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A progressive Real-time DL algorithm for traffic transport scheme with intelligent recommendation

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ABSTRACT

In current days there is a great demand for traffic management in terms of predicting accurate and timely traffic flow. As we all know a lot of survey reports tell that by maintaining proper transport system using intelligent decisions, one can able to reduce the traffic jam on roads. A lot of primitive works have been undergone to solve this problem but no method proved to be successful in predicting traffic on roads very accurately and efficiently. This motivated me to design the proposed work for predicting the real-time traffic for intelligent transport systems by using machine learning algorithms. In general, the traffic environment can affect the traffic flowing on the road due to the following reasons such as traffic signals, accidents, rallies, roads repairs, seminars, functions, weather problems, and a lot more. If the users who drive that way have some prior information about that traffic, the rider can choose an alternate router and can avoid that traffic problem. As there is a huge increase in population as well as the usage of vehicles also increased a lot, which is the main reason for getting traffic problems in the transport system. A lot of big data concepts for transportation management is developed till now but no method is accurate in finding the traffic flow accurately and plan effectively. Hence this motivated me to design the prediction of real-time traffic using ML algorithms combined with genetic and deep learning algorithms to analyze the traffic-related problems more efficiently. For the experimental purposes here we collect some sample traffic-related images and then try to apply image processing algorithms for finding the traffic signs and predict the alternate solution for those traffic problems.

Key Words:

Deep Learning, Machine Learning, Traffic Prediction, Accidents, Weather Problems, Intelligent Transport System.

1. INTRODUCTION

Since the modern city is gradually converting into smart city day by day the rapid increase of population brings great problem for the transportation department to manage the traffic problems. As the cities are getting urbanized, there is a huge increase of traffic problems in this urban areas compared with towns and villages[1]. Hence this is the major research area

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in current days for taking intelligent decisions for traffic monitoring and management. Intelligent Transportation System (ITS) is an indispensable part of smart city which is used as source for traffic prediction in this real world environment. A lot of big data concepts for transportation management is developed till now but no method is accurate in finding the traffic flow accurately and plan effectively.

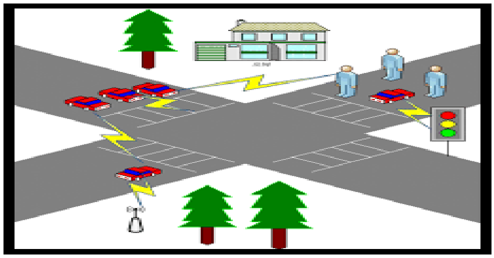

Figure 1. Represent the Intelligent Transportation System (ITS)

From the above figure 1, we can clearly identify the architecture of ITS for traffic controlling in real world environment. In order to solve the problem of present traffic safety, a lot of countries in the world have designed a new model for monitoring the traffic problems and scheduling the vehicles for overall control of vehicle operations.

2. LITERATURE SURVEY

Literature survey is that the most vital step in the software development process. Before developing the new application or model, it's necessary to work out the time factor, economy, and company strength. Once all these factors are confirmed and got approval then we can start building the application

MOTIVATION

In general there are several methods for predicting the traffic problems in real world environment for effective traffic management and avoiding jam and accidents. Now let us discuss about some preventive measures for traffic prediction.

1) INDUCTIVE LOOPS

This is one of the primary facility in which all roads and highways built within the last 15 years have had inductive loops placed beneath their surfaces, at half-mile intervals. These loops are mainly used by the concern municipality which is placed at intersections to control the lights and road signals[9]. For Example Los Angeles alone has more than twenty thousand of these loops embedded in the freeways, for monitoring

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traffic flow. Almost these loops are pre-installed on various products to detect vehicles and count traffic.

ADVANTAGE

This inductive loop technology provides very accurate and efficient traffic count on the road and this can be one way to predict the vehicles present on that road.

DISADVANTAGES

The following are the disadvantages present using these current loops such as these are very tough process to deploy on older streets and highways[10]. This is only used to predict the count of vehicles but not for any other purpose. If this technology need to deploy on old streets then we need to require a lot of edge cutting for the older streets and then try to build these loops inside those old streets.

2) VIDEO IMAGE PROCESSING

This is another form of traffic control device which are attached on road junctions to monitor the traffic using some traffic surveillance tools. These are not arranged on all locations but mostly fixed on some important places such as toll plazas, and at entrances to bridges and tunnels[11].

ADVANTAGES: These Cameras can be set up to monitor multiple lanes; and the images or frames which are captured from these video sequence is clearly view for finding the vehicles count and vehicle model and number plates.

DISADVANTAGES:

The main limitation with this video monitoring is very expensive for large areas of application. These video images are generally unmonitored at traffic management centers, so these images are again processed manually by the professionals [12] to check the accuracy and predict the vehicles. Sometimes these cameras may not generate clear images due to weather problems or climate problems and hence this technology requires considerable unkeep (film must be changed, camera angles adjusted, etc.)

3. PROPOSED ALGORITHMS

In this section we try to discuss about the proposed algorithms which are used for automatic prediction of real time traffic for intelligent transport system using ML algorithm. The following are the some of the ML algorithms which are used in this current application such as:

1) SVM (Support vector Machine)

2) PCA (Principal Component Analysis)

1) SUPPORT VECTOR MACHINES

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This is one of the best supervised machine learning algorithm which can be used for both classification and regression challenges. But, it is mostly used in classification problems.

In this SVM algorithm each and every data item is plotted as one point in n-dimensional space (where n is the number of features you have) with the value of each feature being the value of a particular coordinate. Support Vectors are simply the coordinates of individual observation. Support Vector Machine is a frontier which best segregates the two classes.

ALGORITHM: GENERATE SVM

Input: Training Data, Testing Data

Output: Decision Value

Method:

Step 1: Load Dataset

Step 2: Classify Features (Attributes) based on class labels

Step 3: Estimate Candidate Support Value

While (instances! =null)

Do

Step 4: Support Value=Similarity between each instance in the attribute

Find Total Error Value

Step 5: If any instance < 0

Estimate

Decision value = Support Value\Total Error

Repeat for all points until it will empty

End If

2) PCA

Principal Component Analysis, or PCA, is a dimensionality-reduction method which is very often used to reduce the dimensionality of large data sets, by converting large set of input variables into very smaller variables. In this application we use PCA for object detection from very large traffic network and this PCA can be easily identified the vehicle objects.

PCA ALGORITHM

The PCA algorithm contains following steps such as:

A) STANDARDIZATION

B) COVARIANCE MATRIX COMPUTATION

C) COMPUTE THE PCA COMPONENTS

In the first step the main aim of PCA is to standardize the range of the continuous initial variables so that each and every variable is having some contribution for analysis.

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Mathematically, this standardization is explained in the following waye by subtracting the mean and dividing by the standard deviation for each value of each variable.

$$z = \frac{value - mean}{standard\ deviation}$$

Once the standardization is done, all the variables will be transformed to the same scale. Here we try to find out the correlation between vehicles which are identified in road network.

The aim of this second step in PCA model is to understand how the input variables which are present in the input dataset are varying from the mean and standard deviation with respect to one another. Also this step will try to find out the most related vehicles which are mapped over traffic network and un-related objects are separately represented.

4. SYSTEM IMPLEMENTATION

Implementation is the stage where the theoretical design is converted into programmatically manner. In this stage we will divide the application into a number of modules and then coded for deployment. The front end of the application takes Google Collaboratory or anaconda platform and we integrate the proposed system with web interface to show the performance of our proposed application. The application is divided mainly into following 5 modules. They are as follows:

1. Import Necessary Libraries
2. Load Dataset Module
3. Data Pre-Processing
4. Train the Model Using Proposed Algorithms
5. Automatic Prediction of Traffic

Now let us discuss about each and every module in detail as follows:

IMPORT NECESSARY LIBRARIES

In this module initially we need to import all the necessary libraries which are required for building the model. Here we try to use all the libraries which are used to convert the data into meaningful manner. Here the data is divided into numerical values which are easily identified by the system, hence we try to import numpy module and for loading the categorical data and also other ML and python packages.

LOAD DATASET MODULE

In this module the we try to load the dataset which is downloaded or collected from UCI repository. Here we store the dataset which contains several images which are

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classified very clearly level by level and then try to find out which image is matched with traffic related and which are not related to traffic related. Here in our current application we try to use CCTV footage for gathering frames which contain both traffic related images and normal images in order to check whether there is any traffic present or not.

DATA PRE-PROCESSING MODULE

Here we try to pre-process the input image or frame which is collected from a sample CCTV video sequence and then try to pre-process that traffic related frames which are captured from that CCTV video sequence.

TRAIN THE MODEL USING PROPOSED ML ALGORITHMS

Here we try to train the current model on given dataset using ML Algorithms and then try to identify or classify the objects from the sample video sequence. Once if any object is captured from web cam, now it is cross check with pre-defined images which are present in the input dataset and then try to check with threshold value. If the number of images is less than threshold value, then we can say there is no traffic measured in that region. If the same image contains more than threshold values, then we can confirm that there is very huge amount of traffic present in that region.

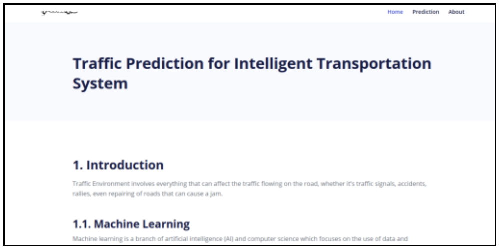
AUTOMATIC PREDICTION OF TRAFFIC

In this module we try to test the accuracy of our current model, we try to test the model on a pre-recorded video of some road network which contains both heavy traffic and less number of vehicles present in that region. The result shows that the proposed method is able to determine the real time traffic very accurately based on the number of vehicles detected and mapped with threshold limit which is specified in that region. If the observed object value is more than the threshold value, then we can consider the network has huge traffic. If the same detected objects are less than the specified threshold value, then we can confirm that very less traffic is present and this classification is accurately done with the help of SVM classifiers.

5. EXPERIMENTAL RESULTS

For showing the performance of our proposed application, we try to deploy the current application using Python as programming language. First we will start the local host server and then run the application on a new web page.

HOME PAGE

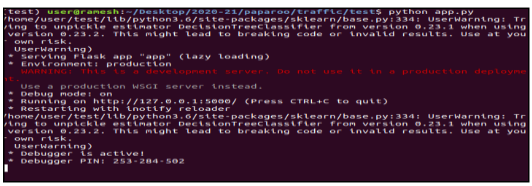


In the above window we can clearly see there are almost information about the project introduction and the importance of ML algorithms in order to design the proposed application.

Collects the data's from the user and stores it in the database for analysis

In the above window we can clearly see there are some important fields like road identity number, direction,day ,date and time for collecting traffic related inputs from several users based on current latitude and longitude.

Local host Started



From the above window we can clearly identify local host server is started and now the main URL is substituted in web page to classify the real time traffic.

Output Window

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From the above window we can clearly identify automatic prediction is traffic is done with our proposed model based on the user inputs.Here it will tell us whether traffic found or not.

6. CONCLUSION

In this proposed work, we for the first time developed a novel methodology of real time traffic detection for intelligent transport network by using ML algorithms. By using computer vision, we can able to identify objects and also calculate the distance between two or multiple objects which are present within the input image. The proposed method was validated by using a sample video sequence which is collected from CCTV camera in which a group of objects such as vehicles will be detected and their count is also measured for each and every individual nodes. Hence this motivated me to design the prediction of real-time traffic using ML algorithms combined with genetic and deep learning algorithms to analyze the traffic-related problems more efficiently. For the experimental purposes here we collect some sample traffic-related images and then try to apply image processing algorithms for finding the traffic signs and predict the alternate solution for those traffic problems.

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