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Design of Traffic Volume Forecasting based on Genetic Algorithm

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Abstract: ***The traffic flow forecasting is very important aspect of traffic predication and congestion. It alleviates the increasing congestion problems that cause drivers to shorten the travelling duration required and prevent financial loss. Increasing congestion is one of the severe problems in big city areas. The aspect of traffic prediction is that it may give drivers to plan their traveling time and traveling path, based on the predictive data information they have. The aim is to design locally weighted regression model by proposing a method, which is a combination of Genetic algorithm and locally weighted regression method. This model helps to achieve optimal prediction performance under various traffic condition parameters. The time series model is used to predict the forecast value for the accurate assumption of the traffic volume generation according to the road capacity. The GA model results show these kind of predictions always be useful for highway road authorities.***

Keywords: ***Traffic Forecasting, Traffic management Algorithms, Genetic algorithms, Prediction***

I. INTRODUCTION

Traffic volume forecasting alleviates the increasing congestion problem, that causes drivers to save a longer traveling time and economical loses, as it is one of the severe problems in big city areas. Traffic forecasting is defined by estimating the number of people or number of vehicles that will use a specific transportation facility in the future. Traffic volume forecasting is important for reducing traffic congestion, improving traffic safety and enhancing control performance of transportation infrastructure. Forecasts explain about the needs of the future and provide an efficient transportation system. The prediction process depends on historical data, i.e. past data, current data, i.e. real time data or both to forecast the traffic in the same interval. Transportation system works on different types of data, which are historical data, real-time data and forecasting data. This system can explained as given: Consider the scenario, where user wants to go from one location to another. For this journey he must have decided the path to travel. But from the traffic volume forecasting model, user can find out best suitable path based on current and past data. This data includes number of vehicles passing through the path on the p particular data, day and time. It may also involves weather data, as it decides congestion on a particular route. Traffic prediction can become effective by improving productivity of the system. Making the system intelligent and safe also makes the surface transportation system by introducing several user services and functions. In the era of fast computers and efficient mathematical models, intelligent transportation systems has been developed rapidly, which makes traffic management easy. In the literature, lots of techniques are proposed to predict traffic flow. Some of the techniques are time series analysis, real-time method, statistical methods, and mathematical methods etc. But, each technique has some advantages and disadvantages. Therefore it is necessary to understand the working model of all the systems. The short-term traffic forecasting is also one of the widely used areas in today's transportation system. It is a current research area and will be considered to be a wide research area in future also. Depending on the accuracy required as well as input data set, various methods for short-term traffic forecasting are also proposed. These methods include trend line analysis, Bayesian networks, econometric indicator, time series analysis, nonparametric regression, neural networks and many more. The paper is organized as follows. Section discusses about traffic volume forecasting model based on Genetic algorithm. Section 3 talks about the results and analysis, Conclusion is provided in Section 4. Here we report our results and compare the performance of our proposed method with other related methods.

II. PROPOSED WORK

The yearly prediction model is proposed here, this paper aims at solving Traffic Volume Forecasting based on Genetic Algorithm (GA). The GA can also handle larger problems than some of the commercially available. This process is used for generating the data set to get all the values. In this project we used a data set of Annual Average Daily Traffic (AADT) from the State of New York — Annual Average Daily Traffic (AADT) is an estimate of the average daily traffic. Which data set contains many parameters such as Region, Area, Road name, road ID, GSI code, AADT, capacity, years, etc., but we are required same few parameters therefor we used to apply preprocessing on the data set.

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This is authorized to the dataset which allows us for the pre-processing of the dataset values which protects the data from tampering. According to the data set, we will get the required value for the population generation to apply in the GA, required parameter selected on the basis of the road traffic volume across the capacity of the road per year.
Taking the average and the difference of the population calculated increase traffic value per year, which is used to calculate the fitness function. The value of the fitness function which allows users to predict the future traffic volume analysis and the next population will be generated on the basis of capacity and traffic volume forecast and results in estimates of future traffic. The Methodology presented will forecast yearly traffic profiles using Functional Data Analysis (FDA). Contribution to traffic volume forecasting research is threefold: it uses FDA to forecast traffic without having to perform clustering of historical data. This study assesses the traffic situation using traffic data collected considers real-time traffic Data for the time relationship. Geometric characteristics (Volume of the road). Highways have several kinds of geometric characteristics, and these different geometric configurations may produce different durations And Calculating the No of the vehicle on road / Road Capacity. GA feature selection:

Traffic volume forecasting using the genetic algorithm-
In this we work on the data set, and on the basis we have preprocess on that dataset in which the data is sorted for consideration. From this date the number of parameters are considered. We have taken the past value of traffic volume from dataset and predicting the future volume.
Algorithm- Algorithm started with a set of data called a population.

Step1: Read data set with 'N' no of parameters. Getting the dataset with all the value and parameters which will be used for the future analysis.
Step2: Dataset extraction of particular value. As per the requirement, the value is sorted from the dataset for processing segment to get the required result.
Step3: Initialized parameter Road name, AADT, RC_ID, Capacity, Years.
Making the initial selection of the value for calculating the required parameter that will be affected the functionality.
step4: Individual evolution of fitness function – Year wise calculation of volume.
After calculating the number of parameter and calculation of year of volume traffic capacity.
Step5: Calculate total fitness value. After the capacity calculation will find the fitness of road capacity.
Step6: Comparative analysis of value. Compare total fitness value with total capacity.
After the result of the calculated value will compare with the fitness if the condition goes beyond the fitness value. According to the need of the traffic forecasts, to generating gene group and using genetic algorithm optimization. The Genetic Algorithm chromosome is weights of the neural network.

The proposed method is explained in the block diagram below:

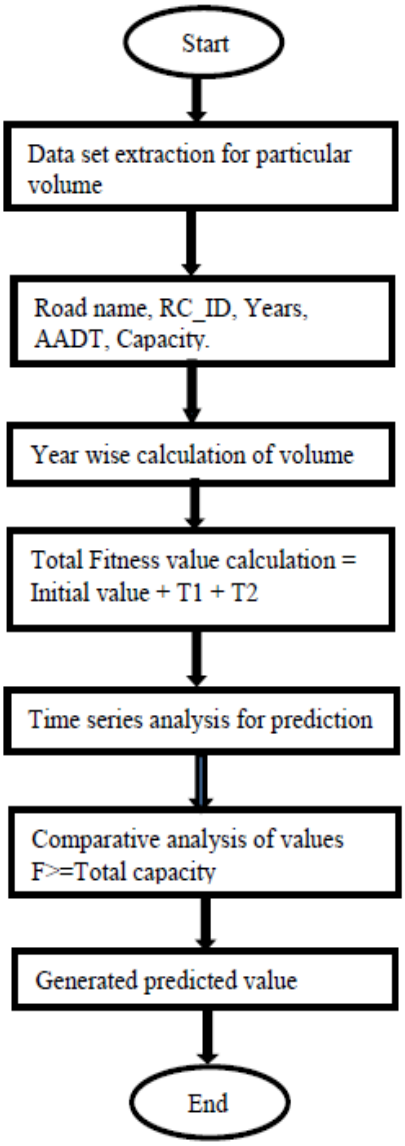


Figure 1. Block diagram of the proposed system.

III. RESULT AND ANALYSIS

Our project started with a set of data called population, first we read the data set with 'N' number of parameters, then apply pre-processing on the data set and extract particular parameter or values, for example Road name, years, capacity of roads, According to data set, we will get the required parameter for the population generation to apply in the genetic algorithm. Required parameter selected on the basis of the road traffic volume across the capacity of the road per year.Taking the average and the difference of the population and calculated increased traffic value per year, which is used to calculate the fitness function.

The value of the fitness function which allows users to predict the future traffic volume analysis and the next population will be generated on the basis of capacity and traffic volume forecast and results in estimates of future traffic.
For example Final regression equation from aggregate analysis road A has ADDT =704 and capacity is 1000 is the suggested present year. The forecasted are reasonably small in most of the cases and speak well for the reliability of the models. The larger forecast in some cases is due to low values of AADT, fewer cases, and large variations in response and predictor variables employed in data tables among the road. Road B has ADDT =1100 and capacity is 1000. In developing traffic growth factor values for functional classes of highways. Although a simple Forecasting model was sought, the statistical analyses to develop it were extensive, sometimes complex, and often subject to the analysts' judgment. Most important, there is an even greater need than usual for more data from a larger number of count road to fill the many gaps in the database used in this study.
This process is used for generating the data set to get all the values from downloaded data from the site https://catalog.data.gov/dataset?tags=traffic-volume which contains many parameters for processing, we are required some few parameters. This is authorized to the dataset which allows us for the pre-processing of the dataset values which protects the data from tampering.
The data set of Annual Average Daily Traffic (AADT) from the State of New York — Annual Average Daily Traffic (AADT) is an estimate of the average daily traffic along a defined segment of roadway. In this project we import dataset that cantain many parameter for processing, but our algorithm required some few parameter , therefor here we used preprocessing of the data set.

	RC_ID	RoadName	Year	AADT
▶	84_0059		1979	8410
	81_0162		1995	9930
	85_0004		1979	9050
	07_8020	CR 3	2012	52.428126
	07_8270	CR 112	2012	51.460852
	03_1495	WOODCLEFT AVE	2009	53.803895
	07_4141	ASHAROKEN BL...	2013	53.478239
	07_2687	CARRIE AVE	2014	86
	07_2904	JAYNE CT	2014	51.512161
	07_3201	NY231 AT 908M	2014	53.409532

Figure 2. Pre-processed data set.

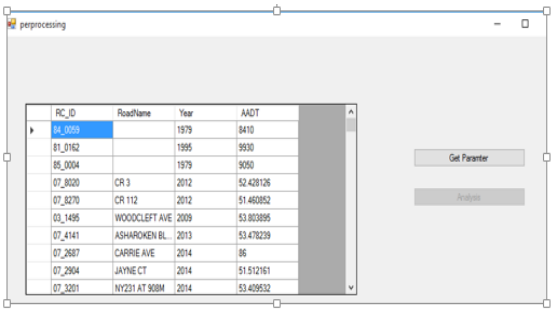


Figure 3. Pre-processing model.

The pre-processing model, in this module we extract some required parameter, According to data set, and we will get the required parameter for the population generation to apply in the genetic algorithm. In pre-processing module the get parameter function calculate fitness function on the basis of parameter, the required parameter selected on the basis of the road traffic volume across the capacity of the road per year.
Taking the average and the difference of the population and calculated increased traffic value per year, which is used to calculate the fitness function.

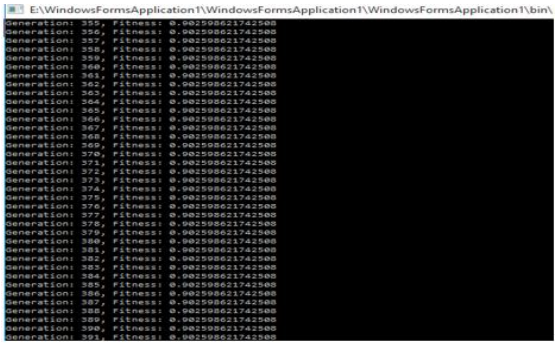


Figure 4. Population generation for fitness calculation.

Figure 4 shows the value of the fitness function which allows users to predict the future traffic volume analysis and the next population. It is generated on the basis of capacity and traffic volume forecast and results in estimates of future traffic. GA separates roads by its fitness function: if the value of fitness function of particular road is less than one then that road consider as fit i.e. under the capacity otherwise the road is unfit i.e. traffic goes beyond the capacity.

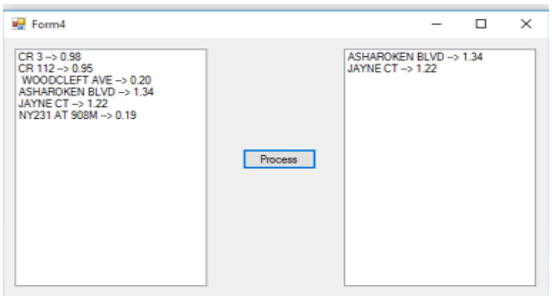
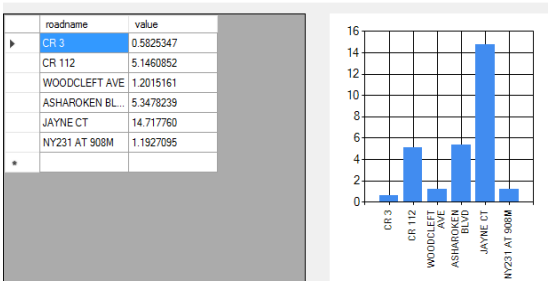


Figure 5. Road fitness function model.

The accurate data collection is more important prior to the analysis. It is because, the proposed Time Series model works on the basis of fitness values and it will select the best solution for the current population. The accurate objective function definition is also very important to find out number and type of parameters used in it. Here one such parameter is road zone. The capacity of the road zone is always constant regardless of the road zone length. The capacity of the road without a road zone is also constant. Road segment is also one of the parameter for traffic forecast. The selected features can be considered as a subset of all possible sets in feature selection. The steps for Evaluation using fitness function are as given: Each chromosome represents a feature subset. These feature subset and the traffic duration builds the regression model, which may be sometime less efficient to forecast. It is because; it has under- predication on congested roads. The proposed based on genetic algorithm is more powerful because it considers changes in traffic conditions to adjust the prediction value at each time point.

Figure 6. Time series model.

We select a year and select the road name, i.e. present in dataset, after that system will show percent increased per year for that particular road and that particular year. In case 1, we select year 2012 for particular road name CR3 that is available in the data set that we have imported, then system will show traffic increased per year based on the required parameter for that particular road in the year 2012. In case 2, we select year 2013 for that same road CR3 that is available in the data set that we have imported, then system will show traffic percent increased based on the required parameter for that particular road in the year 2013. In case 3 we select year 2014 for that same road CR3 that is available in the data set that we have imported, then system will show traffic percent increased based on the required parameter for that particular road in the year 2014. On the basis of that we forecast traffic increment of a year 2015 for that particular road with the help of time series analysis.



roadname	value
CR 3	0.5825347
CR 112	5.1460852
WOODCLEFT AVE	1.2015161
ASHAROKEN BL..	5.3478239
JAYNE CT	14.717760
NY231 AT 908M	1.1927095

Figure 7: Graph for percent incremental difference between years. GA and the local weight with time series give the long-term prediction.

IV. CONCLUSION

In this paper, an efficient method for long-term traffic volume prediction in real road traffic forecast is proposed. The method is based on genetic algorithm and locally weighted with time series prediction. This working on In addition to their higher forecast accuracy; The Traffic forecasting is the process of evaluating the number of people or number of vehicles that will use a distinct transportation facility. The aim is to solving Traffic Volume Forecasting based on Genetic Algorithm is more efficient than other methods. The GA is used to solve a dynamic traffic assignment model. GA allows the moderation of many of the deduction and assumptions that were needed to solve the problem analytically by traditional techniques, GA can also handle larger problems than some of the commercially available. The GA approach provides tangible advantages when used to solve dynamic traffic assignment problems. However, GA and locally weighted rogation for current and annual data prediction. Limitations of different models are studied here and the solution is proposed to address the problems. Finally, GA feature model is suggested to solve the traffic volume prediction problem. The processing time of our proposed approach is also significantly lower than that of another method. The experimental analysis shows that our method compresses the data with high Accuracy.

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