TRAFFIC ANALYSIS USING IMAGE PROCESSING

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Abstract— The vehicle congestion on the road is increasing day by day and also the management of such large traffic by traditional approach isn't adequate enough. To eliminate this problem, the project is developed using machine learning in which the testing model is trained to extract the needed image about traffic Information. Extracted information from image sequences of testing model can give us real information to create the database which is the captured images like accident, foggy places, collision of the vehicles, traffic signal, no traffic jam etc. take the image from testing model and processing the trained model which compares the new image and trained image and identify the reason for violation or reason for accident. Data processing will be done to determine the reason under the cause of the accident. This application is utilizing image processing methods designed and modified to the needs and constraints of traffic analysis. Therefore, it shows that it can reduce the traffic congestion and avoids the time being wasted.
Techniques proposed to analyze traffic by using image processing algorithms are:
• CNN algorithm
• Python (Machine Learning)

1. INTRODUCTION

Traffic flow monitoring and traffic analysis [4] is based on the computer visualization techniques, and specially traffic analysis and monitoring in a real-time mode raise valuable and complicated demands to computer algorithms and technological solutions. People in today's era usually have the tendency of using their own private vehicles for commutation rather than using public or pooled means of transport and this results in large number of private vehicles on road. This endless increasing number of vehicles on road gives rise to many problems amongst them, traffic congestion tops in every aspect. In such scenario one can't restrict individual to limit the usage of their private vehicles but what we can do is at least manage the traffic flow in a way that it doesn't alleviate congestion issues [11]. There are more negative impacts of traffic congestion which includes but are not limited to wasting time of motorists, inability to forecast travel time, higher chance of collisions due to tight spacing and constant stopping. The approach in this article focuses on methods of image processing, pattern recognition and computer vision algorithms to be

useful to road traffic examination and monitoring [13]. One of the most important aspect was to modify these algorithms to fit to real-time road monitoring processes, and as a consequence the model of system for traffic analysis was developed.

Machine learning (ML) [15] means that the computer can figure out a solution without being specifically programmed. That is, machines are able to continuously learn and deal with huge datasets using classifiers and algorithms. Classifiers, which categorize observations, are considered the backbone of ML. Meanwhile, other Machine Learning algorithms are built models of behaviors and use those models as a basis for making future predictions based on new input data. The power of these tools lies in detecting and analyzing network attacks without having to accurately describe them as previously defined. Machine learning can aid in solving the most common tasks including regression, prediction, and classification in the era of extremely large amount of data and cyber security talent shortage [12].

Machine-learning techniques have been applied in many aspects of network operation and management, where the system performance can be optimized and resources can be better utilized. Furthermore, there are many applications for analyzing the traffic based on the ML algorithms such as identifying anomalies through discovery-based workbooks or features that describe user behavior. The combination of machine learning algorithms and traffic analysis [6] is a good topic due to the power of machine learning tools that lies in detecting and analyzing network attacks without having to accurately describe them as previously defined. To develop this project, machine learning algorithms are used to inculcate the cause of the traffic and stating the reason for it. The algorithm used in the project is CNN algorithm [10] and the open CV tool python. The testing model is trained to extract the needed image about traffic information.

Extracted information from image sequences of testing model can give us real information to create the database which is the captured images like accident, foggy places, collision of the vehicles, traffic signal, no traffic jam etc. Extracting the image from the testing model and processing the trained model which compares the new image and the trained model and identify the reason for violation or reason for accident. Data processing will be done to determine the reason under the cause of the accident. This application is utilizing image processing methods [3] designed and modified to the needs and constraints of traffic analysis. Therefore, it shows that it can reduce the traffic congestion and avoids the time being wasted.

2. LITERATURE SURVEY

In literature [1], In this research object Detection and Tracking, Gaussian Mixture model along with Kalman filter were used to perform the task named object detection, to do so video input from signal were taken for processing. The video input taken as example was by considering both day and night time traffic scenario and its limitations. This research used format video as input with frame rate of 25 fps and resolution of 640 x 480. Data was taken from top of a pedestrian bridge with static camera position. The image detected was marked with blob area where the blob area corresponds to the object detected as vehicle. The image detected with blob forms a colorful bounding box around itself representing the detected object, whereas the image without blob area is left unbounded. The system created was validated for vehicle detection using Receiver Characteristic analysis.

In literature [2], As the current available extraction methods are not so efficient for processing the traffic basis data, an efficient acquisition method need to be presented in order to process the traffic condition. The method which is used in this paper is based on improved Kalman filter and gaussian to resolve the conflict of multi-moving vehicle targets detection. Also, heuristics improvement method was applied to improve the efficiency of detection. The method can effectively improve the noise interference and also possess the capability of detecting vehicle from continuous video frame. The main concept presented in this paper was related to no missing, no re-inspection, error detection while detecting the vehicle from the captured images. In literature [3], The paper presented here mainly focuses on the basic idea of creating an environment that uses low-cost camera and its functioning was on the basis of camera-based algorithm in order to process and control the traffic jam on the road. The detection of vehicle from the image

captured was done by subtracting the background and foreground images. Tracking of vehicles is done with the help of Kalman. The algorithm proves its efficiency by maintaining its accuracy of detection in day as well as night time from the videos acquired from CCTV camera and IR camera. Here, the detection of vehicle, counting and tracking was done with the help of computer vision. Also, to clearly discern the vehicle from background, BLOB analysis was performed. The model had enlarged its scope in detection and is more flexible in terms of cluster covariance.

In literature [4], The paper proposed an idea of creating an automated system to control the traffic jam and its flow management with the help of multiple CCTV cameras which are connected all over the internet. To implement this task the whole process is divided in to two sub-tasks: Vehicle Detection System and Traffic Scheduling Algorithm. Vehicle Detection was carried out by using Digital Image Processing and by applying a simple kernel-based Edge Detection and the concepts of Machine Learning was applied to classify the vehicle type into its categories. Scheduling algorithm is designed and optimized by keeping some major points in to consideration such as are low complexity, greater efficiency, and faster process time without compromising on the accuracy of the results. The designed system is extremely efficient and has also proved its beneficiary while using a simple 2MP CCTV camera.

In literature [5], The system designed was with basic components such as CCTV camera, laptop 3 board and a mobile application. The surveillance camera placed at the junction on the road were used in this project to capture the input data of the traffic. The captured images data were then sent to the server where the data is prepared before being preprocessed by the microcontroller. The vehicles from the images are detected using laptop 3 microcontrollers with the help of image processing and the result of the traffic conditions is send to the android-based application via Bluetooth. The information sent to the mobile user has all information regarding the traffic scenarios whether it is dense, sparse or moderate. The mobile user can switch the traffic light via an app also. Thus, an authorized user can view all the traffic patterns on cellphones and monitor the traffic easily at the intersection point on the road. In literature [6], this paper shows the work on traffic analysis and control till date. It helps to regulate the traffic the use of image processing and MATLAB systems. This concept makes use of computational images that needs to be compared with the actual images of the street taken in order to determine the density traffic percentage and setting the time for the traffic signals accordingly which are used to reduce the congestion of traffic. It helps to solve the real time scenarios in the streets, thus enriching the traffic lights by adding image receivers like HD cameras and image processors. In literature [7], this paper aims to conduct the traffic analysis using UAV-based videos and deep learning techniques. The road traffic video is collected by using a position-fixed UAV. The most recent machine learning methods are applied to identify the moving objects in the videos. The relevant mobility metrics are calculated to conduct traffic analysis and measure the consequences of traffic congestion. The proposed approach is validated with the manual analysis results and the visualization results.

In literature [8], E. Atkocinus et al. has proposed an approach for traffic problems and road monitoring like vehicle tracking, traffic jam detection, speed measurement and number plate detection. Vehicle tracking is based on contour extraction as it is extracted for edge linking process. Speed measurement is achieved my motion detection of the vehicle and number plate is recognized by the neural network technology.

In literature [9], Bharati Sharma has proposed automated vehicle detection which is based on the average filter to reduce the noise of the vehicle. It also discusses the differential morphological closing profile for the vehicle shape detection. To extract the target vehicle shape is also being discussed.

In literature [10], Penjaman Nikhasaz has proposed to render the automatic control system for traffic highways and road traffic based on contour extraction and motion of the vehicles. The methods used are background subtraction as it removes the background factors and it detects the foreground and gamma corrections for image contrasting adjustment. Active contour and morphological operations are also proposed.

In literature [11], James G Haran et al. has proposed the algorithms for road detection and environmental conditions and to analyze images from curved roads by using secondary Hough transformation. He also

discusses about the conversion of the grey scale images into a black and white image through thresholding.

In literature [12], Prathisha Gupta discussed about a model to count the traffic load by parameters like edge detection, labelling and removing the noise with the help of median filter. To get sharp and smooth boundaries, Gupta has proposed the median filter.

In literature [13], Benjamen Coifman proposed a vehicle detection and tracking the vehicles system which is used to operate under the various challenging conditions such as daylight, twilight and nighttime conditions. Instead of the entire vehicles to ne racked, only the features of the vehicles will be tracked so that it makes less sensitive to the problem.

In literature [14], Suresh Babu has proposed the automate traffic monitoring by identifying and classification of moving vehicles on the road. This system uses LABVIEW for image processing of vehicle images to extract the silent features.

In literature [15], Swaraj Raman et al. has discussed about the labeling algorithm to count the number of objects which has the ability to distinguish the certain overlapping objects.

3. DESIGN AND RESULTS

Architectural Diagram:
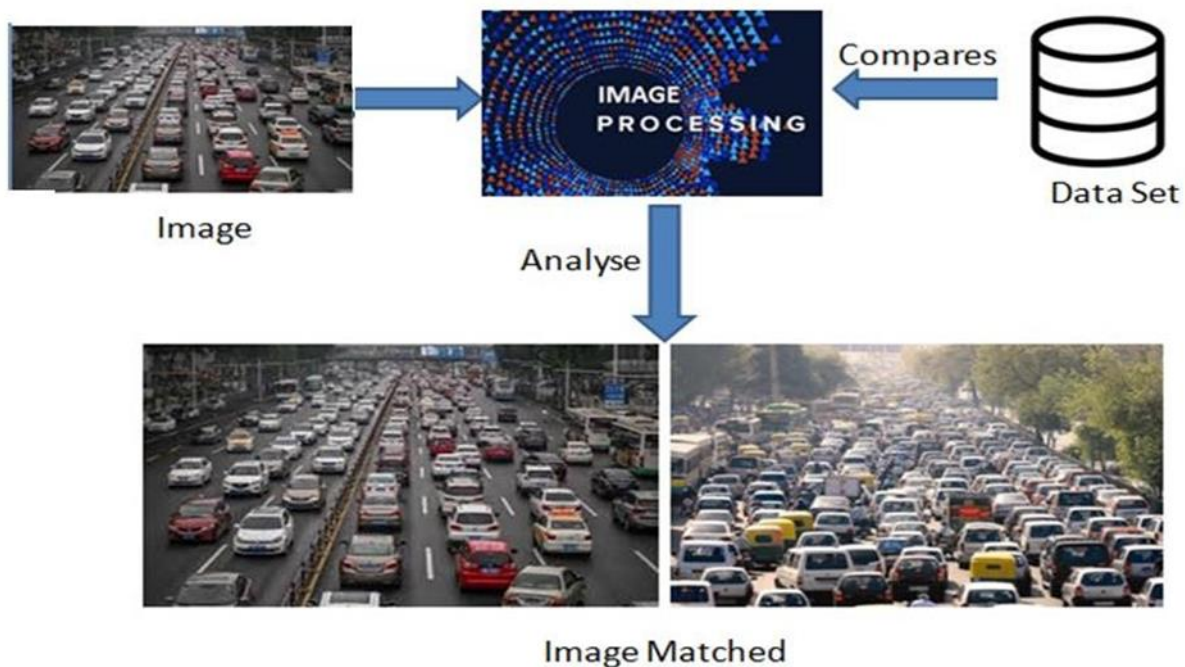
Traffic Analysis using image processing is designed based on the real-world scenario where traffic is a major problem in day-to-day basis. To resolve this, we are making use of CNN algorithm [10] to implement our project and showcase it in a better way. So, the aim of this work is to use the machine learning for traffic prediction. The existing use of machine learning for traffic prediction is in its infancy and it falls short in multiple aspects. Firstly, the datasets which are being used are relatively small in terms of the time duration of the traffic data [15]. Secondly, few of the machine learning techniques use data from testing model and trained model which are done by the researchers, although it is complimentary and useful. This project uses such datasets limited in their scopes as compared to the data systematically collected by the transportation authority. Thirdly, the existing literature machine learning techniques have not outlined any in-depth analysis of the configurations of machine learning networks

[6]. Therefore, additional work is required on the use of machine learning for road traffic prediction and modeling.

4. RESULTS

The proposed method offers a clear project roadmap that lists all the steps required to deliver a project successfully.

In order to examine the performance of the proposed approach, the results include:
•   Training the dataset
•   Analyzing the images
•   Cause of the traffic

Training the dataset:

The system is trained with the traffic images like collision of vehicles, traffic signal, accident etc. so that when the testing model is the traffic image, it needs to analyze the traffic image with the trained model.

Analyzing the images:

The traffic image which gets extracted by the testing model has to be analyzed with the traffic related images which are trained in the dataset. The algorithm used to recognize the images is CNN algorithm. CNN [5] is mainly used for image recognition and image classification.

Cause of the traffic:

When the traffic image is matched with the trained dataset then the cause of the traffic is stated. For example, if the detected image is an accident image, then it gets analyzed and gets matched with the trained dataset and will state the reason saying the traffic is caused due to an accident.

Image	Reason of Traffic
	Due to collision of vehicles traffic jam occurs
	Due to foggy weather traffic jam will be caused
	The path is clear so it indicates that there is no traffic jam
	Due to traffic signal traffic jam is caused

ACCURACY COMPARISON BETWEEN DIFFERENT CAUSES FOR TRAFFIC
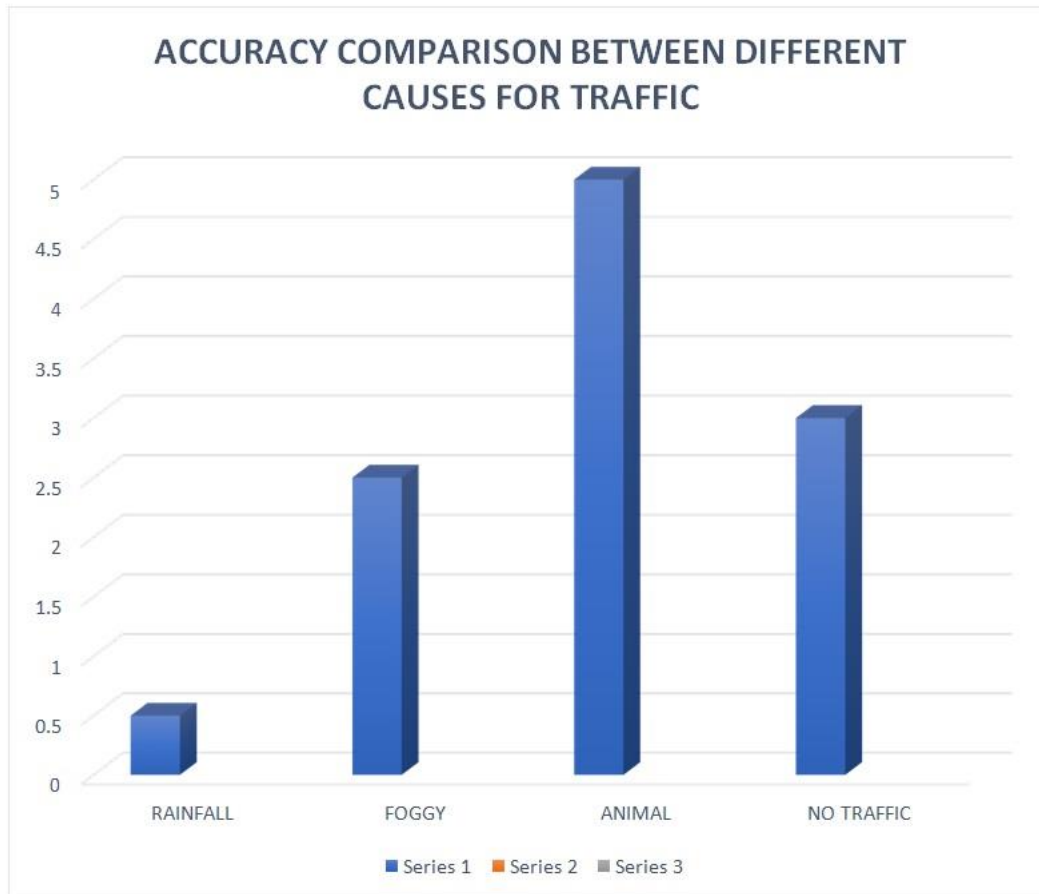
0.9426384 of accuracy achieved

5. CONCLUSION AND FUTURE WORK

Real Time Traffic Analysis [8] aims to fix the problem of traffic which most of the cities in urban as well as rural areas are dealing it. The paper discusses the using of machine learning techniques in traffic analysis. It gives a brief outline and comparison among some existing Machine Learning techniques approaches used in traffic analysis. It is more consistent in detecting the vehicle presence as it envisages the actual traffic frames [2]. This helps in utilizing image processing methods designed and modified to the needs and constraints of traffic analysis. Our project depicts and analyzes the traffic images and states the cause for the traffic. After processing the images [9], if the path is clear, it indicates us that there is no traffic jam. The proposed method is technically feasible to implement with low cost and with optimum accuracy. This project is more efficient and time saving. It helps drivers about routes with residual capacity [5]. Also, informs about which on- ramp to use if options are available.

Future work:

Traffic analysis of the future needs to be especially flexible, cooperative and proactive. It is more flexible in handling changes in supply and demand [7]. Future enhancements can be made for the system of detections, tracking and counting of moving vehicle can be extended to real-time live video feeds. Process of recognition can also be done. Traffic analysis is a proactive and it can be used to attain a range of policy objectives. Private sector and research/education institutes [14] should work together and collaborate more closely. The hardware implementation enables the project to be used in the real-time practical conditions. We propose a system to identify the vehicles as they pass by and assisting in

surveillance on a large scale [1]. Various traffic related technologies can be used for the advance version of the traffic congestion.

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