Machine Learning Methodes Traffic Prediction for Intelligent Transportation System

Prashant Kumbharkar[1*], Deepak Mane[2], Santosh Borde[3], Sunil Sangve[4]

Abstract

The fields of internet and medicine both make extensive use of machine learning and other data extraction techniques. The purpose of this research is to develop a method that is capable of providing accurate and up-to-date projections about traffic flow statistics. The term "traffic environment" refers to anything that might impact the flow of traffic along a road, including but not limited to traffic signals, accidents, demonstrations, and even road works that could cause a backlog in the flow of traffic. If a driver or passenger has access to prior knowledge that is very close to an estimate of all of the aspects of the level of life that have been stated above plus countless other factors that may have an influence on traffic, they are better equipped to make an educated choice. In addition to this, it contributes to the creation of cars that do not need drivers. Large-scale information ideas for transportation elicit an emotional reaction from us, and the amount of information available on traffic has been rapidly expanding over the last several decades. Although certain models for predicting traffic are employed in the real world to estimate the flow of traffic, these models are still not enough for dealing with applications that take place in the actual world. Because of this reality, a lot of people in the United States have been thinking about the shortcomings of forecasting traffic flow using information and models based on traffic. It is impossible to estimate the flow of traffic with any degree of precision since the quantity of information that is accessible to the transportation system is so large. The last several decades have seen a huge increase in the amount of data collected on traffic, and we are now working on implementing big data principles into the transportation sector. The methodologies that are now being used for estimating traffic flow make use of certain traffic prediction models; nevertheless, these models are still insufficient to deal with real-world scenarios. As a direct consequence of the aforementioned fact, we got to work on solving the challenge of forecasting the flow of traffic by utilizing the traffic data and models. It is difficult to effectively predict the flow of traffic since there is an insane quantity of data accessible for the transportation system. Using approaches such as machine learning, genetic programming, soft computing, and deep learning, our goal was to do an analysis on the huge amounts of data pertaining to the transportation system while simultaneously reducing the amount of complexity involved. In addition, image processing algorithms are employed to detect a traffic sign, which helps in the whole process of training autonomous cars in the correct manner.

KeyWords: Traffic Environment, Genetic algorithm, Machine Learning, Big Data, Image Processing.

DOI Number: 10.14704/NQ.2022.20.12.NQ77197 **NeuroQuantology2022;20(12): 2219-2224**

Introduction

Many different kinds of businesses, as well as government organizations and individual travellers, have a need for accurate and up-to-date information about traffic flow. It enables riders and drivers to enhance their trip judgment, which in turn serves to ease traffic congestion, improve the efficiency of traffic operations, and minimize emissions of carbon dioxide.“The creation and implementation of Intelligent Transportation Systems (ITSs) result in a more accurate forecast of traffic flow.It is dealt with as an essential component for the achievement of success in advanced traffic management systems, advanced public transportation systems, and traveller information systems”[1].

Corresponding author: Prashant Kumbharkar
Address: [1]Professor, Computer Engineering JSPM'S RajarshiShahu College of Engineering,Pune, [2,3,4]Professor, Computer Science Department, JSPM'S RajarshiShahu College of Engineering, Pune
E-mail: [1]pbk.rscoe@gmail.com, [2]dtmane@gmail.com, [3]santoshborde@yahoo.com, [4]sunilsangve@gmail.com

The flow of traffic is based on real-time traffic data as well as historical data that is gathered from a

variety of sensor sources, such as inductive loops, radars, cameras, mobile Global Positioning System, crowd sourcing, and social media. We have now reached an age in which a significant amount of data is transported, and traffic data is growing at an exponential rate as a result of the widespread use of both classic sensors and new technology. Data is playing an increasingly important role in the regulation and administration of transportation. [2], [3]. However, there are already a number of systems and models that can forecast the flow of traffic; the most of them employ shallow traffic models, and despite their best efforts, they are still not entirely accurate because of the vast dataset dimension.

Academics and businesses alike have taken an interest in deep learning principles in recent years thanks to their use in solving classification issues, comprehending natural language, reducing dimensionality, detecting objects, and modeling motion. All of these applications are possible because to the power of deep learning techniques. Mining the underlying features that are present in data from the most fundamental level up to the most advanced level is accomplished by DL via the application of multi-layer notions of neural networks [4]. They are able to recognize enormous amounts of structure within the data, which in the end assists us in visualizing the data and drawing useful conclusions from it. The majority of ITS departments and researchers in this field are also worried on building an autonomous vehicle, which has the potential to make transportation systems much more cost-effective and lower the danger of lives being lost. The integrated advantage of this approach is also the reduction of wasted time. Over the last several decades, there has been a significant increase in the amount of focus placed on the safe operation of autonomous vehicles. "It is essential that the information will be delivered at the appropriate moment by means of a driver assistance system (DAS), autonomous vehicles (AV), and Traffic Sign Recognition (TSR)"[5].

Because several reports and studies have shown that genetic, deep learning, image processing, machine learning, and soft computing techniques work well with Big Data, we recommend using them to forecast traffic patterns. Furthermore, we want to implement soft computing techniques.

Literature Review

The researchers have created a variety of traffic prediction using machine learning. Several of the works are discussed in detail in this article.

LvYisheng, Yanjie Duan, It is recommended that this unique technique for predicting traffic flow based on deep learning be used, which takes into consideration the spatial and temporal correlations intrinsically. For the purpose of learning generic traffic flow characteristics, a stacked auto encoder model is used, and its training is carried out in a greedy layer wise approach. To the best of our knowledge, this is the first time that a deep architecture model has been deployed to describe traffic flow characteristics for prediction utilizing auto encoders as building blocks. [Citation needed] [Citation needed] In addition, the results of the studies show that the strategy that was developed for predicting the flow of traffic has greater performance.

Panel Azzedine, BoukercheJiahaoWang, In this article, we will attempt to build up a clear and comprehensive evaluation of several machine learning models, as well as an analysis of the benefits and drawbacks of these machine learning models. In order to do this, various machine learning models will be grouped according to the kind of ML theory that they implement. Within each category, we will begin by providing a brief introduction to the ML theory that is used, and then we will concentrate on the particular adjustments that are made to the model so that it may be used to solve a variety of different prediction tasks. In the meanwhile, we will also compare across other categories, which will assist us to have a broad picture of which sorts of machine learning algorithms are effective at which types of prediction jobs according to the unique model properties they possess. In addition, we take a look at the helpful add-ons that are utilized in traffic prediction, and last but not least, we talk about the problems that still need to be solved in the area of traffic prediction.

Jiaming Xie, One key component of creating an intelligent transportation system in smart cities is the ability to predict the flow of traffic. The difficulty of traffic prediction is in striking a balance between the weight given to historical traffic data and that given to real-time traffic data. One of our ideas is to merge data-driven methods with model-driven strategies. This will enable us to use both current data and stored information. First, we'll have a look at and discuss the problems with the auto-regressive integrated moving average and the periodic moving average model. Second, the hybrid prediction model incorporates an artificial neural

network to strike a balance between the two. Ultimately, the success and accuracy of the proposed method are shown by the outcomes of experimental short-term and long-term projections.

A. Ata, M.A. Khan, S. Abbas G. Ahmad A. Fatima, Because of the tremendous increase in the city's population, the urban transportation networks need to be developed in a way that is both effective and environmentally friendly, making full use of the technology available today. An important problem that causes a bottleneck in traffic movement is one that involves the flow of dynamic traffic. The goal of this article is to use Artificial Neural Networks to forecast where and when traffic jams will form (ANN). This technique will either eliminate or greatly reduce the congestion, resulting in a more uniform flow of traffic. The purpose of this article is to provide a remedy for this situation. Proposed MSR2C-ABPNN stands for Modeling Smart Road Traffic Congestion Control using Artificial Back Propagation Neural Networks. It's supposed to make government services more open, accessible, and cost-effective for locals. For the purpose of this research, a neural network is trained using the back propagation method, which enables congestion forecasting to be put into practice. The proposed system's goal is to improve travelers' ease of mind so they can make more informed transportation choices, and the neural network provides a practical way to gather such information. In terms of mean squared error (MSE), the newly suggested MSR2C-ABPNN using time series achieves preferable outcomes compared to the fitting approach.

Data set preparation and preprocessing: Any endeavor involving machine learning must begin with the collection of data. The second stage of a project's implementation is an advanced stage that consists of gathering information, selecting information, preparing information, and transforming information. Each of these stages may be broken down into a number of individual steps. The goal of converting data into a form that is compatible with machine learning is to accomplish preprocessing. The availability of structured and clean data makes it possible for information humans to demand a lot of accurate findings from an applied machine learning model. Formatting, cleaning, and taking samples are all components of the method.

Proposed Model

Any strategy that makes use of information and control technology may be broken down into its component parts as follows:

“Collection of Data

Processing of Data

Decision Making System

Arrangement and inspection support based on information”.

For the purpose of the intelligent transportation system, a variety of different wireless communication technologies have been used. Within the context of the transportation system, radio modem communications on UHF and VHF frequencies are used extensively for both short- and long-range communication.

We have implemented and evaluated a variety of machine algorithms in an effort to achieve greater levels of efficiency and precision in our outcomes. A Decision Tree Algorithm was used by our team in order to determine classification and regression (DT). The value of the target variables is what you want to be able to forecast using this approach. The concept of decision tree learning refers to a function that accepts a vector of attribute values as its input and returns a "Decision," which is a single output result. Ii is a kind of algorithm that is used for supervised learning. It is possible to utilize it to tackle problems involving regression as well as classification. DT determines its outcomes by carrying out a series of tests on the dataset that was used for training [10].

In order to identify outliers, another crucial step in obtaining a precise result, we have resorted to support vector machines (SVMs), a set of supervised learning algorithms that may also be utilized for classification and regression. When the number of samples is less than the number of dimensions, the SVM excels, and it is also effective in high-dimensional environments[11].

A dependable example of an algorithm for machine learning is the random forest method. The term for this practice is called bootstrap aggregation. The random forest technique is mostly used for the purpose of data classification. It is based on many forecasting models. It is possible to construct several models from a single set of training data by making use of the bootstrap technique. Estimation of statistical values has also been accomplished with the use of a bootstrap approach. [12].

Steps Involved in implementation:-

Developed the application that is capable of supplying us with the GPS coordinates.

Carry out the aforementioned algorithm.

Conduct an analysis on the matrix pertaining to the dataset.
Separate the dataset into a testing and a training section.
Conduct research on the various machine learning algorithms.
Utilize a machine learning system to make predictions about the 45-minute interval parameters
Draw a conclusion on the gridlock in the traffic.
By carrying out the procedures outlined above, we will be able to execute this method and produce the model that provides a greater degree of accuracy to the machine learning model than the ones that are currently in use. By combining the BP approach with the gradient-based improvement strategy, teaching the deep network is a simple and straightforward process. Regrettably, it is well known that deep neural networks built using this approach have risky performance. Therefore, the deep learning models have not been included into the job that I do. In addition, the created dataset does not have a great deal of characteristics, which means that using deep learning and genetic algorithms will not be an intelligent choice. By using the approach that was provided, we were able to handle a large number of problems, including those involving big data; also, the enormous dimensions of the dataset were decreased, which prevented the model from being over-fit.

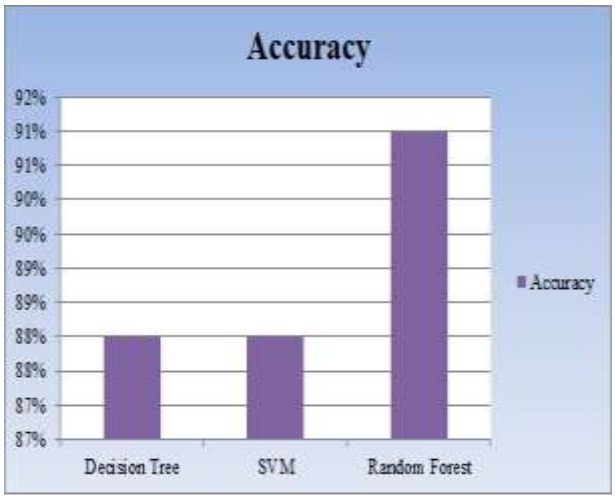

Fig 1: Accuracy of Research

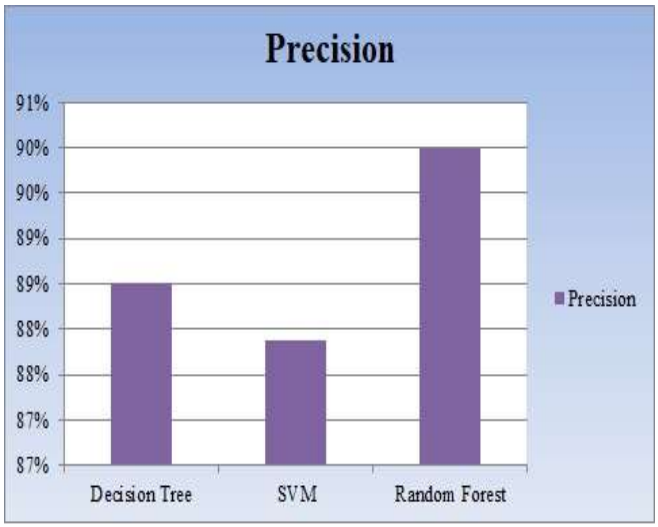

Fig 2: Precision of Research

Result Analysis

The results of the performance of the models that were produced by various machine learning algorithms are shown in the figures that follow. These methods are explored in this work. Accuracy, precision, and recall are just a few of the characteristics that have been specified in this figure.

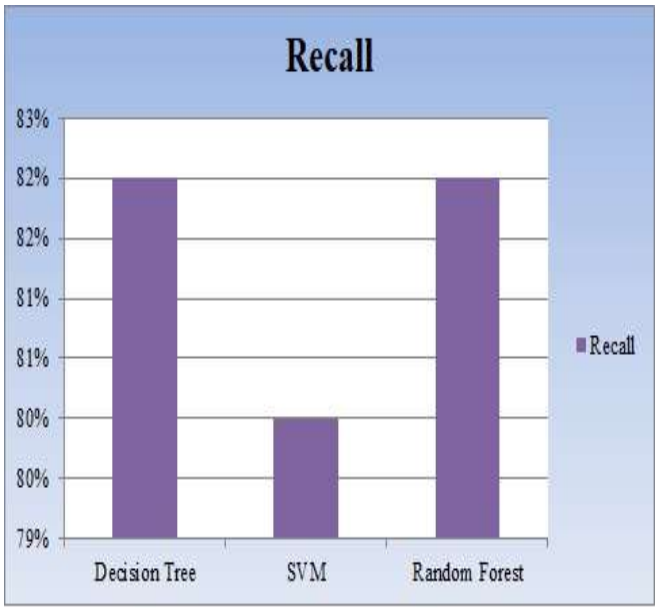

Fig 3: Recall of Research

Conclusion

The machine learning community has not focused a lot of attention on deep learning and genetic algorithms despite the fact that these are critical issues in the field of data analysis. The suggested technique has a better degree of accuracy than the algorithms that are already in use, and it reduces the complexity problems that are present throughout the dataset. In addition, we want to include the web server into the application integration process. Also, the algorithms for the objects will continue to be enhanced to have a far greater level of accuracy.

References

Fei-Yue Wang et al. Parallel control and management for intelligent transportation systems: Concepts, architectures, and applications. IEEE Transactions on Intelligent Transportation Systems, 2010.

Yongchang Ma, Mashrur Chowdhury, MansourehJeihani, and Ryan Fries. Accelerated incident detection across transportation networks using vehicle kinetics and support vector machine in cooperation with infrastructure agents. IET intelligent transport systems, 4(4):328–337, 2010.

Rutger Claes, Tom Holvoet, and Danny Weyns. A decentralized approach for anticipatory vehicle routing using delegate multiagent systems. IEEE Transactions on Intelligent Transportation Systems, 12(2):364–373, 2011.

Mehul Mahrishi and Sudha Morwal. Index point detection and semantic indexing of videos - a comparative review. Advances in Intelligent Systems and Computing, Springer, 2020.

Joseph D Crabtree and NikiforosStamatiadis. Dedicated short-range communications technology for freeway incident detection: Performance assessment based on traffic simulation data. Transportation Research Record, 2000(1):59–69, 2007.

H Qi, RL Cheu, and DH Lee. Freeway incident detection using kinematic data from probe vehicles. In 9th World Congress on Intelligent Transport SystemsITS America, ITS Japan, ERTICO (Intelligent Transport Systems and Services-Europe), 2002.

Z. Zhao, W. Chen, X. Wu, P. C. Y. Chen, and J. Liu. Lstm network: a deep learning approach for short-term traffic forecast. IET Intelligent Transport Systems, 11(2):68–75, 2017.

C. Zhang, P. Patras, and H. Haddadi. Deep learning in mobile and wireless networking: A survey. IEEE Communications Surveys Tutorials, 21(3):2224–2287, thirdquarter 2019.

Chun-Hsin Wu, Jan-Ming Ho, and D. T. Lee. Travel-time prediction with support vector regression. IEEE Transactions on Intelligent Transportation Systems, 5(4):276–281, Dec 2004.

Yan-Yan Song and LU Ying. Decision tree methods: applications for classification and prediction. Shanghai archives of psychiatry, 27(2):130, 2015.

Yiming He, Mashrur Chowdhury, Yongchang Ma, and PierluigiPisu. Merging mobility and energy vision with hybrid electric vehicles and vehicle infrastructure integration. Energy Policy, 41:599–609, 2012.

Jason Brownlee. Bagging and random forest ensemble algorithms for machine learning. Machine Learning Algorithms, pages 4–22, 2016.

Fei-Yue Wang et al. Parallel control and management for intelligent transportation systems: Concepts,architectures, andapplications. IEEE Transactions on Intelligent TransportationSystems, 2010.

Rutger Claes, Tom Holvoet, and Danny Weyns. A decentralized approach for anticipatory vehicle routingusing delegate multiagent systems. IEEE Transactions on Intelligent Transportation Systems, 12(2):364–373,2011

Mehul Mahrishi and Sudha Morwal. Index point detection and semantic indexing of videos - a comparativereview. AdvancesinIntelligentSystems and Computing,Springer, 2020.

JosephDCrabtreeandNikiforosStamatiadis.Dedicatedshortrang ecommunicationstechnologyforfreeway incident detection: Performance assessment based on traffic simulation data. Transportation ResearchRecord, 2000(1):59–69, 2007.

H Qi, RL Cheu, and DH Lee. Freeway incident detection using kinematic data from probe vehicles. In 9thWorld Congress on Intelligent Transport SystemsITS America, ITS Japan, ERTICO (Intelligent TransportSystemsandServices-Europe),2002.

Z. Zhao, W. Chen, X. Wu, P. C. Y. Chen, and J. Liu. Lstm network: a deep learning approach for short-termtrafficforecast.IETIntelligent TransportSystems,11(2):68–75, 2017.

C. Zhang, P. Patras, and H. Haddadi. Deep learning in mobile and wireless networking: A survey. IEEECommunicationsSurveysTutorials,21(3):2224–2287,thirdquarter2019.

C K Gomathy and V Geetha. Article: Evaluation on Ethernet based Passive Optical Network Service Enhancement through Splitting of Architecture. International Journal of Computer Applications 138(2):14-17, March 2016. Published by Foundation of Computer Science (FCS), NY, USA, ISSN No: 0975-8887

DR.C.K.Gomathy , V.Geetha , S.Madhumitha , S.Sangeetha , R.Vishnupriya Article: A Secure With Efficient Data Transaction In Cloud Service, Published by International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 5 Issue 4, March 2016, ISSN: 2278 – 1323.

C.K.Gomathy.(2010),"Cloud Computing: Business Management for Effective Service Oriented Architecture" International Journal of Power Control Signal and Computation (IJPCSC), Volume 1, Issue IV, Oct - Dec 2010, P.No:22-27, ISSN: 0976-268X

Dr.C K Gomathy, Article: A Semantic Quality of Web Service Information Retrieval Techniques Using Bin Rank, International Journal of Scientific Research in Computer Science Engineering and Information Technology (

IJSRCSEIT) Volume 3 | Issue 1 | ISSN : 2456-3307, P.No:1563-1578, February-2018

Dr.C K Gomathy, Article: A Scheme of ADHOC Communication using Mobile Device Networks, International Journal of Emerging technologies and Innovative Research (JETIR) Volume 5 | Issue 11 | ISSN : 2349-5162, P.No:320-326, Nov-2018.

Dr.C K Gomathy, Article: Supply chain-Impact of importance and Technology in Software Release Management, International Journal of Scientific Research in Computer Science Engineering and Information Technology (IJSRCSEIT) Volume 3 | Issue 6 | ISSN : 2456-3307, P.No:1-4, July-2018