**Traffic Management through Density Estimation**

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**Abstract**

Start with brief introduction and then write whole methodology in short and obtained results.

According to World Health Organization census 2021 approximately 1.3 million lives gets cut short as a result of road traffic crash. Between 20 – 50 million more people suffer from non – fatal injuries, resulting as a disability. Road traffic injuries cause considerable economic losses to individuals, their families, and to the nations as a whole. In fact road traffic crashes cost most countries 3% of their gross domestic product.

Road accidents are outcomes of reckless and speedy driving of vehicles, not obeying traffic rules, the “right of the mighty” attitude of bigger vehicles towards smaller ones, overburdened hauling of public and transport vehicles, poor maintenance of the vehicles, drink and drive, and above all the terrible condition of the already chocked roads with every inch invaded by unauthorized persons and properties. Delays due to all the above reasons of traffic congestion at the junctions cause people to exceed speed limits leading to increased road accidents that calls for more adequate traffic management system.

1. **Introduction**

Display sample images of datasets with that explain the problem. Write some description about each problem.

**Traffic congestion** is a condition in transport that is characterised by slower speeds, longer trip times, and increased vehicular [queueing](https://en.wikipedia.org/wiki/Queuing_theory). Traffic congestion on urban road networks has increased substantially since the 1950s. [1] When traffic demand is great enough that the interaction between vehicles slows the speed of the traffic stream, this results in some congestion. Traffic congestion wastes a huge portion of the national income for fuel and traffic-related environmental and socioeconomic problems.

[2] However, the traffic problem is very complicated due to the involvement of diverse parameters. First, the traffic flow depends on the time of the day where the traffic peak hours are generally in the morning and in the afternoon; on the days of the week where weekends reveal minimum load while Mondays and Fridays generally show dense traffic oriented from cities to their outskirts and in reverse direction respectively; and time of the year as holidays and summer. Secondly, the current traffic light system is implemented with hard coded delays where the lights transition time slots are fixed regularly and do not depend on real time traffic flow. The third point is concerned with the state of one light at an intersection that influences the flow of traffic at adjacent intersections. Also, the conventional traffic system does not consider the case of accidents, roadworks, and breakdown cars that worsen traffic congestion. In addition, a crucial issue is related to the smooth motion through intersections of emergency vehicles of higher priorities such as ambulances, rescue vehicles, fire brigade, police, and VIP persons that could get stuck in the crowd. Finally, the pedestrians that cross the lanes also alter the traffic system.

[3] The conventional traffic system needs to be upgraded to solve the severe traffic congestion, alleviate transportation troubles, reduce traffic volume and waiting time, minimize overall travel time, optimize cars safety and efficiency, and expand the benefits in health, economic, and environmental sectors. This paper proposes a simple, low-cost, and real time smart traffic light control system that aims to overcome many defects and improve the traffic management. The system is based on Image Processing through Machine Learning Algorithms that process the count of vehicles on the road, monitors the traffic volume and density flow, and changes the lighting transition slots accordingly.

Map

Description automatically generated with medium confidenceA picture containing text, way, tree, scene

Description automatically generated

(a)Vehicle Count Images – Image processing

1. **Related Work**

Write work done in this field with references.

The design of intelligent traffic control system is an active research topic. Researchers around the world are inventing newer approaches and innovative systems to solve this stressful problem. Models based on mathematical equations are applied to estimate the car waiting time at a junction, the number of cars in the waiting queue, the extension of the waiting cars along the lane, the optimal timing slots for green, yellow, and red lights that best fit the real and veritable situation and the efficient combination of routing. In fact, the mutual dependencies between nearby intersections lead to a complicated formulation with cumbersome parameters. These parameters are accidental, hazardous, dependent, and the worse point is the variance of these parameters with time. Thus, finding a dynamic, consistent, and convenient solution is quite impossible. Researchers from different disciplines are collaborating to explore feasible solutions that reduce traffic congestion. Therefore, various methodologies are constantly proposed in the literature and many techniques are implemented profiting from the technological advances of microcomputers, recent manufactured devices and sensors, and innovative algorithms modeling, as much as possible, the complication of traffic lights.

The IR sensors are employed in numerous traffic systems [5-9]. The IR transmitter and the IR receiver are mounted on either sides of a road. When an automobile passes on the road between the IR sensors, the system is activated and the car counter is incremented. The collected information about the traffic density of the different roads of a junction is analyzed in order to modify dynamically the delays of green light at the lane having the significant traffic volume. The whole system could be controlled by PIC microcontroller or even by PLC [10-11].

To inform the traffic system about the arrival of the emergency vehicles toward the junction, they are supported by RF emitters [12-14] that send warning signals to RF transceivers disposed at every traffic light intersection. The triggering sequences of the traffic lights are modified correspondingly in order to provide a special route to the emergency vehicles. Other researchers [15] use the Global Positioning System (GPS) to communicate with the traffic light controllers and send preemption signals. The ambulance was equipped with both RF to communicate with traffic light controller and the GSM module to report to hospital doctors about the patient status and to receive messages concerning the kind of therapy or first aid recovery that should be done to the injured patient [16].

Many works [17-18, 4] predict the density of the traffic based on image processing methodology. But these techniques require the acquisition of good images whose quality are weather dependent, especially with the rain and the fog. Other researchers use sophisticated algorithms to model the various states of the traffic such as fuzzy logic [19] and genetic algorithms [20].

Most published works are dedicated to one junction or intersection where the influence of the adjacent intersections is not examined. Thus, the situation becomes more complicated and widely dependent. Further efforts should be made to achieve complete modeling, monitoring, and control for multiple synchronized junctions.

1. **The Proposed Methodology**

Write one block diagram which should include all the steps of the proposed method. Write short description for each steps or block. Discuss all the features in detail below:

Diagram

Description automatically generated

* 1. **Feature 1**

Write all the steps of the preprocessing step that you have implemented. Display some sample results for each class. Add some equations for algorithmic steps. (Same for all features)

1. First of all we have to take the real time feed from the camera that has been attached on the traffic signal. We will directly take an image from it by processing our code and send it for further processing.
2. Image is converted to gray scale.
3. Clusters are formed using Eucledian distance (YOLO Algorithm).
4. Borders of clusters are formed representing area of each vehicle.
5. Categorized vehicles based on the matching features with the available dataset of vehicles.
6. Finally, counted the total number of vehicles.
   1. **Feature 2:**
   2. **Proposed architecture/ model**

Write in details about learning, training and CNN architecture. Mention reference here. Write some equations for loss function and other details.

We have made our model learn that it must analyze according to the data received at that moment. The model will tell us to operate which signal at which time on which lane. For that we have followed the following steps: -

1. First of all, we have found out the x and y axis length of the road and then calculated its area by multiplying them.
2. Then, we have found out the total area covered by the vehicle with the help of an equation.
3. Then we found out the density of the vehicles by the equation : area covered by vehicles / total area
4. According to the density, we have applied our algorithm and allotted RGY accordingly.

**Considered Features**

1. We have provided green signal to a lane if it has not been opened for last 140 seconds.
2. We have given green signal to the highly densed road.
3. Our algorithm will provide green signal until the last vehicle on the considered area of road passes the signal. Here we have considered 10 seconds for yellow light.
4. If there are less vehicles than we have allotted 3 seconds for green and 5 seconds for yellow followed.
5. If a lane has been green in an iteration, then it will not been considered again in immediate next iteration.
6. **Experimental Results**

Write nature, size and complexity of the dataset. Write about the measures, definition and equations. Write about existing systems and methods that you have implemented for r comparative study.

The data set consist only of images and an excel file. The images required for generating a single output are 4. We will count the number of vehicles in each image and then send it to analyze and hence generate output.

* 1. **Experiments on Individual features**

For these experiments, write result when single feature will be used. Sample results and Table. And explain why individual feature wont work /or issues. (This will justify the reason of combined features)

Results and tables

There are no issues currently here as our model is working at night as well as in rain/ foggy weather. We have a separate system for emergency vehicles as well.

* 1. **Experiment on combined features**

Sample results of the proposed and existing methods. Sample results(images) and Table.

Some failure cases of the proposed method. Write the reason for poor results.

1. **Conclusion and Future Work**

I will edit this part.

**References**

Write all the references that you have referred in the text. Please follow particular format for writing references. Try for APA format [ authors name, publication date, relevant info(page number)].

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