TRAFFIC ROUTE PREDICTION

Python approach

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ABSTRACT

In this project centered on predicting alternate routes in response to traffic congestion, we utilize machine learning algorithms such as Support Vector Machines (SVM), Decision Tree, and Random Forest. The performance of each algorithm is meticulously assessed using metrics like accuracy, precision, recall, F1 score, and visualized through confusion matrix graphs. Prior to applying machine learning, a thorough data analysis is conducted through graph visualization to comprehend the traffic flow and congestion across various routes. Despite the comprehensive analysis, SVM exhibits suboptimal performance, while Decision Tree stands out as a robust performer in accurately predicting routes. The Random Forest algorithm is also leveraged to enhance prediction robustness. The evaluation metrics offer a comprehensive understanding of the algorithms' strengths and weaknesses. The dataset utilized for training encompasses detailed information on traffic congestion, ensuring the reliability and accuracy of the route predictions. This project not only contributes to optimizing passenger travel experiences but also holds potential for effective traffic management strategies.

INDEX : Traffic congestion prediction, Alternate route prediction, Machine learning algorithms, Support Vector Machine (SVM), Decision Tree, Random Forest, Model evaluation metrics (accuracy, precision, recall, F1 score), Confusion matrix visualization, Traffic flow analysis

I. INTRODUCTION

In the face of mounting challenges posed by urban traffic congestion, our project endeavors to revolutionize transportation with a focus on Traffic Route Prediction. The goal is to empower commuters by offering real-time alternative routes informed by cutting-edge machine learning algorithms, including Support Vector Machines (SVM), Decision Tree, and Random Forest. This initiative aligns with the broader mission of developing smart transportation systems to enhance urban mobility, reduce congestion, and improve the overall efficiency of traffic management. By embracing advanced technologies, we aim to usher in a new era of responsive and adaptive route planning for a seamless and stress-free commuting experience.

II. LITERATURE SURVEY

TITLE : Traffic pattern analysis and traffic state prediction of urban traffic road network based on correlated routes

AUTHOR : Zhuowei Zhang; Weibin Zhang

ABSTRACT: In this paper, a method for traffic pattern analysis and state prediction for correlated routes in the road network is proposed. First, the concepts of correlated route, correlated route chains, and correlated route sets are defined, and a route correlation degree calculation model that considers route traffic heterogeneity and its judgment criteria are proposed to determine the correlated route sets in the region. Second, we incorporate the self-organizing mapping (SOM) algorithm with Dunn index (DI), named as SOM_DI, to classify the traffic states on the correlated route chain and determine the optimal number of traffic state. The traffic pattern on the correlated path chain is analyzed to obtain the temporal state chains and the spatial state chains. Finally, an algorithm is proposed to select the input spatio-temporal features of the support vector regression (SVR) model and predict the traffic state on the correlated route chain, which is named as STFS_SVR. The simulation results show that the method proposed in this paper can accurately classify the correlated routes of regional traffic and its optimal traffic state.

TITLE : Development of Reinforcement Learning-Based Traffic Predictive Route Guidance Algorithm Under Uncertain Traffic Environment

AUTHOR : Donghoun Lee, Sehyun Tak, Sari Kim

ABSTRACT: There have been enormous efforts to develop a novel vehicle routing algorithm to reduce origin-to-destination (OD) travel time. Most of the previous studies have mainly focused on providing the shortest travel time route based on estimated traffic information. Few researches have considered the use of predictive information on traffic dynamics to improve the quality of route guidance algorithms. However, there is still uncertainty associated with future traffic conditions, particularly in non-recurrent traffic congestion caused by the abnormal event. For a reliable navigation service under uncertain traffic conditions, this research develops a reinforcement learning-based traffic predictive vehicle routing (RL-TPVR) algorithm. The proposed algorithm is designed to mitigate the variability of OD travel time by incorporating predictive state representation and prediction reward modeling in the reinforcement learning scheme. The RL-TPVR is evaluated in terms of OD travel time based on various traffic scenarios with different demand patterns. Several numerical studies including a performance gap analysis, case study, and comparative study are conducted using microscopic simulation experiments. The performance gap analysis demonstrates the superiority of the RL-TPVR with respect to traffic uncertainty, particularly in non-recurrent traffic congestion cases. In addition, the case study shows that the RL-TPVR exhibits a flexible and dynamic OD travel route depending on the given traffic situations. Furthermore, the comparative study verifies that the proposed algorithm outperforms other existing algorithms in both recurrent and non-recurrent traffic congestion cases. These findings suggest the RL-TPVR has great potential for providing the shortest travel time route under uncertain traffic conditions.

TITLE : Function of Traffic Prediction in Alleviating Traffic Congestion

AUTHOR : Zheng Zhao, Zhenxing Han, Changchen Zhao, Yixin Zhang

ABSTRACT: Traffic prediction technique can be used to guide people's travel, and there are many researches have been conducted to achieve a higher prediction accuracy. If the traffic prediction result can be timely conveyed to all travelers, personal travel plan may also change accordingly, thus to influence the traffic state of the road network. This paper considers decision-making model, cyclic causal model, and game process, and analyzes the function of traffic prediction in alleviating traffic congestion. Simulation results prove that the sharing mechanism of traffic forecast results is very important, meanwhile, a limited effect can be also found when using traffic prediction to alleviate traffic congestion.

TITLE : Traffic Prediction Using Graph Neural Network

AUTHOR : Lakshman S V Sri, A Karthick; S Akash, R. Anuradha

ABSTRACT: Traffic prediction is an important and challenging task in transportation management. Accurately predicting traffic patterns is crucial for reducing congestion, improving safety, and optimizing travel time. In recent years, graph neural networks (GNNs) have shown great potential in predicting traffic by taking into account the graph structure of road networks. In this project, we propose to develop a traffic prediction system using GNNs. The proposed system consists of three main components: data pre-processing, model development, and model evaluation. We first collect traffic data from various sources and pre-process it to remove noise and inconsistencies, and convert it into a suitable format for GNNs. We then develop a GNN model designed to capture the graph structure of the traffic network and use it to predict traffic patterns for a given time interval. The proposed model is trained and optimized using a loss function and evaluated using standard metrics such as root mean squared error (RMSE). The proposed traffic prediction system has the potential to significantly improve traffic management and reduce congestion by providing accurate traffic predictions. The GNN model can capture complex traffic patterns and dependencies between different parts of the road network, leading to more accurate predictions. Overall, this project aims to provide a better understanding of the potential of GNNs in traffic prediction and contribute to the development of more efficient and effective transportation management systems

TITLE : A Survey on Traffic Flow Prediction Methods

AUTHOR : Kevin Irawan, Rahadian Yusuf, Ary SetijadiPrihatmanto

ABSTRACT: In order to grow efficiency in Intelligent Transportation System (ITS), a number of dynamic route guidance scheme has been designed to assist driver in determining the optimal route for their journeys. To determine an optimal route, utilizing real-time traffic information is a key factor in improving traffic efficiency. Not only being able to utilize the real-time traffic information, but prediction of the traffic proves as one of the important aspects in improving traffic efficiency. In this paper, we will discuss various methods related to traffic flow prediction in ITS that will eventually lead to a proposed method. We will review some papers related to traffic flow prediction methods. Traffic flow prediction method is divided into two general types: Short-Term Prediction method and Long-Term Prediction method. Short-Term Prediction method relies on real-time information; however, this method can be redundant for a daily recurring traffic condition. On the other end, Long-Term Prediction relies on time series collective data from traffic condition routine, but this method is vulnerable to atypical traffic conditions like accident or road work. In the end, the author will propose a method to create a new sufficient method. This proposed method is a traffic prediction method that combines dynamic real-time information prediction (short-term prediction) and time series analysis prediction (long-term prediction).

III. PROBLEM STATEMENT

The current state of traffic management often relies on reactive approaches, leading to delays and suboptimal travel experiences. Existing navigation systems, predominantly based on historical data or rule-based algorithms, struggle to adapt to real-time changes in traffic dynamics. This limitation underscores the need for a more sophisticated and dynamic system that can provide accurate route recommendations, particularly in the face of unpredictable traffic scenarios. Our proposed Traffic Route Prediction system seeks to bridge these gaps, introducing advanced machine learning techniques to offer proactive and adaptive route predictions based on the most current and relevant traffic information.

3.1 DISADVANTAGES

Existing traffic route prediction systems often suffer from limited accuracy due to outdated or insufficient data, struggle with real-time adaptability to sudden traffic changes, and frequently rely on basic algorithms that do not fully leverage advanced machine learning techniques.

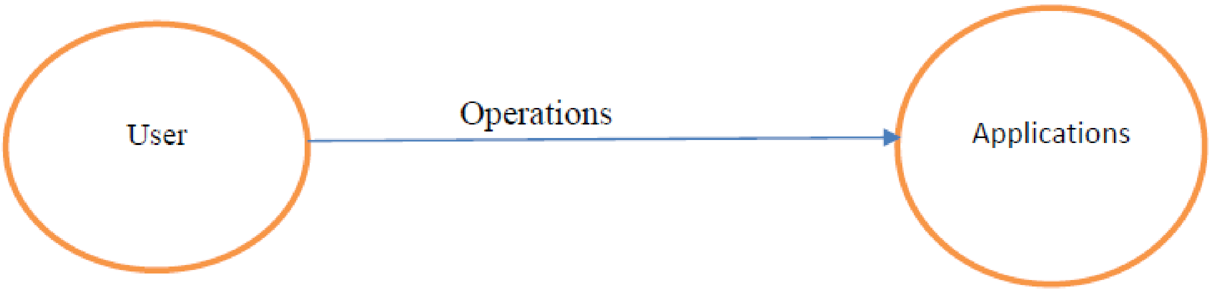
IV. PROPOSED SYSTEM

In envisioning our Traffic Route Prediction system, we embark on a transformative journey to enhance the accuracy and responsiveness of route recommendations. The proposed system integrates Support Vector Machines, Decision Tree, and Random Forest algorithms, each meticulously evaluated using key metrics such as accuracy, precision, recall, and F1 score. Through the incorporation of graph visualization techniques during data analysis, we gain a comprehensive understanding of traffic flow dynamics, further refining our predictive capabilities. This holistic approach aims not only to optimize travel routes but also to contribute to the creation of a robust and adaptive traffic management system. By leveraging the power of advanced analytics, our proposed system aspires to set new benchmarks in efficiency, reliability, and sustainability for urban transportation networks, paving the way for a smarter and more interconnected future.

ADVANTAGES

Existing traffic route prediction systems leverage historical traffic data, real-time updates, and advanced algorithms to provide accurate and timely route suggestions. These systems improve travel efficiency by minimizing delays and optimizing route selection. Additionally, they enhance user experience with features like congestion alerts and alternative route options.

V. SYSTEM ARCHITECTURE

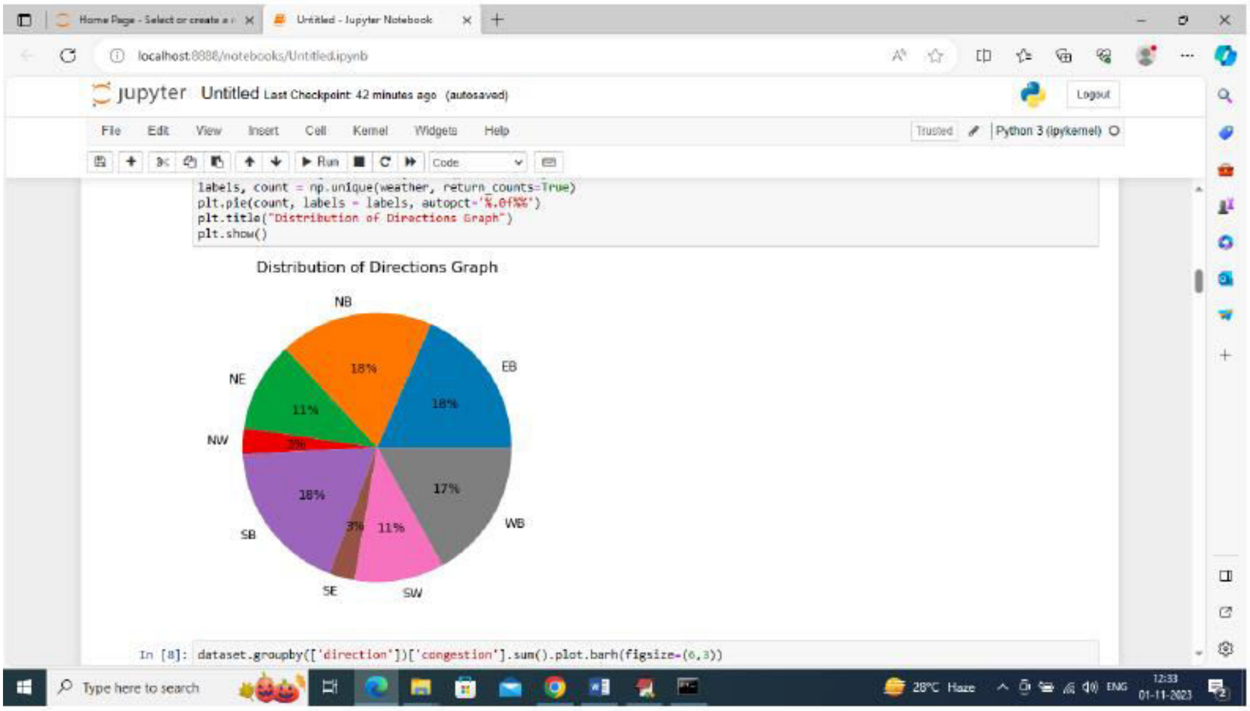


VI. IMPLEMENTATION

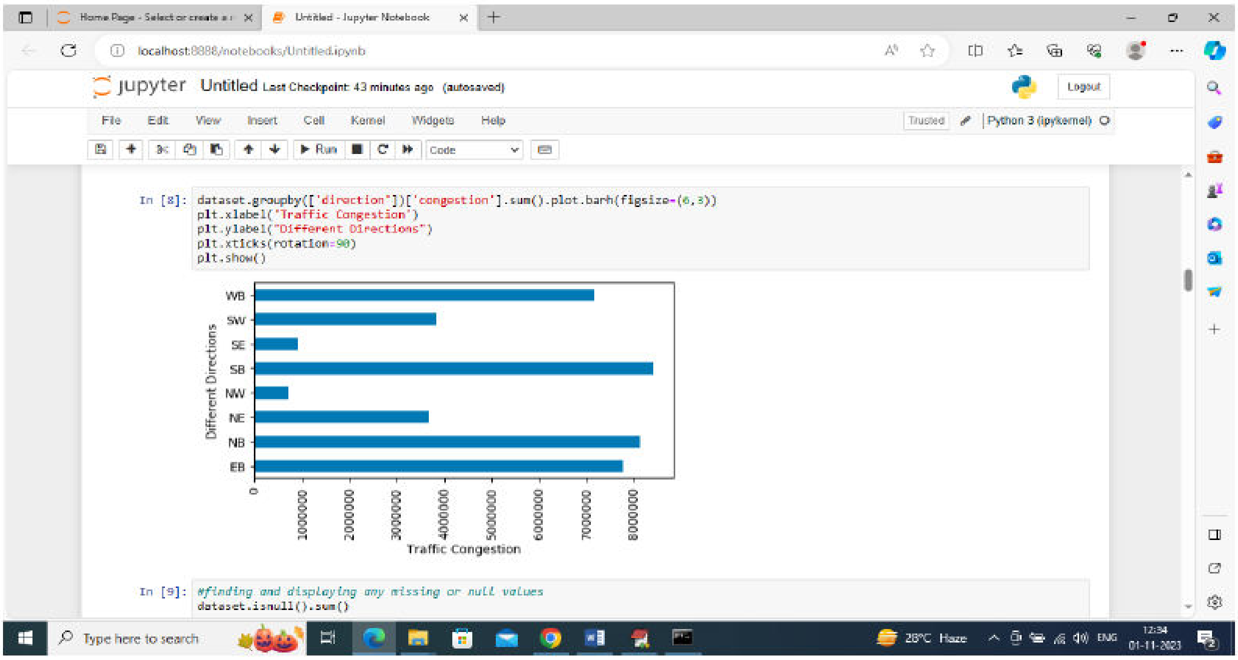
USER

The User Profile Management module is designed to handle all aspects related to user accounts and profiles within the Crime Data Analysis System. This module ensures that user information is securely stored, managed, and utilized to provide a personalized and efficient experience for each user. It encompasses features for user registration, authentication, role-based access control, profile customization, and activity tracking.

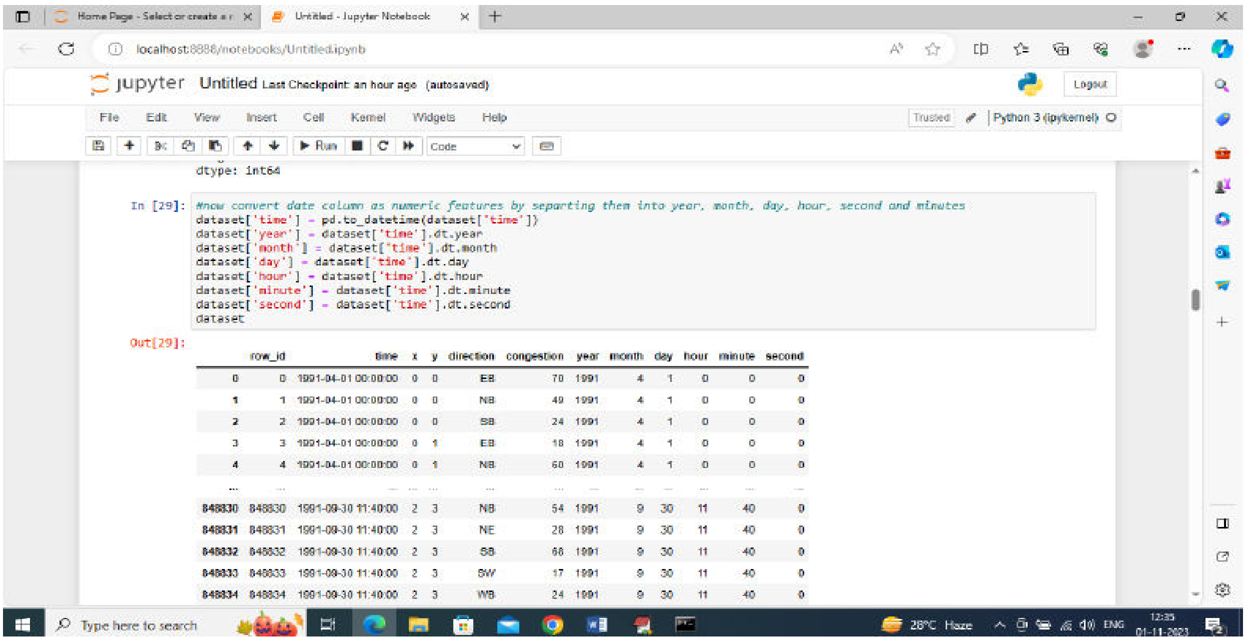
VII. RESULT ANALYSIS



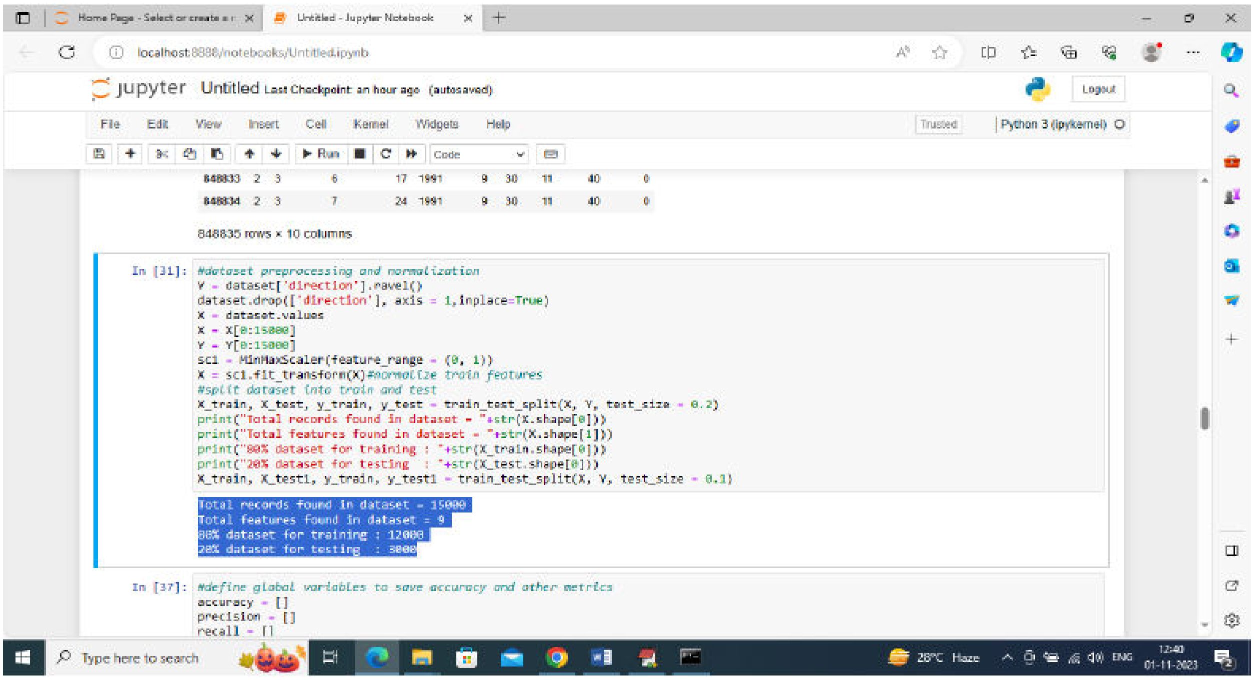
In above graph we are finding percentage of different directions or route exists in the dataset



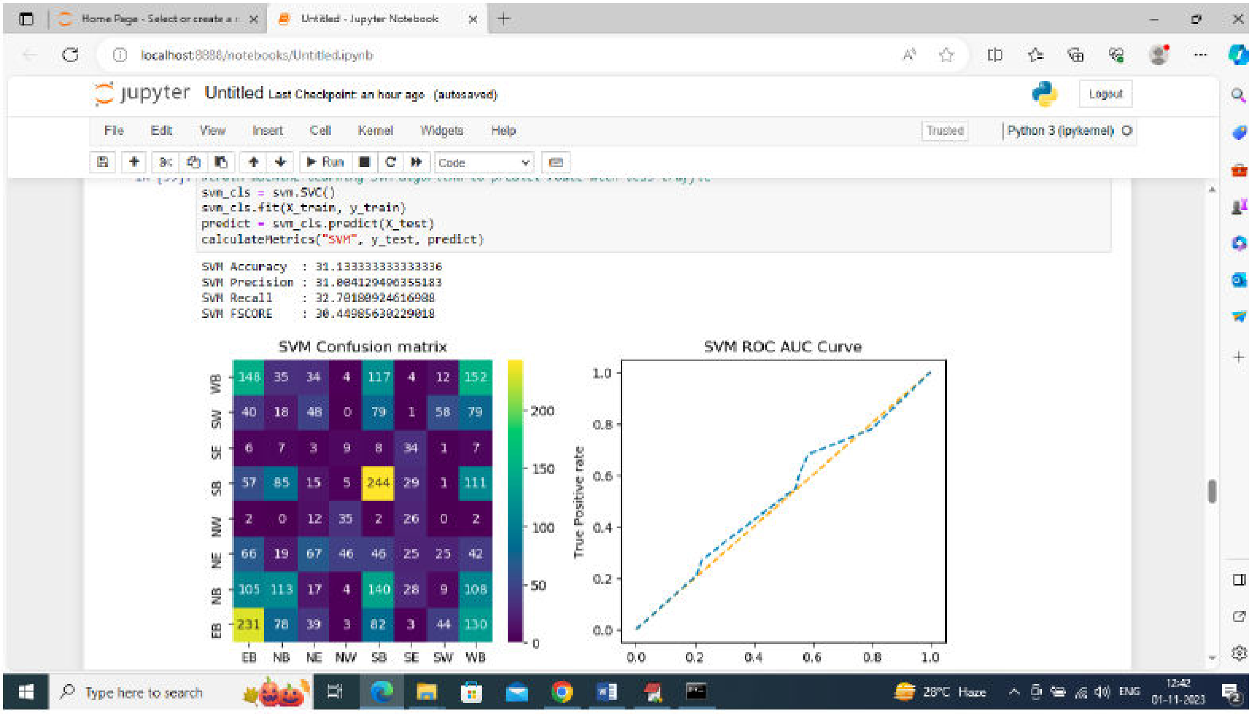
In above graph we are finding sum of traffic exists in each direction where x-axis represents traffic count and y-axis represents direction



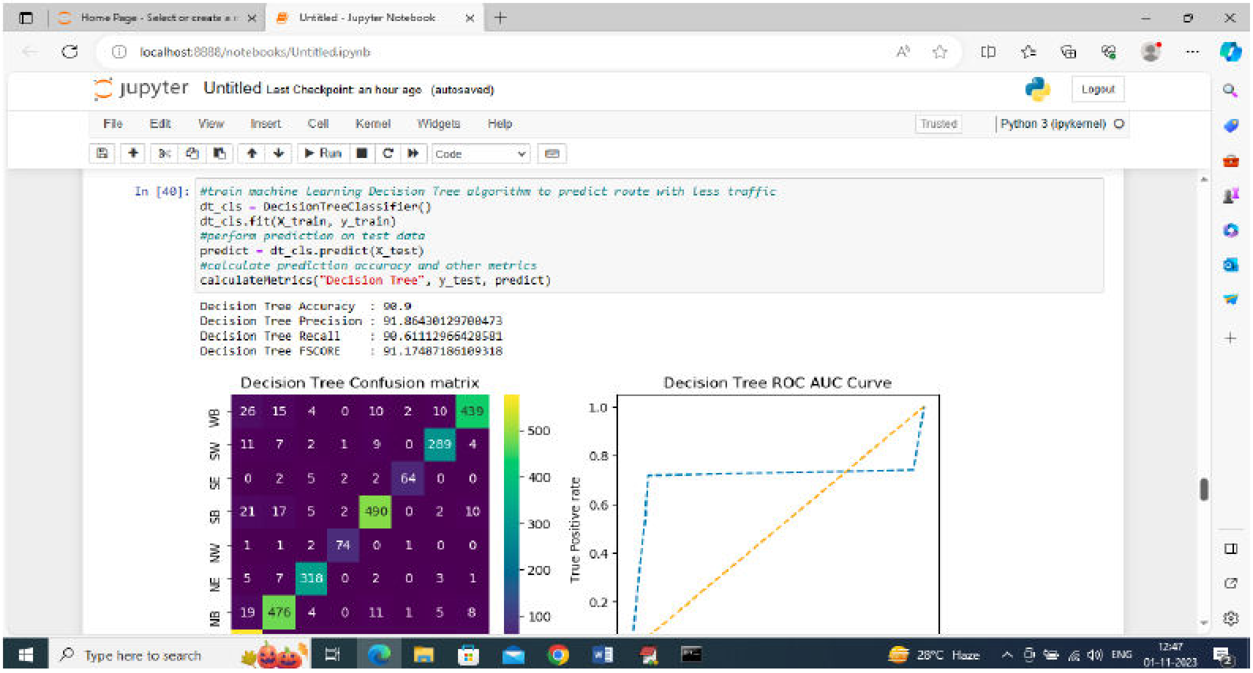
In above screen we are processing dataset to convert date into Day, Month and Year format so we can analyze traffic day or month wise and in above output we can see now dataset has day, year and month columns



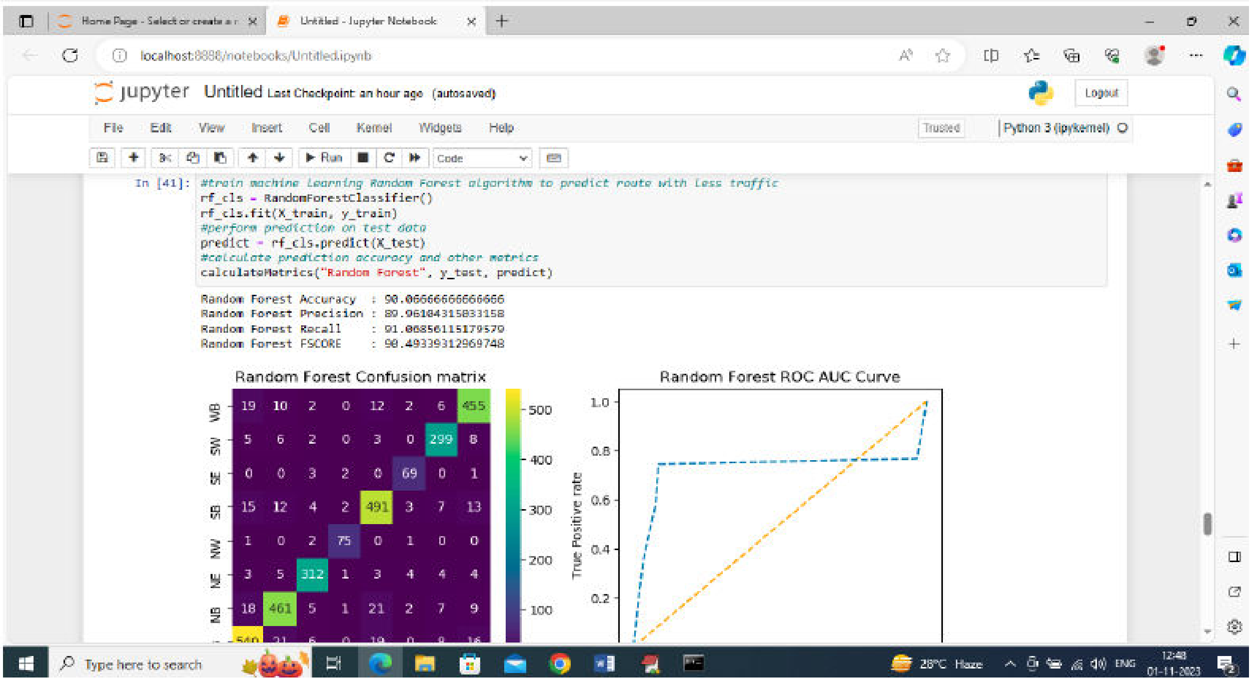
In above screen we are processing dataset such as normalization and then splitting into train and test where application using 80% dataset for training and 20% for testing and in blue color we can see train and test size



In above screen training SVM algorithm and after training SVM got 30% accuracy and can see other metrics also. In confusion matrix graph x-axis represents Predicted Labels and y-axis represents True Labels and all boxes in diagnol represents correct prediction count and remaining boxes represents incorrect prediction counts and from above graph we can notice SVM predicted many records incorrectly. In ROC curve graph x-axis represents False Prediction and y-axis represents True Predictions and if blue line comes on top of orange line then predictions are correct and if goes below orange line then predictions are incorrect and in above graph we can see only few predictions are correct.



In above sceen training decision tree and it got 90.9% accuracy and can see other metrics and results graph



In above screen training Random Forest and it got 90.06% accuracy and can see other metrics also and in above confusion matrix graph in diagnol we can see many records are correctly predicted and in all blue boxes only few are incorrectly prediction. In ROC graph also we can see only few predictions are incorrect

VIII. CONCLUSION

In conclusion, our Traffic Route Prediction project represents a significant leap forward in addressing the persistent challenges of urban traffic congestion. Through the integration of advanced machine learning algorithms such as Support Vector Machines, Decision Tree, and Random Forest, we have endeavored to provide commuters with real-time alternative routes, enhancing the overall efficiency of traffic management. The comprehensive evaluation of these algorithms using accuracy, precision, recall, and F1 score metrics has revealed the prowess of Decision Tree in predicting routes amid dynamic traffic conditions. The analysis, coupled with graph visualization techniques, has afforded us deeper insights into traffic flow dynamics, enriching the predictive capabilities of our system. While the Support Vector Machines exhibited suboptimal performance, the robustness and adaptability of our proposed system, especially leveraging the strengths of the Decision Tree algorithm, showcase the potential to revolutionize route planning in urban environments.
The reliance on up-to-the-minute traffic information and the proactive nature of our system distinguish it from conventional approaches, promising a more seamless and stress-free commuting experience. As we navigate towards a future marked by smart transportation systems, our Traffic Route Prediction project not only optimizes travel routes but also lays the groundwork for a more sustainable and interconnected urban mobility landscape. This endeavor holds promise for transforming the way we approach and manage traffic, offering a glimpse into a future where efficient, adaptive, and data-driven systems redefine the possibilities of urban transportation.

IX. FUTURE SCOPE

The future scope for traffic route prediction projects is vast and promising, driven by advancements in technology and increasing urbanization. Integrating artificial intelligence and machine learning can enhance prediction accuracy by learning from vast datasets and adapting to new traffic patterns in real-time. The incorporation of Internet of Things (IoT) devices, such as smart traffic lights and connected vehicles, can provide richer, more granular data, enabling more precise and dynamic route adjustments. Furthermore, the development of autonomous vehicles relies heavily on sophisticated traffic prediction models to ensure safe and efficient navigation. As cities grow and transportation needs evolve, these systems could also incorporate multimodal transport options, offering seamless transitions between different modes of travel, such as buses, trains, and bike-sharing programs. Overall, the continuous improvement and integration of these technologies promise to transform urban mobility, reducing congestion, improving safety, and enhancing the overall efficiency of transportation networks.

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