

Analyzing Factors and Optimizing Techniques for Traffic Congestion

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Abstract - Due to increasing population and its requirements, there is more requirement of vehicles to meet supply chain and travelling goals, which in turn leads to an increase in the complexity of traffic environment. The demand for road space is greater than the supply which results in traffic congestion. In 2013 a report was made by IBM's global Commuter Pain study in which Delhi was found among top 10 cities having worst traffic jams, such worsening condition of Delhi roads represents a depressing profile of India. A large amount of time passes on road while travelling on daily basis, and facing congestion, pollution, struggle and effort of dodging traffic became the cause for chronic stress and various physiological issues. The increasing traffic leads to wastage of time, money and fuel. So, we must find a way to avoid and minimize traffic congestion. In our research paper, we are trying to analyze the factors which are the cause for congestion and trying to give an optimization technique for reduction of congestion.

Key Words: Congestion, Traffic Signs, Detection, Attributes and Prediction.

1. INTRODUCTION

The road became an important mean of transportation during the era of the Roman Empire. The demand for road travel by people is continuously growing as population increasing, particularly in the metropolitan areas. Transport industry plays a major role in determining the traffic conditions of a particular area. So, this tool belongs to transport industry. Transport industry is cyclic in nature. A cyclical industry is much related to business cycle and its performance is also related to economy. As transportation of products and services is booming with growing economy so the transportation industry is cyclic. Several intensive attempts has been made to this point on the traffic prediction and mostly are in highway scenario. The overall deals with traffic prediction are frequently arranged in categories of parametric methods and nonparametric methods. Parametric methods uses historical average and smoothing techniques, regression based prediction models while the nonparametric methods refer to the non-parametric regression and artificial intelligence techniques based prediction models. Application fits well into social and economic trends. Due to sudden increment in private transport influencing urban culture, economy, traffic congestion became one of

the intolerable problems. Congestion increasing the journey time by preventing movement of traffic. People, therefore are interested in ways to avoid congestion. This is where the project play its role. As most of the people does not know the meaning of traffic signs about what is signifies, therefore they obey the wrong rules which leads to traffic congestion and accidents which lead to more delay in every work. Therefore traffic sign detection and recognition [1] has become a hot research field of researcher. It is mainly the use of vehicle's camera for processing the image and does real-time detection of Traffic signs and tells the driver about it. Due to weather and lightning condition may affect the visibility of traffic signs [2], which can lead to take wrong turns, restricted overtakes, accidents results into traffic congestion. Traffic signs can be categorized into three categories mandatory, cautionary and informatory. By following these signs properly discipline is maintained on roads. Pre-informed drivers can avoid committing mistakes, and avoiding the problems like accidents, congestion and utilizing resources and safe driving.

2. RELATED WORK

In 2012, [3] Hangzhou Dong et al. introduces an improved cell transmission model (CTM). Traffic trademark is anticipated by the inflow and surge vehicles during a time of one-time step. Each time step gives the estimation of the inflow vehicle amount and traffic limit of the segment. This progression rehashes until end conditions don't meet. Cell esteems set apart after each succession by consenting to the guidelines and reestablished. The yield of the new log territory and term of starting blockage can be resolved.

Empirical Approach network control, GERTRUDE [4] (Morrish, 1980) is a framework to eliminate the traffic clog from a basic segment and focal region and look after it, in top period by permitting just 'ideal' volume to go through a selective zone of controlled traffic. This methodology resolves the over-burdening of the traffic at the basic intersection by giving the supplies to abundance requests and applying the blend of the arrangement of neighborhood traffic limits and fixed time control plans dependent on the shut circle framework for noteworthy courses with the goal that traffic is held in the repository. Bretherton and colleagues (1986) examined the SCOOT calculation and asked two strategies to represent

congestion [5]. One of them is to utilize 'congested offsets' to control lines and clog by processing 'clogged balances' either away when the downstream connection is full. The least basic upstream association is blocked or picking such a way, that traffic moving endlessly from the clogged territory isn't blocked. A 20% postpone decrease was seen by the utilization of the SCOOT calculation with foreordained blocked balances. Another strategy is to handle clog by 'gating' traffic by permitting the constrained stream in the critical territory. Control (cycle and split) is reliant on either level of blockage or level of immersion on joins inside a specific region. It is accustomed to permitting orders on the edge of the blocked territory to constraining stream. In particular tests, gating activity diminishes delay by 52 percent.

Foreseeing traffic stream or volume on a connection of an intensely used road network to direct traffic, there's one among various issues identified with modernized sign control. [6] If traffic clog can be predicted on a connection in a focal territory of the road arrange, the blockage could be maintained a strategic distance from in a few different ways. For instance, upstream vehicles could be told to require elective route(s), or green time of traffic signals inside the external zone may be decreased for vehicles taking care of into the connection. On the off chance that it is predicted that the traffic stream will surpass the foreordained wellbeing level on a link in an urban turnpike, this could be forestalled by controlling the traffic volume streaming into the interstate at the cost doors of entrance ramps. Ideal traffic light settings could best be resolved if the value of future traffic streams rather than present or past information were utilized. Kalman filtering, one among the principal propelled courses in present-day control hypothesis, depends on suppositions arranged by Kalman (1960). It ought to be applied to transient fixed or nonstationary arbitrary wonders. In rush hour gridlock, it's been utilized with progress for request expectation with astounding exactness (Gazis and Knapp, 1971).

Another technique is proposed for anticipating travel time from recorded traffic information utilizing a gullible Bayesian arrangement. Bayesian characterization is a class of straightforward probabilistic calculation which apply Bayes' hypothesis to get familiar with the basic likelihood dispersion of the information. This can anticipate class participation probabilities [7], for example, the likelihood that a given tuple has a place with a specific class. A straightforward Bayesian classifier is known as the Naïve Bayesian classifier. At first, the client characterizes a birthplace with start time and goal. A course may involve numerous sections from cause to the goal. From the start, the methodology for estimating first street fragment travel time utilizing innocent Bayesian characterization is actualized. At that point, this first street portion's end-time turns into the beginning time of the following street

section. At long last, utilizing progressive emphasis, we can gauge surmised go time from starting point to the goal. The main source of traffic blockage is the unbalance transportation of supply and demand. Expanding road supply is one of the answers to this logical inconsistency. In any case, works originating from the greater part of the nations demonstrated that reliance on developing more roads would bring about a circle of " - traffic blockage - clog easing - road-building delivering new clog - more transportation request construct new roads," which couldn't take care of the issue to be sure. Hence, an ever-increasing number of specialists would like to locate another arrangement in which traffic charging is one of the viable measures. Singapore turned into the soonest and, in this manner, the most prosperous city to execute the blockage charge. In 1975, the Singapore government put 6,600,000 Singapore dollars in coordinating the zone permit framework (ALS) [8]. While deciding how to value traffic blockage charging, the accompanying variables ought to be thought of: Vehicle type, Congestion degree, Road Network Situation, Charge Scope, Travelers bearing capacity, and Region change. Road Congestion charge is a framework engineer including government and open. Charge plan ought to incorporate charge reason, charge district just as charge technique.

3. PURPOSED METHODOLOGY

Traffic sign are the silent speakers of the rules on the road. They signifies different rules for preventing congestion on road and ensures the road safety. In India , most of the people do not know the exact meaning of the particular traffic sign. Being unaware of road signs means throwing danger to the wind. It can lead to loss of life , property and congestion problem. In 2010[9], Chao wang proved through research paper that Road accidents and Congestion have a direct relationship.

This issue can be resolved if the vehicle have some system that can alert the driver by telling him the meaning of upcoming traffic sign through speech. The CNN Model can be helpful to achieve this aim. In this Research Paper , CNN Model is used in the detection of traffic sign. The big idea behind CNNs is that a local understanding of an image is good enough. The practical benefit is that having fewer parameters greatly improves the time it takes to learn as well as reduces the amount of data required to train the model.

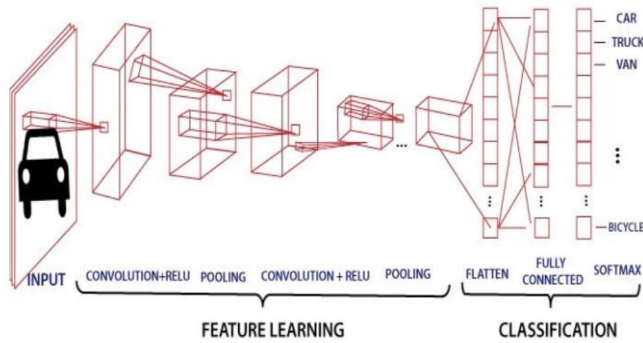


figure 1. CNN model

3.1 Data Set

In this Research paper, GTSDB sign dataset is used. It stands for German Traffic Sign Benchmark. It contains more than 40 classes. It has more than 50,000 images having sufficient number of images for particular class. This dataset is perfect for making CNN model for prediction. The dataset contains various complex traffic sign and blurred images for verifying the ability of the algorithm.



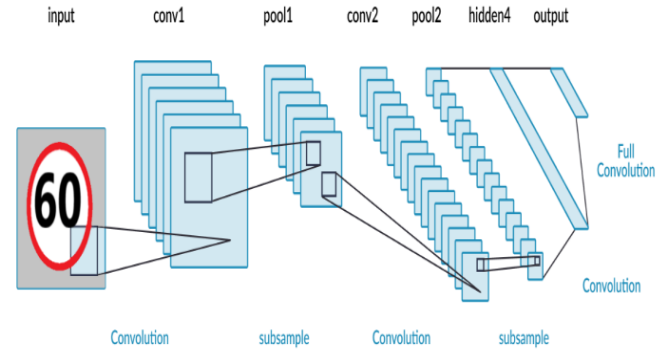
Figure 2. Different types of traffic signs

3.2 Image Preprocessing

Before the image is given as input to the neural network, Image Preprocessing is done for making changes to images at the lowest level. It helps in improving the data of image by removing the unwanted distortions and intensify the vital attributes for further process in processing. It is used here for changing the dimension of images to (32,32,3), converting the image to grayscale, standardize the lighting

of an image and to normalize the values between 0 and 1 instead of 255. These operations helps in making better CNN model.

3.3 Network Structure and Training Model



A Convolutional Neural Network (CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other. It began by taking the input image and give it to ConvNet for reducing the image in a form which is easier to process for correct prediction. Then the images enters into the Convolution layer. The objective of the Convolution Operation is to extract the high-level features such as edges, from the input image. Then it enters into the Pooling Layer for lessen the operational power required to exercise the data through dimensionality depletion. Now the image is converted into the suitable form for Multi-level Perceptron for changing image into column vector.

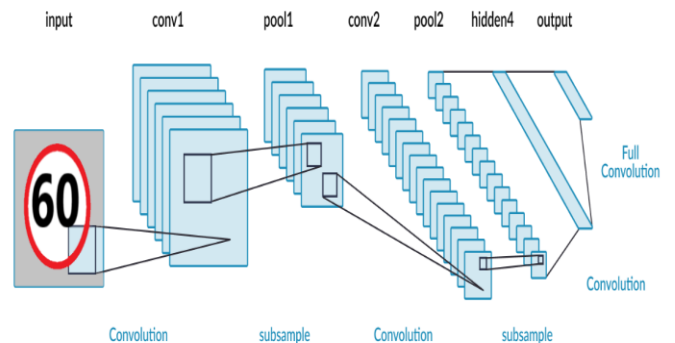


Figure 3. Network Model

After a series of epochs, the model will differentiate between certain dominant and dependent attributes in

images and categorize them using Softmax classification technique.

4. RESULT AND CONCLUSION

In this Research paper, the algorithm is performed using python 3.6.4 and jupyter notebook for the visualization of data and results. There are total of 43 classes in the dataset from 0 to 42. In each class, there were different images of same traffic sign belongs to single class.

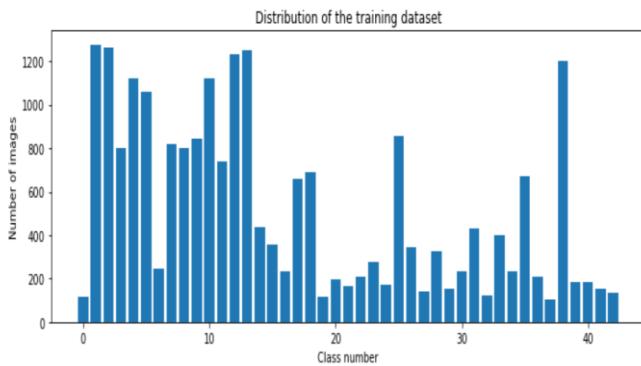


Figure 4. Number of images for different classes

After having the trained CNN model, matplotlib library is used to show the relationship between loss and epochs, and accuracy and epochs.

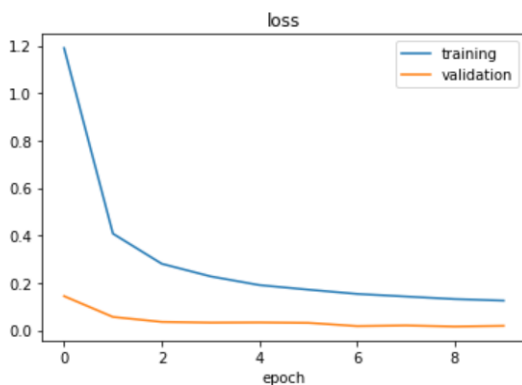


Figure 5. Loss versus epoch

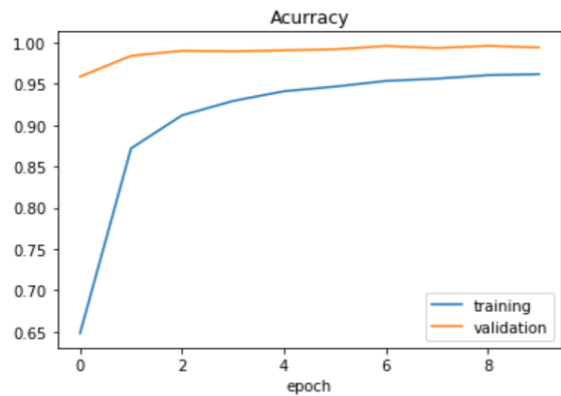


Figure 6. Accuracy versus epoch

Figure 5 shows that with the increase in the number of epochs, there is significant decrement in the loss and become constant after ten epochs. Figure 6 shows that with the increase in number of epoch there is significant increase in the accuracy of the model and becomes constant after ten epochs. When the model is evaluated by using the test data, it gets the accuracy of about 98 %.

For Providing the GUI interface, tkinter package is used which is an Python interface for the Tk GUI toolkit. In this for testing, one can upload the image of traffic sign for getting an output in text format as well as speech format.



Figure 7. GUI for traffic sign prediction

In GUI, there is an button for Real-time prediction, it will pop-up the web camera and when it will get the traffic sign image it will show the name of the sign through text as well as speech. For this purpose, opencv is used which is

highly advance library with pivot on real-time applications.

In figure 8, it is shown that using the trained model, the webcam is predicting the image and gives the class name and the probability of belonging that image to that particular class. So in this paper, we mentioned the different problems facing by the people due to traffic congestion and the various techniques gave by the different researchers in their research paper for the reduction of traffic congestion. Finally, we purposed an effective way for reducing the chances of congestion and accidents through Traffic sign detection. It can be integrated or embedded with the vehicle's camera which can also helps in autonomous driving system. Till now 50,000 images are used in this CNN model. More images can be used for improving the real-time accuracy.

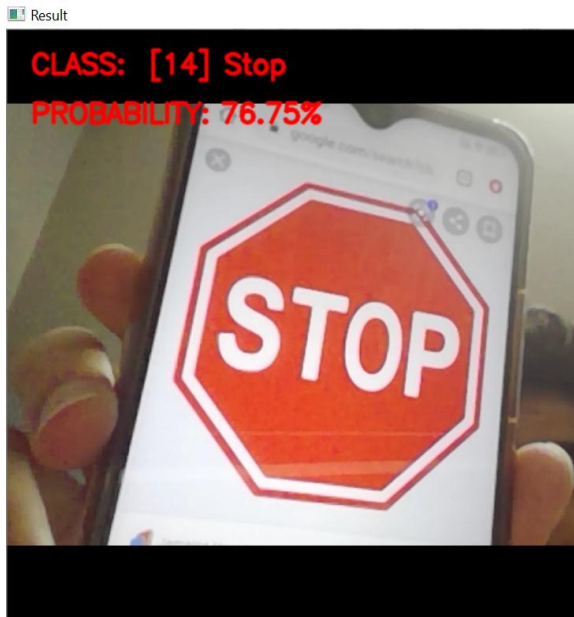


Figure 8. Real time prediction using Webcam

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