consists of 120000 images with 80 different categories
3. ImageNet Dataset: It consists 500000 images with 200 different categories

**Model Development:**

The models that will be taken into the consideration are as below,

1. R-CNN (Region-based Convolutional Network)
2. Fast-RCNN (Fast Region-based Convolutional Network)
3. Faster R-CNN (Faster Region-based Convolutional Network)
4. You Only Look Once (YOLO)
5. Single Shot Detector (SSD)

For identifying the number of vehicles passing through the signal can be SORT algorithm. In total in this research total of 5 algorithms will be used for the detection and counting of the vehicles.

**Evaluation Metric:**

The metrices that is to be considered over here is not only the accuracy of the detection of the objects rather the time of computation which is our main factor to decide upon the algorithm. Before going to that let me define what is mAP. Average Precision (AP). For the VOC2007 challenge, the interpolated average precision (Salton and Mcgill 1986) was used to evaluate both classification and detection. For a given task and class, the precision/recall curve is computed from a method’s ranked output. Recall is defined as the proportion of all positive examples ranked above a given rank. Precision is the proportion of all examples above that rank which are from the positive class. The AP summarises the shape of the precision/recall curve, and is defined as the mean precision at a set of eleven equally spaced recall levels [0,0.1,...,1]: AP = 1/11 ∑ r∈{0,0.1,...,1} pinterp(r). The precision at each recall level r is interpolated by taking the maximum precision measured for a method for which the corresponding recall exceeds r: pinterp(r) = max p(r˜), where p(r˜) is the measured precision at recall ˜r.