A MACHINE LEARNING-DRIVEN DECISION STRATEGY FOR AUTONOMOUS VEHICLE NAVIGATION

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ABSTRACT

Present autonomous vehicles do not take into account the state of the vehicle's interior while deciding how to drive; instead, they solely take into account external aspects like pedestrians and road conditions. In order to address the issue, this paper suggests "A Driving Decision Strategy (DDS) Based on Machine learning for an autonomous vehicle," which establishes the best course of action for an autonomous vehicle by examining both internal and external factors (such as RPM levels and consumable conditions). Using sensor data from automobiles stored in the cloud, the DDS develops a genetic algorithm to find the best driving strategy for an autonomous vehicle. In order to validate the DDS, this paper compared it with models of MLP and RF neural networks. In the testing, the DDS identified RPM, speed, steering angle, and lane changes 40% faster than the MLP and 22% faster than the RF. It also had a loss rate that was around 5% lower than that of current car gateways.

Keywords: Driver safety, autonomous vehicle navigation, machine learning, and decision-making

1 INTRODUCTION

But as autonomous vehicles get better at what they do, there are more sensors needed to identify information. The in-vehicle overload may be brought on by an increase in these sensors. Sensor data is computed by in-car computers in autonomous vehicles. Overload can have an impact on decision-making and control speed as calculated data volume rises. The vehicle's stability may be jeopardized by these issues. Some researches have created hardware that can carry out deep-running tasks inside the car to avoid the overload, while others calculate the sensor data from the car using the cloud. nevertheless, gathered from automobiles to ascertain the manner in which the vehicle is operating. In order to reduce in-vehicle computation, this paper proposes a Driving Decision Strategy (DDS) based on machine learning for autonomous vehicles. It generates big data on vehicle driving within the cloud and uses historical data from the cloud to determine the optimal driving strategy. The suggested DDS uses a genetic algorithm that is kept in the cloud to evaluate them and determine which driving style is optimal.

MOTIVATION

Currently, global companies are developing technologies for advanced self-driving cars, which is in the 4th stage. Self driving cars are being developed based on various ICT technologies, and the principle of operation can be classified into three levels of recognition, judgment and control. The recognition step is to recognize and collect information about surrounding situations by utilizing various sensors in vehicles such as GPS, camera, and radar. The judgment step determines the driving strategy based on the recognized information. Then, this step identifies and analyzes the conditions in which the vehicle is placed, and determines the driving plans appropriate to the driving environment and the objectives. The control step determines the speed, direction, etc. about the driving and the vehicle starts driving on its own. An autonomous driving vehicle performs various actions to arrive at its destination, repeating the steps of recognition, judgment and control on its own.

OBJECTIVES

The DDS learns a genetic algorithm using sensor data from vehicles stored in the cloud and determines the optimal driving strategy of an autonomous vehicle. This paper compared the DDS with MLP and RF neural network models to validate the DDS. In the experiment, the DDS had a loss rate approximately 5% lower than existing vehicle gateways and the DDS determined RPM, speed, steering angle and lane changes 40% faster than the MLP and 22% faster than the RF.

.2.LITERATURE SURVEY AND RELATED WORK

Y.N. Jeong, S.R.Son, E.H. Jeong and B.K. Lee, “An Integrated Self- Diagnosis System for an Autonomous Vehicle Based on an IoT Gateway and Deep Learning, ” Applied Sciences, vol. 8, no. 7, July 2018 This paper proposes “An Integrated Self-diagnosis System (ISS) for an Autonomous Vehicle based on an Internet of Things (IoT) Gateway and Deep Learning” that collects information from the sensors of an autonomous vehicle, diagnoses itself, and the influence between its parts by using Deep Learning and informs the driver of the result. The ISS consists of three modules. The first In-Vehicle Gateway Module (In-VGM) collects the data from the in-vehicle sensors, consisting of media data like a black box, driving radar, and the control messages of the vehicle, and transfers each of the data collected through each Controller Area Network (CAN), FlexRay, and Media Oriented Systems Transport (MOST) protocols to the on-board diagnostics (OBD) or the actuators. The data collected from the in-vehicle sensors is transferred to the CAN or FlexRay protocol and the media data collected while driving is transferred to the MOST protocol. Various types of messages transferred are transformed into a destination protocol message type. The second Optimized Deep Learning Module (ODLM) creates the Training Dataset on the basis of the data collected from the in-vehicle sensors and reasons the risk of the vehicle parts and consumables and the risk of the other parts influenced by a defective part. It diagnoses the vehicle’s total condition risk. The third Data Processing Module (DPM) is based on Edge Computing and has an Edge Computing based Self-diagnosis Service (ECSS) to improve the self-diagnosis speed and reduce the system overhead, while a V2X based Accident Notification Service (VANS) informs the adjacent vehicles and infrastructures of the self-diagnosis result analyzed by the OBD. This paper improves upon the simultaneous message transmission efficiency through the In-VGM by 15.25% and diminishes the learning error rate of a Neural Network algorithm through the ODLM by about 5.5%. Therefore, in addition, by transferring the self-diagnosis information and by managing the time to replace the car parts of an autonomous driving vehicle safely, this reduces loss of life and overall cost. Yukiko Kenmochi, Lilian Buzer, Akihiro Sugimoto, Ikuko Shimizu, “Discrete plane segmentation and estimation from a point cloud using local geometric patterns, ” International Journal of Automation and Computing, Vol. 5, No. 3, pp.246-256, 2008.

This paper presents a method for segmenting a 3D point cloud into planar surfaces using recently obtained discrete-geometry results. In discrete geometry, a discrete plane is defined as a set of grid points lying between two parallel planes with a small distance, called thickness. In contrast to the continuous case, there exist a finite number of local geometric patterns (LGPs) appearing on discrete planes. Moreover, such an LGP does not possess the unique normal vector but a set of normal vectors. By using those LGP properties, we first reject non- linear points from a point cloud, and then classify non-rejected points whose LGPs have common normal vectors into a planar-surface-point set. From each segmented point set, we also estimate the values of parameters of a discrete plane by minimizing its thickness. Ning Ye, Yingya Zhang, Ruchuan Wang, Reza Malekian, “Vehicle trajectory prediction based on Hidden Markov Model,” The KSII Transactions on Internet and Information Systems, Vol. 10, No. 7, 2017.

In Intelligent Transportation Systems (ITS), logistics distribution and mobile e-commerce, the real-time, accurate and reliable vehicle trajectory prediction has significant application value. Vehicle trajectory prediction can not only provide accurate location-based services, but also can monitor and predict traffic situation in advance, and then further recommend the optimal route for users. In this paper, firstly, we mine the double layers of hidden states of vehicle historical trajectories, and then determine the parameters of HMM (hidden Markov model) by historical data. Secondly, we adopt Viterbi algorithm to seek the double layers hidden states sequences corresponding to the just driven trajectory. Finally, we propose a new algorithm (DHMTP) for vehicle trajectory prediction based on the hidden Markov model of double layers hidden states, and predict the nearest neighbor unit of location information of the next k stages. The experimental results demonstrate that the prediction accuracy of the proposed algorithm is increased by 18.3% compared with TPMO algorithm and increased by 23.1% compared with Naive algorithm in aspect of predicting the next k phases' trajectories, especially when traffic flow is greater, such as this time from weekday morning to evening. Moreover, the time performance of DHMTP algorithm is also clearly improved compared with TPMO algorithm.

3 EXISTING SYSTEM

k-NN, RF, SVM and Bayes models are existing methods Although studies have been done in the medical field with an advanced data exploration using machine learning algorithms, orthopedic disease prediction is still a relatively new area and must be explored further for the accurate prevention and cure.it mines the double layers of hidden states of vehicle historical trajectories, and then selects the parameters of Hidden Markov Model(HMM) by the historical data. In addition, it uses a Viterbi algorithm to find the double layers hidden states sequences corresponding to the just driven trajectory. Finally, it proposes a new algorithm for vehicle trajectory prediction based on the hidden Markov model of double layers hidden states, and predicts the nearest neighbor unit of location information of the next k stages.

Drawbacks

1. less efficiency and need more are to explored for prevention

4 PROPOSED WORK AND ALGORITHM

Here we proposes “A Driving Decision Strategy(DDS) Based on Machine learning for an autonomous vehicle” which determines the optimal strategy of an autonomous vehicle by analyzing not only the external factors, but also the internal factors of the vehicle (consumable conditions, RPM levels etc.). The DDS learns a genetic algorithm using sensor data from vehicles stored in the cloud and determines the optimal driving strategy of an autonomous vehicle. This paper compared the DDS with MLP and RF neural network models to validate the DDS. In the experiment, the DDS had a loss rate approximately 5% lower than existing vehicle gateways and the DDS determined RPM, speed, steering angle and lane changes 40% faster than the MLP and 22% faster than the RF.

Advantages

1. These improvements system to control the vehicle based on sensor data

5 METHODOLOGIES

MODULES

ABOUT TECHNOLOGY

Below are some facts about Python.

Python is currently the most widely used multi-purpose, high-level programming language. Python allows programming in Object-Oriented and Procedural paradigms. Python programs generally are smaller than other programming languages like Java.

Programmers have to type relatively less and indentation requirement of the language, makes them readable all the time.

Python language is being used by almost all tech-giant companies like – Google, Amazon, Facebook, Instagram, Dropbox, Uber… etc.

The biggest strength of Python is huge collection of standard library which can be used for the following –

- Machine Learning
- GUI Applications (like Kivy, Tkinter, PyQtetc.)
- Web frameworks like Django (used by YouTube, Instagram, Dropbox)
- Image processing (like OpenCV, Pillow)
- Web scraping (like Scrapy, Beautiful Soup, Selenium)
- Test frameworks
- Multimedia

6 RESULTS AND DISCUSSION

FIG 1: In above screen click on 'Upload Historical Trajectory Dataset' button and upload dataset

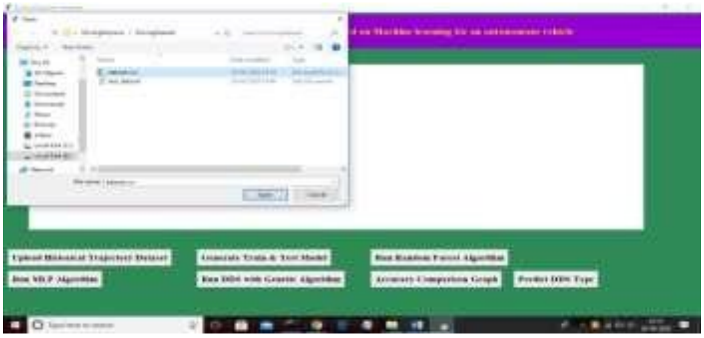

FIG 2: Now select 'dataset.csv' file and click on 'Open' button to load dataset and to get below scree

FIG 3 In above screen dataset is loaded and now click on 'Generate Train & Test Model' button to read dataset and to split dataset into train and test part to generate machine learning train model

FIG 4 In above screen dataset contains 977 total trajectory records and application using 781 (80% of dataset) records for training and 196 (20% of dataset) for testing. Now both training

and testing data is ready and now click on 'Run Random Forest Algorithm' button to train random forest classifier and to calculate its prediction accuracy on 20% test data

FIG 6 In above screen MLP got 48% prediction accuracy and in below screen we can see genetic algorithm code used for building propose DDS algorith

FIG 7 In above screen we can see genetic algorithm code used in DDS algorithm and now click on 'Run DDS with Genetic Algorithm' button to train DDS and to calculate its prediction accuracy

FIG 9: In above screen propose DDS algorithm got 73% prediction accuracy and now click on 'Accuracy Comparison Graph' button to get below graph

FIG 10 In above graph x-axis represents algorithm name and y-axis represents accuracy of those algorithms and from above graph we can conclude that DDS is performing well compare to other two algorithms. Now click on 'Predict DDS Type' button to predict test data

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7. CONCLUSION AND FUTURE SCOPE

This essay suggested a driving decision-making approach. In order to evaluate the car's ideal driving strategy given the slope and curvature of the road it is traveling on, it applies a genetic algorithm based on accumulated data. It also provides drivers with a visual representation of the driving and consumable circumstances of an autonomous vehicle. Experiments were carried out on the DDS to choose the best driving approach by examining data from an autonomous vehicle in order to confirm the DDS's validity. The DDS finds the best driving strategy 40% faster than the MLP, although having an accuracy that is comparable to its. Also, the DDS finds the best driving strategy 20% quicker than the RF and with a 22% greater accuracy. Because it needs to be accurate and real-time, the DDS is therefore the most suitable for figuring out the ideal driving strategy. Compared to other approaches, the DDS finds the vehicle's ideal driving strategy more quickly since it sends only the essential data to the cloud, where the genetic algorithm evaluates the data. Unfortunately, there weren't enough resources for visualization because the DDS experiments were carried out on PCs in virtual environments.

FUTURE SCOPE

Subsequent research endeavors ought to evaluate the DDS through its application to real-world automobiles and augment the comprehensiveness of visualization elements by means of expert designers. employing more sophisticated machine learning methods and algorithms to increase the driving choice strategy's precision and effectiveness. extending the driving choice strategy's reach to incorporate more variables like weather, traffic, driver preferences, and vehicle health.

8 REFERENCES

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