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Survey of Traffic Congestion Detection and Traffic Management through CNN

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Abstract: *In most major areas traffic has been one of the largest challenges. Classification of traffic flow is crucial in evaluating the management and strategic planning of traffic enforcement. Traffic jams has an effect on society, as it take a lot of time even though it is essential to manage the traffic jams. Through classifying we could get to recognize which pathway has congestion, by which we would then test the causes for congestion and make suitable conclusions to optimize the effectiveness. Traffic video data is an appropriate source for monitoring the traffic. Traffic congestion generally produces additional gasoline pollution which is injurious to people and then also generates a series of trouble in the maintenance of road transport and sinks a lot of deadly time and energy waste. Way to diagnose traffic congestion results to a big issue and such traffic congestion allows vehicles to take various shortcuts in breach of the traffic laws which cause dangerous crashes. A lot of research has gone into alert system for traffic collision on the street. Though other research is capable of achieving impressive outcomes, the major issue of detecting traffic collisions seems far from being fully resolved because of the complicated circumstances like the climatic conditions, a vehicular traffic simultaneously. As the first step to manage the traffic and reduce accidents, the traffic congestion should be detected as soon as possible and measures should be taken to clear it early. This paper discusses about the traffic congestion detection and traffic management through Convolution Neural Network (CNN) techniques.*

Keywords: Traffic congestion, traffic collision, traffic detection and monitoring, accidents, CNN

1. INTRODUCTION

Mostly with extremely growing population of vehicles, congestion problems are becoming much more dreadful all across the globe. Emerging economies' traffic jams is now even important to consider because of the poor quality of the road network and individual's awareness. Furthermore, road accidents like illegal parking, cars in the incorrect direction and the unusual pedestrian's presence frequently occur on the roadway. Generally such incidents cause unpredictable impaction in the current trajectory of the route and are also the chief cause for the other disaster of traffic. Transport infrastructure faces many challenges such as traffic congestion, signal jumps, leading to the biggest problem of traffic accidents worldwide. Traffic incidents harm public properties, serious passenger injuries and deaths on the road. Traffic oriented study is the relatively novel technique that is helpful on-road protection for the living things. Most researchers focused on estimation of flow of traffic, transportation and infrastructure, object recognition, lane markings identifications, traffic incident detection, traffic velocity estimation and traffic light reorganization in traffic related analysis. Below figure 1 shows the overview of traffic management system. The road traffic data is collected through Traffic signals and it is transmitted via GPS to the Traffic centre which performs the traffic management.

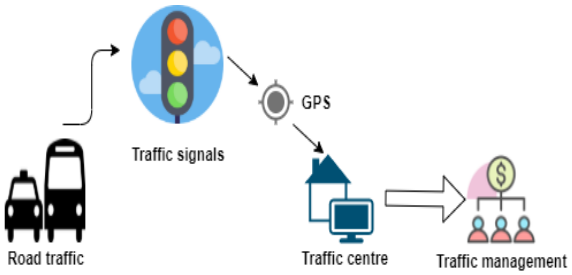

Figure 1: Traffic management system

Although traffic flows quite gradually, the roads can manage the traffic flows even more effectively; that either means more simultaneous traffic as well as the same traffic in less time. The best approach here is that all vehicles must always be moving with normal speed and acceleration without unintended braking. Hence, smart traffic management system will identify the number of vehicles at each position, approximate the speed of the vehicles at that same specific time and in the end adjust the traffic lights correspondingly to obtain the best result. Cameras for video traffic control are mounted in many transport networks. The traffic modifications are monitored via monitoring systems and necessary steps were taken correspondingly. This video observation is indeed helpful for maintaining and in event of disasters. CNN performs the classification and identification of the images. CNN is composed of neurons with trainable network weights. By examining every

frame the cars are retrieved through the background image of the film. Obtained cars are tested taking time and space into consideration. This work describes the management of traffic and detection of traffic congestion using several CNN techniques.

2. LITERATURE SURVEY

Yingying Zhu et. al., [1] proposed a innovative text dependent traffic symbol identification framework with two factors of a machine learning. Most specifically, they implemented completely convolutional network applicant road signs category areas offering feature points interestingly. The approach suggested makes really good utilization of the traffic signs functionality to increase performance and precise term identification. The two-stage plan, on the one side identification methodology reduces the text recognition search area, and erases text around traffic signs. The primary objective of identification of text dependent traffic signals is to get text data of traffic signs dependent on texts. Accordingly, they also planned to concentrate on multilingual text detection techniques for traffic signs that require the proposed adjustment to traffic sign identification system in a number of countries.

Yuan Yuan et. al., [2] has given three important contributions. First is to boost identification efficiency with the use of structural data and makes creative use of temporal variation of the signs prior to use. Secondly, Upgrade through non - linear monitoring efficiency and localisation reliability. A modern and effective incremental Structure includes off-line tracker, electronic detector, and movement model together the predictor is optimized for detection of traffic signals and tracking at the same time. Finally, to obtain a progressively steady classification result, a scale dependent intra-outline combination technique is proposed. They assess the strategy on two open informational collections and the execution has indicated that the proposed framework can get outcomes practically identical with the machine learning strategy with fewer processing asset in a close ongoing way.

Suggested system is tested on open data sources and proved effectiveness and efficiency by extensive correlations and evaluations.

Hao Zhu et. al, [3] introduces an extensive literature study on smart transport knowledge of the world. The province-of-the-art advanced algorithms and computational methods for smart cars, with a description of their benefits and disadvantages. Specific emphasis is given to lane detection systems and path detection techniques, identification of traffic signs, car monitoring, perform analytics and assessing the scene. They often provide additional data on datasets, analysis and interpretation of data, and insights on potential possibilities for analysis in that field.

Present environmental understanding and modelling methods issues is related to the dynamic surrounding conditions and the necessity for appropriate approaches to interpret them in absolute terms. The evolving climate and temperature, and the complicated histories, in particular the occlusion of objects also pose big obstacles for smart vehicles. In addition, it is significant to identify the path in off-road conditions.

Yi Yang et. al., [4] addressed real-time traffic sign identification such as localization of what traffic sign type occurs in which input source image at a speedy process time. To attain the objective, they proposed an incredibly fast technique widely, that is 20 comparatively quicker than the better detection technique. This detection platform is dependent on proposal for extraction of traffic signs. Next came a SVM classification which is used to detect and identify the false positives and subsequent suggestions into their super groups dependent on innovative colour HOG functionality. Moving on, the classification section classifies the observed signs into their different sub classes under every super Class.

Hee Seok Lee and Kang Kim et.al, [5] recommended effective identification of traffic signals approach by which traffic sign positions are determined collectively with the exact borders. To that end, they have extended the element bounding box identification challenge and developed an item pose estimating issue, and the question is successfully simulated using CNN focused on latest object identification advancements.

The predicted traffic sign position is used for transforming the traffic sign border models into the image plane data, offering precise, high precision of boundaries. To hit realistic speed of detection, they analyzed the best performing basis systems and accessed redundant layers of the infrastructure by taking into account traffic parameters.

Hengliang Luo et. al., [6] presented a new method focused on data should understand all traffic sign types for both text and symbol dependent signals, recorded in

video streams through camera installed in a car. The system is composed of 3 phases, regions of interest extraction for traffic signals, region of interest precision and ranking, and data post processing. Traffic label region of interests are initially extracted from every object, using optimum steady extreme sectors on channels of gray and uniform RGB. Their comprehensive classes will then be optimized and allocated through suggested multitask neural convolution network that is qualified with a good amount of information, incorporating synthetic traffic signals and road-view labelled frames.

The post processing at last merges the outputs in all images to perform a identification choice. As data is important a key source in machine learning dependent auto-traffic sign detection system, they intend to utilize a bootstrap approach to mark further necessary data using the satellite imagery map plug-in. Furthermore, how to detecting and identifying road signs along with an edge to edge structure should be researched in coming days.

Rakesh et. al., [7] mathematically checked the requested protocol in a six intersection environment, using a site traffic simulator. They conducted every drug in a distributed manner to explore a solution to keep track of a traffic signal at a junction using the suggested technique rather than appealing to different other components. Traditional network traffic density estimates several limitations on practices like radars, loophole devices, ultrasonic waves, and so forth. Fully automated website traffic level estimation occurs in this specific study as well as automotive distinguishing process allowing the usage of semantic network.

Xiaolei Ma et. al., [8] suggested a convolution-based neural network method that needs to learn traffic as frames and indicates high-precision, large-scale, broad network traffic speeds. Temporal and spatial traffic mechanics are translated through a 2 dimensional time-space framework into images that explain the space and time relationships of traffic conditions. In two sequential stages, CNN is applied to the input image. Initially abstract traffic element extortion and broad network traffic speed estimation. Using two real world transport infrastructure, the north east transport system and second ring road in Beijing as instances, assesses the efficiency of the suggested process.

Moreover, the forecast of large-scale network traffic involves further demanding capabilities for forecasting, like the capacity to interact with extra processing uncertainty caused by entire network, the capacity to shape a smarter and much more effective projection to overcome the temporal relationships of traffic on 2D roads, and the capability to estimate longer period futures to replicate overcrowding transmission.

3. DETECTION OF TRAFFIC CONGESTION AND TRAFFIC MANAGEMENT

Traffic management involves 4 major steps which are shown in below figure 2.

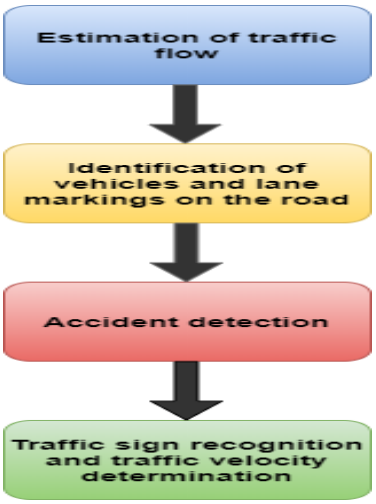

Figure 2: Phases of traffic management

- **Estimation of traffic flow**

  The estimation of traffic flows primarily concentrates on how quickly the volume of traffic on roads increases. Traffic monitoring offers alerts of network updates from start to end. Despite of this forecast it is helpful to control traffic jams at peak times by handling and controlling traffic by steering to correct diversions.

- **Identification of vehicles and lane markings on the road**

  Traffic surveillance and lane markings detection are still one of the primary challenges in automotive traffic control management system to make sure secured driving. Current convolution neural network is employed to execute traffic and lane detection, when operating at connection speeds required for a time frame device.

- **Accident detection**

  Detection of traffic incidents is helpful for automated traffic networks to notify emergency teams for better and quick treatment for people who have come across incidents. CNN using its different networks assists for this process.

- **Traffic sign recognition and traffic velocity determination**

  Traffic sign recognition and traffic velocity determination acts as a most significant step in superior traffic systems for aided driving. Such forecasts are only useful in creating a smart transportation network that is only used to control traffic and to take care of the accessibility of speed emergency vehicle for the incidents occurred to the travellers.

The basic idea about CNN process in traffic management is discussed below:

CNN is a special architecture of neural networks consisting of neurons as solitary units. Neurons are grouped in layers such as input, hidden and output layers. Information flows from input to output layer as shown in below figure 3 involving some computations at each layers. A convolution neural network consists of convolution, pooling and fully connected layers.

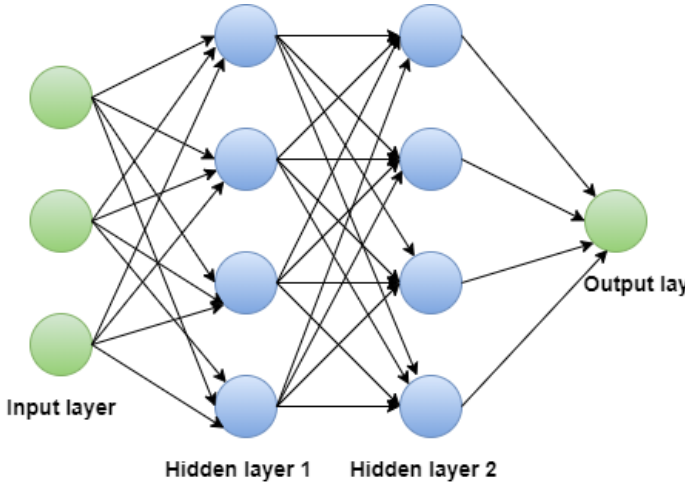

Figure 3: Basic Neural network architecture

The basic step of CNN model is to build a supervised machine learning model. This model is constructed using four stages as described below:

- **Building a model**
  Model building is based on the machine learning techniques. And here it is according to the neural networks.
- **Training the model**
  This is done after building a model. Model is trained through training dataset and for this trained data, outcome is expected.
- **Testing the model**
  Once the training is completed, in this stage the testing dataset is used. And it is used for checking reliability.
- **Evaluation of model**
  Finally this trained and tested model is utilized to evaluate the real world datasets.

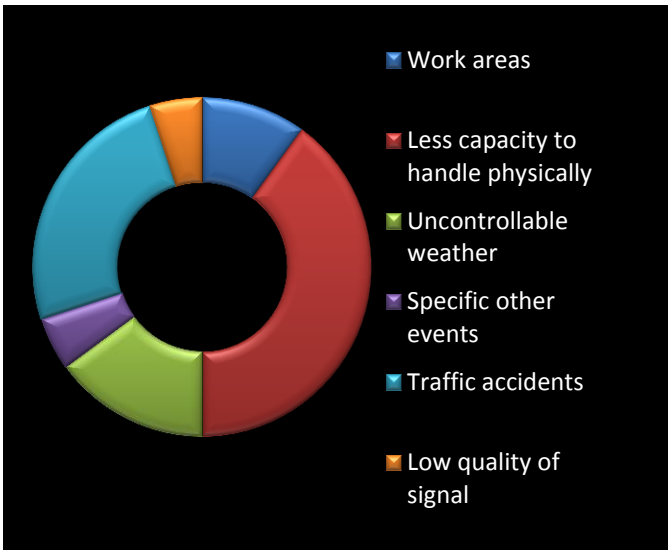

Figure 4: Causes for traffic congestion

The above figure 4 shows the main reasons contributing for traffic overcrowding. They are work area in metropolitan cities, low capability to manage, bad weather such as rain, fog etc, Specific public events where more people will gather, occurrence of traffic accidents and low quality signal.

4. CONCLUSION

To make the computer to study and to identify much more different kinds of transportation as well as other items on the street, there must be more and massive training sets running on machine that will require up a large amount of space and time to train the device to have the greater efficiency. For instance, to train the computer for motor vehicle or crosswalk, have to input an increasingly wider training collection. CNN is made up

of stacks of convolution layers segregated by layer upon layer of pooling and activation. These layers are also referred as representing layers. These layers are composed of multiple filters which work on input image data. Pooling and activation layers manage the product of processing, which affects the output resolution. The supporting and convolution layers combined perform the extraction of the features. This survey work presents the significance of CNN role in detection and management of traffic in prevention of the dangerous accidents on road.

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