ISSN No:-2456-2165

# Smart Traffic Management using Deep Learning

B. B. Waghmode, Namokar Magdum, Vardhaman Patil, Vishal Kumar
Department ofComputer Engineering
Sinhgad Institute of Technology and Science, Nahre
Savitribai Phule Pune University

**Abstract:- The recent era is marked by rapid improvement and advances in technology. One of the most essential areas that demand improvement is the traffic signal, as it constitutes the core of the traffic system. This demand becomes stringent with the development of Smart Cities. Unfortunately, road traffic is currently controlled by very old traffic signals regardless of the relentless effort devoted to developing & improving the traffic flow. These traditional traffic signals have many problems including inefficient time management in road intersections; they are not immune to some environmental conditions, like rain; and they have no means of giving priority to emergency vehicles. In this paper, we present the architecture of our proposed Smart Traffic Signal controller. We present local traffic management of an intersection based on the demands of future Smart Cities for fairness, reducing commute time, providing reasonable traffic flow, reducing traffic congestion. Traffic problem are increasing day by day and it is becoming a serious problem in the recent world [2]. Various traffic monitoring systems have been developed. Traffic is always a complex and challenging problem due to a mixture of different types of vehicles as well as the large number of vehicles on road. To improve the traffic management, it is critical to develop a real time traffic flow estimation system which can detect, classify and count vehicles, detect traffic violation at any given time. In this study, a multi-vehicle detection and tracking approach was proposed to achieve these requirements.**

## I. INTRODUCTION

The traffic congestion problem is increasing day by day everywhere around us and must be solved more intelligently considering the continuous increase in traffic in not-so distant future. Among most proposed solutions like building more infrastructure or improving citizen commute patterns, creating an intelligent control system to manage the traffic flow comes to be a better and most efficient solution. The more intelligent control system part over here means to use more sophisticated timing algorithms with the help of machine learning algorithms to solve the problem autonomously. Instead of using fixed time intervals system should be able to set variable timers to each lane.[1] These variable timers should be computed by the algorithms based on different traffic conditions in real-time. Using such solutions in real life can positively affect various characteristics of a daily commute, especially in metropolitan cities. It may also help in saving many valuable resources like time and fuel while managing the smooth traffic flow with the least stops possible.

Due to increase in the no. of roads and vehicles, traffic control has become an essential part of intelligent transport system. Many researches have been conducted for traffic management applications based on image and video processing approaches.[7] The analysis of traffic video data includes detection of vehicles, counting of vehicles, congestion of traffic and collisions of vehicles. These applications have become popular recently due to the availability of low-cost cameras and embedded devices.
Real-time videos pose several challenges for automated traffic analysis.[2] The difficulties faced by the automated system include the presence of shadows, occlusion of vehicles, Environmental variations such as rain, fog, dust, etc., which normally degrade the performance.

Existing traffic prediction approaches can be roughly categorized into 2 types, that is, model-based approaches and data-driven approaches.[4] A model-based approach mimics the traffic dynamics by explicitly adopting traffic flow models. Once the traffic simulation system is well established, traffic prediction can be achieved through the evolution process of the system. In comparison, a data-driven approach establishes a mapping between historical traffic flow and its future prediction but does not presume a traffic flow model to describe the dynamics of a transportation system. With the development of big data and deep learning, data-driven prediction models have attracted more attention and achieved superior performances. However, as far as we can tell, there is no one traffic prediction model that consistently outperforms other models under any traffic condition and for any traffic dataset. The solution must be intelligent and has decision-making capabilities depending on the different situations in the different lanes. There are different phases of the proposed model. The first phase is video processing. The continuous video stream from the traffic camera situated at the traffic signal junction is fed to the model. During the video processing, the frames are extracted from the video input. There are hundreds of frames present in a stream of few seconds, so it is not possible to process each frame and it is not required because there is no such significant change in the vehicle density between two consecutive frames. Therefore, each frame after a particular time interval is taken. Then shrinking the size of the frame is done from the actual size of the frame to 416 x 416 pixels. After this phase, the processed frame is fed to the model for object detection. The neural network extracts the features and identifies the object using bounding boxes. The total vehicle count of a lane is passed to the dynamic traffic signal timer algorithm. The algorithm considers the density of all the other lanes and calculates the relativity between them. Depending on which, it classifies the lane in either low, medium, or high

ISSN No:-2456-2165

vehicle density class, it decides the green signal timer for a particular lane.

## II. LITERATURE REVIEW

Surging traffic levels and increasingly busier roads are common issues across the globe. Consequently, there is an increasing requirement to develop intelligent traffic surveillance systems that can play a crucial role in highway monitoring and road management systems. Author Jose Melo et al. have addressed challenges of lane detection with the help of segmentation and clustering methods. The algorithm they have used is the Public Transportation facilities and Equipment Management System (PTMS) algorithm, which helps in resulting input to higher-level traffic monitoring systems like estimating traffic speed, frequency of lane changes, and accident detection. Alvin Abdagic [5]et al. proposed a solution to memorize stationary vehicles, detecting turning movement using an optical flow algorithm. Instead of relying heavily on the sensors, their solution uses CPU processing. Thus, reducing the costs of both development and maintenance. The process contains a video capture using infrared (IR) cameras converted into frames of intensities of traffic. Using these intensities optical flow is calculated and a magnitude is generated. The main problem which arises while detecting the vehicles is identifying the lane and vehicles present in that lane. In the proposed study, a system to count the number of vehicles on roads is discussed. The method involves analyzing a sequence of road images to determine the flow of vehicles for the given time and place.

The proposed Surging traffic levels and increasingly busier roads are common issues across the globe. Consequently, there is an increasing requirement to develop intelligent traffic surveillance systems that can play a crucial role in highway monitoring and road management systems. Author Jose Melo et al. have addressed challenges of lane detection with the help of segmentation and clustering methods. The algorithm they have used is the Public Transportation facilities and Equipment Management System algorithm, which helps in resulting input to higher-level traffic monitoring systems like estimating traffic speed, frequency of lane changes, and accident detection. Alvin [5] et al. proposed a solution to memorize stationary vehicles, detecting turning movement using an optical flow algorithm. Instead of relying heavily on the sensors, their solution uses CPU processing. Thus, reducing the costs of both development and maintenance. The process contains a video capture using infrared (IR) cameras converted into frames of intensities of traffic. Using these intensities optical flow is calculated and a magnitude is generated. The main problem which arises while detecting the vehicles is identifying the lane and vehicles present in that lane. A solution to this problem is given by Prashant Jadhav et al. using image processing in MATLAB. [2] In the proposed study, a system to count the number of vehicles on roads is discussed. The method involves analyzing a sequence of road images to determine the flow of vehicles for the given time and place.

The proposed method used an ANN model to estimate vehicle densities, traffic flow rates, and vehicle trajectories on different video captures of road intersections. Surojit Dey [4] et al. proposed a solution that is efficient and fast which uses image processing, data mining, and artificial neural network. The proposed method measures the average speed of traffic and traffic density from cameras in real time. The processing speed was faster as well. However, only prediction and estimation of the traffic system were done. There is no proper solution to the traffic congestion problem. To give an optimal solution regarding the traffic congestion, Jingwei [10] Cao et al. used a You Only Look Once and SSD (Single Shot multi-box Detector) model which are one of the current mainstream object detection frameworks based on deep learning. A Faster R-CNN and regression idea of YOLO realizes the detection and classification of multiple bounding boxes based on a simple end-to-end network that works on the KITTI dataset. We additionally implemented the program of wrong side vehicle detection in addition to impose the fine for that vehicle.

## III. RELEVANCE

To develop a system of smart traffic management using Deep Learning due to limited resources provided by current infrastructure and increase in number of road users. In various countries the traffic problems are being increased day by day and traffic is becoming a more severe issue. The main cause for increment in traffic deadlocks is the increment in the number of transportation objects, the deprived development of roads and no appropriate allocation of resources. To control the traffic is a very difficult job and only the traditional system cannot control this serious system. Traffic survey is the study to determine the number, of movement, & classification of vehicles at a given time. The survey exercises are important for the relevant authorities to perform planning & design of traffic facilities, estimating road usage and traffic trends, measuring current demand to decide priorities for improvement and road expansion.

## IV. MOTIVATION

The primary motivation for this kind of solution can be said to be the increasing transportation in major cities. Fast transportation systems and rapid transit systems are vital for economic developments for any state. More population means more vehicles on the streets day-by-day. Traditional traffic management systems are not built with the consideration of increasing traffic at this high pace.[6] Thus, it cannot keep up with the variable changing traffic conditions daily. In the past few years, fields like machine learning and computer vision have developed to be so better and easy to implement these days. Using concepts like deep learning to detect the vehicles and automatically adjust accordingly helps in many ways for better transportation flow. An algorithm can be created to detect the patterns of the traffic flow and react accordingly. This not only makes the system robust but also more efficient in managing the traffic. Traffic flow prediction is an essential part of the intelligent transport system. This is the accurate estimation of traffic flow in a given region at a particular interval of time in the future. The study of traffic forecasting is useful in mitigating congestion and make safer and cost-efficient travel. Traffic management is the arranging, observing and

control or impacting of activity. It expects to: boost the adequacy of the utilization of existing foundation; to guarantee dependable and safe operation of transport; to address ecological objectives; and guarantee reasonable assignment of framework space among contending clients. Traffic monitoring system developed so far are primarily focused on structured traffic that is not the case in a country like ours. Development of overhead structures can't be considered as avail an option since it increases the cost substantially, the same goes for under the road construction. Necessity to analyze traffic pattern, near real time reporting and simultaneous conduction of smooth traffic-flow. Our country (India) is the second largest population of world; according to that vehicles are increased day to day life. Here, the questions arise! how to avoid the congestion in the road; that means traffic management. [Google]

Sample Dataset 1

Sample Dataset 2

## V. CONCLUSIONS

In this article, a smart traffic control system is proposed which can be widely used in a smart city application for optimal traffic flow of vehicles. For smooth flow of traffic, it is necessary to handle traffic congestion properly. The system takes the real-time traffic data, captured from the pre-installed cameras at the intersection as input for the object detection phase and calculates the number of vehicles for density estimation. These densities are given to the timer algorithm as input for manipulating the green signal timer of the consecutive lanes. The timer algorithms are capable of handling multiple scenarios based on the practical condition which removes the flaws of the traditional static timer. The main advantage of the proposed method is the use of video processing over sensors which reduces the setup cost, low maintenance, and relatively more durability and accuracy.

## REFERENCES

[1]. Indrabayu , Rizki Yusliana Bakti , Intan Sari Areni , A. Ais Prayogi "Vehicle Detection and Tracking using Gaussian Mixture Model and Kalman Filter" , 2016 International Conference on Computational Intelligence and Cybernetics Makassar , Indonesia , 22-24 November 2016

[2]. Li Xun , Nan Kaikai , Liu Yao , Zuo Tao "A Real-Time Traffic Detection Method Based on Improved Kalman Filter", 2018 3rd International Conference on Robotics and Automation Engineering (ICRAE) Guangzhou, China , 17-19 November 2018

[3]. Safoora Maqbool, Mehwish Khan, Jawaria -Tahir, Abdul Jalil, Ahmad A li, Javed Ahmad Vehicle Detection, Tracking and Counting" 2018 IEEE 3rd International Conference on Signal and Image Processing (ICSIP) Shenzhen, China, 13-15 July 2018

[4]. R. Krishnamoorthy, Sethu Manickam "Automated Traffic Monitoring Using Image Vision". The 2nd International Conference on Inventive Communication and Computational Technologies (ICICCT 2018) Coimbatore, India, 20-21April 2018

[5]. Jess Tyron G. Nodado, Hans Christian P. Morales, Ma Angelica P. Abugan , Jerick L. Olisea , Angelo C. Aralar , Pocholo James M. Loresco " Intelligent Traffic Light System Using Computer Vision with Android Monitoring and Control" , Proceedings of TENCON 2018 - 2018 IEEE Region 10 Conference Jeju

[6]. Sayan Mondal, Alan Yessenbayev, Jahya Burke, Nihar Wahal, "A Survey of Information Acquisition in Neural Object Detection Systems", 32nd Conference on Neural Information Processing Systems (NeurlPS 2018), Montreal, Canada

[7]. Muhammad Hanif Tunio, Noor Ahmed Shaikh, Imran Memon, Riaz Ahmed Shaikh, Ghulam Ali Mallah, Yumna Magsi Automation of Traffic Control System Using Image Morphological Operations" 2020 International Conference on Information Science and Communication Technology 978-1-7281-6899-9/20//$31.00 ©2020 IEEE

[8]. Asha C S, A V Narasimhadhan "Vehicle Counting for Traffic Management System" 978-1-5386-1112-8/18/$31.00 ©2018 IEEE

[9]. Mingqi Lv , Zhaoxiong Hong, Ling Chen , Tieming Chen, Tiantian Zhu , and Shouling Ji , Member, IEEE "Temporal Multi-Graph Convolutional Network for Traffic Flow Prediction" 1524-9050 © 2020 IEEE. https://www.ieee.org/publications/rights/index.html

[10]. Dongfang Ma, Xiang Song, and Pu Li "Daily Traffic Flow Forecasting Through a Contextual Convolutional Recurrent Neural Network Modeling Inter-and Intra-Day Traffic Patterns" 1524-9050 © 2020 IEEE. https://www.ieee.org/publications/rights/index.html