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Assignment of Data Mining

Title: -Intelligent Transport System

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Intelligent Transport System

INTRODUCTION

An intelligent transportation system (ITS) is an advanced application which, without embodying intelligence as such, aims to provide innovative services relating to different modes of transport and traffic management and enable users to be better informed and make safer, more coordinated, and 'smarter' use of transport networks. Although ITS may refer to all modes of transport, the directive of the European Union 2010/40/EU, made on the 7 July 2010, defined ITS as systems in which information and communication technologies are applied in the field of road transport, including infrastructure, vehicles and users, and in traffic management and mobility management, as well as for interfaces with other modes of transport.] ITS may improve the efficiency of transport in a number of situations, i.e. road transport, traffic management, mobility, etc

Many of the proposed ITS systems also involve surveillance of the roadways, which is a priority of homeland security. Funding of many systems comes either directly through homeland security organizations or with their approval. Further, ITS can play a role in the rapid mass evacuation of people in urban centers after large casualty events such as a result of a natural disaster or threat. Much of the infrastructure and planning involved with ITS parallels the need for homeland security systems.

In the developing world, the migration from rural to urbanized habitats has progressed differently. Many areas of the developing world have urbanized without significant motorization and the formation of suburbs. A small portion of the population can afford automobiles, but the automobiles greatly increase congestion in these multimodal transportation systems. They also produce considerable air pollution, pose a significant safety risk, and exacerbate feelings of inequities in the society. High population density could be supported by a multimodal system of walking, bicycle transportation, motorcycles, buses, and trains.

Other parts of the developing world, such as China, India and Brazil remain largely rural but are rapidly urbanizing and industrializing. In these areas a motorized infrastructure is being developed alongside motorization of the population. Great disparity of wealth means that only a fraction of the population can motorize, and therefore the highly dense multimodal transportation system for the poor is cross-cut by the highly motorized transportation system for the rich. The goal of Intelligent Transport Systems (ITS) is applying information technology, communications, sensor

technology and the internet to transportation systems to improve travel safety, reliability, passenger convenience, increase mobility, mitigate traffic congestion and reducing fuel consumption. Intelligent traffic control system is an important part of the ITS .

Intelligent transportation technologies

Intelligent transport systems vary in technologies applied, from basic management systems such as car navigation; traffic signal control systems; container management systems; variable message signs; automatic number plate recognition or speed cameras to monitor applications, such as security CCTV systems; and to more advanced applications that integrate live data and feedback from a number of other sources, such as parking guidance and information systems; weather information; bridge de-icing (US deicing) systems; and the like. Additionally, predictive techniques are being developed to allow advanced modelling and comparison with historical baseline data. Some of these technologies are described below.

Wireless communications

Traffic monitoring gantry with wireless communication dish antenna

Various forms of wireless communications technologies have been proposed for intelligent transportation systems. Radio modem communication on UHF and VHF frequencies are widely used for short and long range communication within ITS.

Short-range communications of 350 m can be accomplished using IEEE 802.11 protocols, specifically WAVE or the Dedicated Short Range Communications standard being promoted by the Intelligent Transportation Society of America and the United States Department of Transportation. Theoretically, the range of these protocols can be extended using Mobile ad hoc networks or Mesh networking.

Computational technologies

Recent advances in vehicle electronics have led to a move towards fewer, more capable computer processors on a vehicle. A typical vehicle in the early 2000s would have between 20 and 100 individual networked microcontroller/Programmable logic controller modules with non-real-time operating systems. The current trend is toward fewer, more costly microprocessor modules with hardware memory management and real-time operating systems. The new embedded system platforms allow for more sophisticated software applications to be implemented, including model-based process control, artificial intelligence,

Smartphone-based rich monitoring. Smartphones having various sensors can be used to track traffic speed and density.

Sensing technologies

Technological advances in telecommunications and information technology, coupled with ultramodern/state-of-the-art microchip, RFID (Radio Frequency Identification), and inexpensive intelligent beacon sensing technologies, have enhanced the technical capabilities that will facilitate motorist safety benefits for intelligent transportation systems globally. Sensing systems for ITS are vehicle- and infrastructure-based networked systems, i.e., Intelligent vehicle technologies. Infrastructure sensors are indestructible (such as in-road reflectors) devices that are installed or embedded in the road or surrounding the road (e.g., on buildings, posts, and signs), as required, and may be manually disseminated during preventive road construction maintenance or by sensor injection machinery for rapid deployment. Vehicle-sensing systems include deployment of infrastructure-to-vehicle and vehicle-to-infrastructure electronic beacons for identification communications and may also employ video automatic number plate recognition or vehicle magnetic signature detection technologies at desired intervals to increase sustained monitoring of vehicles operating in critical zones of world.

Inductive loop detection

Inductive loops can be placed in a roadbed to detect vehicles as they pass through the loop's magnetic field. The simplest detectors simply count the number of vehicles during a unit of time (typically 60 seconds in the United States) that pass over the loop, while more sophisticated sensors estimate the speed, length, and class of vehicles and the distance between them. Loops can be placed in a single lane or across multiple lanes, and they work with very slow or stopped vehicles as well as vehicles moving at high speed.

Video vehicle detection

Traffic-flow measurement and automatic incident detection using video cameras is another form of vehicle detection. Since video detection systems such as those used in automatic number plate recognition do not involve installing any components directly into the road surface or roadbed, this type of system is known as a "non-intrusive" method of traffic detection. Video from cameras is fed into processors that analyze the changing characteristics of the video image as vehicles pass. The cameras are typically mounted on poles or structures above or adjacent to the roadway. Most video detection systems require some initial configuration to "teach" the processor the baseline background image.

Algorithms of ITS

Map matching algorithms

Map matching algorithms integrate positioning data with spatial road network data to support the navigation modules of intelligent transport systems requiring location and navigation data. Research on the development of map matching algorithms has significantly advanced over the last few years. This article looks at different methods that have been adopted in map matching algorithms and highlights future trends in map matching and navigation research.

Methodologies Used In Map Matching Algorithms

The general purpose of a map matching algorithm is to identify the correct road segment on which the vehicle is travelling and to determine the vehicle location on that segment. The parameters used to select a precise road segment are mainly based on the proximity between the position fix and the road, the degree of correlation between the vehicle trajectory derived from the position fixes and the road centerline, and the topology of the road network. Orthogonal projection of the position fix onto the selected road segment is normally used to calculate the vehicle location on the segment. Figure 1 shows a general map matching process (see Quddus, 2006 for details) which takes inputs from an integrated GPS/DR such as easting (E), northing (N), speed (v), and heading (θ) and the error variances associated with them. The map matching process also takes inputs from a spatial digital road network database. The outputs of the algorithm are the correct link on which the vehicle is travelling and the location of the vehicle () and the error variances associated with them.

travel time prediction algorithms

Recently, travel time prediction has become a crucial part of trip planning and dynamic route guidance for many advanced traveler information and transportation management systems. Moreover, a scalable prediction system with high accuracy is critical for the successful deployment of ATIS (Advanced Travelers Information Systems) in road networks. In this paper, we propose two travel time prediction algorithms using naïve Bayesian classification and rule-based classification. Both classification techniques provide a velocity class to be used for measuring travel time accurately. Our algorithms exhibit high accuracy in predicting travel time when using a large amount of historical traffic database. In addition, our travel time prediction algorithms are suitable for road networks with arbitrary travel routes. It is shown from our performance comparison, our travel time prediction algorithms significantly outperform the existing prediction algorithms, such as the link-based algorithm, the switching model, and the linear regression algorithm. In addition, it is revealed that our algorithm using naïve Bayesian classification is better on the performance of mean absolute relative error than our algorithm using rule-based classification.

path tracking algorithm

The algorithm is based on a geometrical analysis and GPS data specified to trace in real-time the current position of the vehicle according to a previous digital map of the path to be tracked. As a case study, the tracking algorithm has been developed following the regulations of the public transportation of Medellin, important Colombian city with a large number of public buses and a significant complexity in the mobility within the city.

Genetic Algorithm

ITS are complex systems. It is important to find out what should be included or excluded in the evaluation system. This part is to establish the inputs and outputs of evaluation model and identifying the benefits and costs related to the implementation of ITS infrastructure. The ITS implementation may generate several effects, such as engineering economics, transportation network performance, improvement of safety, environmental impact, regional economic impact and efficiency and equity considerations. This module aims to develop a group of factors for evaluating new intelligent transport systems and develop performance indicators, which give a measure of the effects on society, economics and environment. Both short-term and long-term impacts of ITS implementation are analyzed based on those factors.

Application areas of Intelligent Transport System

The entire application of ITS is based on data collection, analysis and using the results of the analysis in the operations, control and research concepts for traffic management where location plays an important role.

Here sensors, information processors, communication systems, roadside messages, GPS updates and automated traffic prioritization signals play an imperative role in the application of:

1- Advanced Traffic Management System

Intelligent transportation system (ITS) includes large numbers of traffic sensors that collect enormous quantities data in an attempt to provide information for the support and improvement of signal timing operations. Advanced forms of signal control, such as second and third generation control, are dependent on the sensor data supplied by ITS. However, basic forms of control such as time-of-day (TOD), which is the prevalent signal control methodology used in this country, do not rely on the sensor data for operation. The sensor data is in fact capable of providing abundant amounts of information that can aid in the development of improved TOD signal timing plans by providing historical data for automatic plan development and maintenance and TOD interval identification. Data mining tools are necessary to exact the pertinent information from the data

2- Advanced Traveler Information System

Advanced Travelers Information Systems (ATIS) is one of the functional areas of Intelligent Transportation Systems (ITS) and it aims at providing real time traffic information to the travelers for making better travel decisions. This information would be most effective if provided to travelers during or before the start of their trip. Therefore, accurate prediction models are required in ATIS for conveying reliable information about the future state of traffic. Different methods used for the prediction of traffic parameters include historic averaging, regression analysis, Kalman filtering, time series analysis, machine learning, etc. The objective of this research is to explore the use of automated sensor data and data driven techniques for traffic state prediction under Indian traffic conditions. Travel time and traffic density (as an indicator of congestion) are used commonly to inform users about the state of a traffic system. However, these two parameters are spatial in nature and direct measurement from field is difficult. Therefore, estimation of these parameters from location based data is a challenge in many of the ITS implementations. The present study addresses the problem of estimation of traffic density with the help of location based sensors which are capable of measuring parameters such as volume and Time Mean Speed (TMS). Machine learning techniques namely, k-Nearest Neighbor (k-NN) and Artificial Neural Network (ANN) are selected as the estimation and prediction tool in this study, based on acceptable performance of the same in earlier studies.

3- **Advanced Vehicle Control system**

The concept of the Intelligent Vehicle/Highway System (IVHS) is a direct descendent of earlier work on "roadway automation". Recent advances in a variety of technologies have now made automatic control of the operation of road vehicles a much more realistic proposition than it was even in the recent past. This paper begins by identifying three stages in the likely evolution of these advanced vehicle control systems (AVCS), showing how AVCS is related to the other IVHS functions. The technological elements of AVCS, corresponding to needed research and development work, are then described. The international state of the art in these technologies is reviewed, and the paper concludes with a discussion of an evolutionary progression that could be followed to lead from present-day driving to the long-term concept of an automated freeway network. View less

4- **Advanced Public Transportation System**

Advanced public transportation systems (APTS) seek to apply transportation management and information technologies to public transit systems to increase their efficiency of operation and improve the safety of public transportation riders. Examples of APTS applications include real-time passenger information systems, automatic vehicle location systems, bus arrival notification systems, and systems providing priority of passage to buses at signalized intersections.

5- **Advanced Rural Transportation Systems**

The Advanced Rural Transportation Systems area will improve mobility, safety, efficiency and communication in rural areas intelligent Vehicle Initiative Advanced Rural Transportation Systems involve the application of technologies from the other functional areas of ITS in a rural setting advanced rural transportation systems; advanced traffic management systems; advanced traveler information systems; advanced vehicle control systems. Advanced rural transportation systems (ARTS) intend to utilize developing ITS technologies to improve safety and efficiency of rural surface transportation systems.

6- **Advanced Commercial Vehicles Operations system**

Commercial Vehicle Operations is an application of Intelligent Transportation Systems for trucks .A typical system would be purchased by the managers of a trucking company. It would have a satellite navigation system, a small computer and a digital radio in each truck. Every fifteen minutes the computer transmits where the truck has been. The digital radio service forwards the data to the central office of the trucking company. A computer system in the central office manages the fleet in real time under control of a team of dispatchers. In this way, the central office knows where its trucks are. The company tracks individual loads by using bar-coded containers and pallets to track loads combined into a larger container. To minimize handling-expense, damage and waste of vehicle capacity, optimal-sized pallets are often constructed at distribution points to go to particular destinations.

What can be done(Suggestions)

Data Mining could help in studying daily traveler characteristics. In big crime laden cities, the movements of criminals could be studied, if boarding trains is somewhat connected to their ID/cell phones. Data Mining could help predict their movements and this could help in preventing attacks on vehicles in which important celebrities and their relatives travel. Data mining could help in predicting which route the criminals would be taking and thus quickly alert security agencies to catch the thieves. Early warning could be given to the occupants of the vehicles to abort their travel if any plans for bomb attacks are discovered. Data mining engines need to be used along with security techniques like encryption/decryption and firewalls to prevent attacks like Denial of service.

There are many methods of data preprocessing, data cleaning can remove the noise in the data, correct them inconsistent. Data integration of data from multiple sources into a consistent data storage, such as data cubes and data warehouses. Data conversion (e.g. normalization) may also be used. Such as standardization can improve data mining involves the effective distance metric and accuracy of the algorithm. Data statute by removing redundant features, aggregation or clustering methods to compress data. These data processing techniques in data mining before use, you can greatly improve the quality of data mining models. The results of data mining technology in the transportation system is mainly to predict and deal with traffic flow data, the future direction of the analysis of the data obtained by the data, the development trend forecasting traffic flow and use the predicted traffic guidance. In addition you can also contact by studying different factors affect the corresponding relationship between traffic flow data, obtained the degree of influence of different factors on the traffic flow , and use the results of these studies properly instruct transport services for the transportation system.

Traffic control system is one of the various areas, where critical data about the well-being of the society is recorded and kept. Various aspects of a traffic system like vehicle accidents, traffic volumes and concentration are recorded at different levels. There are many reasons for the occurrence of road accidents, such as distracted driving, environmental disasters, unsafe lane changes, collisions due to congestion, improper turning, and animal or pedestrian crossing. In order to ensure the sustainability of vehicular transportation, it is necessary to implement an effective intelligent transportation planning system that will improve road traffic safety and create a more eco-friendly environment. This paper presents a short analysis of green transportation, collision avoidance in transportation, electric cars, and autonomous cars, and provides a suggestion toward the end for developing an effective and efficient sustainable transportation planning system .Our country has all this problems above and death tolls are very high due to the poor transport system so it's better to adopt ITS and use Determining and Big Data concepts.

Conclusion

The rapid growth of population and vehicle transportations demands more reliable and efficient transportation networks. Intelligent transport systems are developed to achieve this goal by exploiting different technologies and applications.

ITS improve transportation safety and mobility, and enhance productivity through the use of advanced communications, sensors and information processing technologies. When integrated into the transportation system's infrastructure, and into vehicles themselves, these technologies relieve congestion, improve safety, and enhance Indian productivity.

Intelligent transportation system technologies–everything from traffic cameras to real time road and traffic information lines–being implemented in many states hold the promise of making travel safer, more efficient and less impactful on the environment. These technologies allow drivers to avoid accident sites, get real time traffic updates and pay tolls at full highway speeds, among other things. In the future, technology will also allow cars to wirelessly exchange data on location and braking to prevent accidents from occurring in the first place and to connect with the larger transportation network (including traffic lights) in order to decrease congestion and improve efficiency and mobility.