

Driving Decision Strategy using Machine Learning Algorithms for Autonomous Vehicles

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Abstract—Autonomous vehicles are the core in the technology of automation and decision making. Indeed there are various parameters that need to address effectively for better results and least disaster. But the current self vehicles/ autonomous vehicles are in great juncture of capable understanding without any human interaction especially in the way of changing lanes various algorithms are in support of decision making. This paper suggests a Decision strategy for lane changing by applying some eminent algorithms like MLP, Random Forest and some genetic algorithms. Comparison of accuracy among these and suggesting a solution in form of Driving Decision Strategy based genetic algorithm is mentioned as the final outcome of the paper. Accuracy check is also made as in the results from which best option can be chosen accordingly with greater efficiency.

Index Terms— Autonomous vehicles, Genetic algorithms, Radio frequency Training, Cloud Computing.

I. INTRODUCTION

In general Autonomous Vehicles are more efficient and effective and much safer based on considerable improvements [1]. Even better end to end driving models are suggested using Deep Convolution Neural Networks (DCNN). Present independent vehicle decides its driving system by thinking about just outer variables (People on foot, street conditions, and so forth) without considering the inside state of the vehicle [2]. To take care of the issue, the paper proposes "A Driving Decision Strategy (DDS) Based on Machine Learning for a self-governing vehicle" which decides the ideal system of a self-governing vehicle by breaking down not just the outer variables, yet additionally the inside elements of the vehicle (intermittent conditions, Motor functions and so on). To achieve this, most importantly number of sensors involved in the rise of performance is proportionate. In recent days most researchers are working on finding the exact trajectories and avoiding bottlenecks in decision making. Various studies refers to increase of vehicle ownership escalates the growth of automobile revenue and that is appreciable, but the illegitimate decision making of vehicle transponders create a panic on the pedestrians [3]. Besides it all, many factors like environmental conditions, weather parameters, visibility on roads, geometric constraints may also effect the driving decisions [3]. This reference is needed to overcome the risks in mitigating the accidental interventions. In a certain study of driving decision making process, vehicle sensors are detecting the movements and predictions are made from the data processing system making the appropriate decisions for control and remedy of accident preventions. This will always reduce the intermittent effects. Behaviour is a major parameter to be addressed and studied as behavioural inferences are challenging on roads and decision making effects in these cases. Researchers have given aggressive solutions by considering

behavioural existences on the roads and improving self decision rules on vehicles [4]. This varies with respect to multiple road design and construction characteristics viz. Two way lanes, cross over roads, changing lane points, pedestrian ways, street light points. So strategic decision making is devised for all the mentioned parameters especially lane change over and cross road intersections.

II. RELATED WORK

Making decisions is a very prime in autonomous vehicles and any kind of uncertainties will lead to trouble on busy roads. Intersection identity is addressed properly without violating traffic rules and decision making is important. Some works like deep learning methods, proposes movement of vehicles on detecting environmental scenes on which decisions are made. Variety of simulators like CARLA, TORCS supporting the features in synchronization with user API, vehicle movement, pedestrian movement, frictional profiles, variations of critical entities and so on and so forth [5]. Using Deep Reinforcement learning multiple parameters like angle of vehicle, axis, speed, rpm, deep axis velocity, and speed X, speed Y are needed to analyze and effectiveness is interpreted on state space and action space [6]. Researchers depict a driving decision strategy algorithm by considering the training input and trained input is processed across angle, direction; variation depicted among careful observation of lane changes under different chromosomes. Pedestrian cross over across versatile characterization is also coped up with careful observation for getting outputs [1]. Learning of DDS is expected as a when a group of child chromosomes are processed and is finished similar to mutation. The repetition is done for all the trained sets of data at different levels with understanding of suitability generation and expansion within a great usage of performance in machine learning. Driving Decision Strategy again repeats the mutation computation process if a training set is generated accordingly in an optimal driving table of particular slope and curvature of the driving road, generates an optimal driving table, and stores the set of chromosomes in the optimal driving table. In busy roads at urban intersection the autonomous vehicles are given a multi objective optimization solution with a Gaussian Process Regression Model in predicting the vehicle trajectories and have been proven efficient. Non dominated Sorting algorithm is most popular genetic algorithms provisioning the method of handling multi objective optimization problem. Crowded distance sorting is latter stage of non dominated distance sorting mentioning the rejected state of trajectories with autonomous vehicles in the intersection roads of urban spaces. Experiments conducted in the same work using deep deterministic Policy Gradient eliminates the correlation between training samples and improve stability of training [2]. Certain solutions of autonomous vehicles with Optimized Support vector machine regression is proposed on adapting various vehicle states subjective to the position of the vehicle, speed, position of the surrounding vehicle, speed of surrounding vehicles, sudden abnormalities, vision and environmental effects, close reactions in care and cancellation of positions, jerk cases etc. Based on preliminary data processing, the subjective precision statistics are applicable in data processing and data processing program [3]. Also various studies say on Driving Decision-Making Mechanism of Autonomous Vehicle is approaching a new strand at classic examples in urbanities with an excellent experimental support. More importantly deciding on roads with impact of care expansion in regard to road parameters like adhesion expansion, curvature, slopes, frictional parameters are set [3]. Hidden states are observed in some cases, termed as uncontrollable intersections with inclined characters of killing potential driving directions. Care is to be taken in applying mechanisms in those cases of understanding inherent deviations on the roads of busy intersection [4]. In general human decisions will be in the cases of turning the vehicles in right, left, same side, opposite directions and lane keeping as well. Personalized driving Indicator selection, Manual Driving Scene Setting, Manual Driving Analysis are also made up to clear indication of generating maps in clear observation and remote action in accordance with reinforcement learning at critical intersection [6].

III. METHODOLOGY

The proposed methodology distributes the data set over the algorithms like Run Random Forest algorithm, MLP algorithm, DDS genetic algorithm and finally comparing the accuracy of all the applied algorithms. Through the accuracy, DDS is predicted on the attributes chosen in the data set in accordance especially with time frames of the vehicle, type of the vehicle, elaborate conditions of the vehicle. With this DDS gives in support of MLP gives the expected learns a hereditary calculation utilizing sensor information from vehicles placed in the cloud and decides the ideal driving decision procedure of a self-ruling vehicle. Current paper concentrates on the DDS, MLP and RF neural system models to accept the DDS. Over the analyze, the DDS had a unfortunate rate around 5% lower than present vehicle entryways and the DDS decided RPM, speed, directing point and path changes

quicker than the MLP also, quicker than the Random Forest. The step wise procedure in the flow chart is explained in detail below in Fig.1..

- Initially data processing is carried out.
- From the previous step data exploration and Training and Testing is carried out through various available tools.
- Finally prediction is carried out for generality and observation.

A. Upload Historical Trajectory Dataset

Dataset is framed from the data generated from sensors in the vehicles to observe the understanding of various characteristic parameters like environmental conditions, jerks, abnormal conclusions etc.

The dataset consists of vehicles time and average, minimum, maximum speed of the vehicle and rpm values of the vehicle.

B. Generate Train & Test Model

To generate training and test model the dataset itself divide the data into two different datasets. One is for training purpose and second dataset is for testing purpose. 80% of the dataset is for training and 20 % of the dataset is for testing purpose. Genetic Algorithms (GAs) are adaptive heuristic search algorithms that belong to the longer part of evolutionary algorithms. Genetic algorithms are based on the ideas of natural selection and genetics.

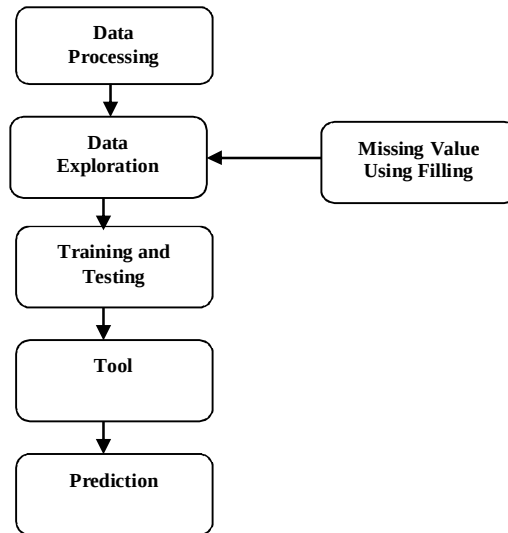


Fig.1. Flow chart of data processing in DDS

C. Accuracy Comparison Graph

Accuracy comparison graph is use to compare all the three algorithms accuracy value.It tells the efficiency of every algorithm by using a bar graph.

D. Predict DDS Type

To predict the DDS type we have to give the testing dataset as an input and predict the output by using a genetic algorithm. It gives the decision of lane change and for the steering angle and the speed mode of the vehicle

IV. RESULTS AND FINDINGS

This section gives the results in respect to Random Forest, MLP in veracities of data set through Recall, Precision, FMeasure and Accuracy. Finally DDS genetic algorithm accuracy is compared with the previous mentioned algorithms. Comparison of accuracy among the three algorithms is observed and lane change using the DDS is shown in a very interactive UI.

Finding 1

This shows the performance of data sets on the Random Forest Algorithm in terms of precision -67.59%, recall-67.61%, FMeasure-66.64%, accuracy-67.34%.



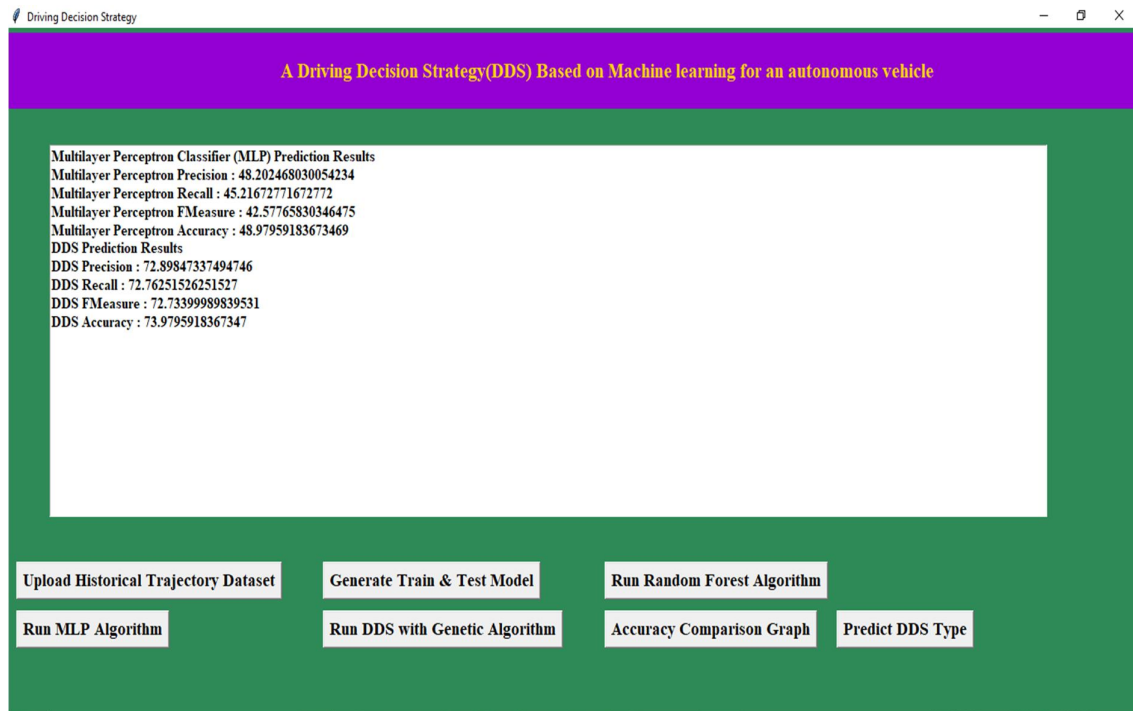
Finding 2

This shows the performance of data sets on the MLP in terms of precision -48.202%, recall-45.216%, FMeasure-42.577%, accuracy-48.979%.



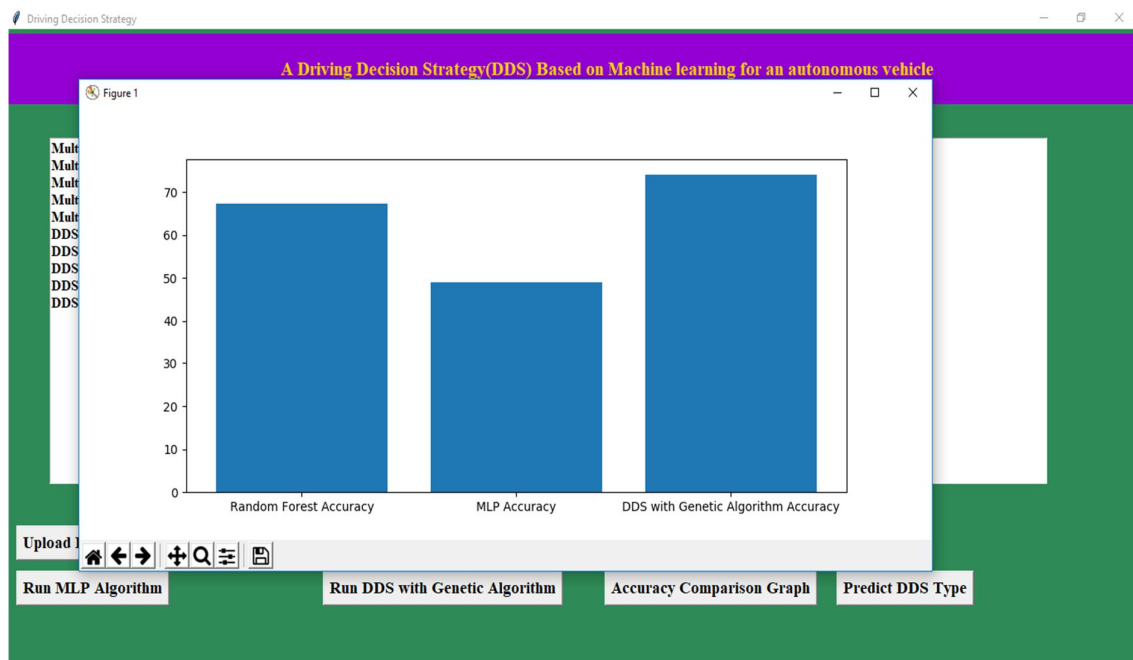
Finding 3

This shows the performance of data sets on the DDS prediction Algorithm over MLP in terms of precision -72.89%, recall-72.76%, FMeasure-72.73%, accuracy-73.97%.



Finding 4

This shows the comparison of accuracy over the three algorithms considered and providing a best Driving Decision Strategy with effective accuracy 73.9%.



Finding 5

This shows the DDS in response with lane change, steering angle and speed; in response with the justification of careful understanding in choosing a specific machine learning algorithm.



V. CONCLUSION

This paper proposes a Driving Decision Strategy by predicting the possibilities over change of lane, speed, and steering angle. It has been concluded the accuracy over all applicable algorithms is high in genetic algorithm and it is around 73%, better among all existing algorithms. Autonomous vehicles/self vehicles are perfectly carried and travelled on roads with accurate decision making only. Versatile parameters are observed in taking decisions like angular velocity, speed, curvature in multiple places viz urban areas, busy roads, heavy intensity junctions and intersections.

FUTURE SCOPE

In future similar prototypes can be created for real time vehicles on roads with much more interaction and acceptance rate. Actual vehicles when applied may be cumbersome with realistic parameters responding differently. Even though it is giving a different outcome at some place results could be positive.

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