Project Synopsis
on

Behavioural Pattern Analysis of Drivers

Submitted as a part of course curriculum for

Bachelor of Technology
in
Computer Science

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DECLARATION

We hereby declare that this submission is our work and that, to the best of our knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgement has been made in the text.

Signature of Students

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CERTIFICATE

This is to certify that Project Report entitled "**Behavioural Pattern Analysis of Drivers**" which is submitted by **Shivi Goel, Sneha Jaiswal, Shikha Dixit** in partial fulfilment of the requirement for the award of degree B. Tech. in Department of Computer Science of Dr A.P.J. Abdul Kalam Technical University, Lucknow is a record of the candidates own work carried out by them under my supervision. The matter embodied in this report is original and has not been submitted for the award of any other degree.

Date:

Supervisor Signature
Prof. Vikas Kamra
(Assistant Professor)

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Last but not the least, we acknowledge our friends for their contribution to the completion of the project.

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ABSTRACT

The current provision of providing a permanent driving licence in India majorly includes filing of the application, issuance of learner's licence and completion of a driving test within a month of the issuance of the learner's licence. But this one-time physical driving test is not an efficient criterion for issuing driving licences. It is necessary to further explore the relationship between driver behaviour, vehicle status and road traffic environment to determine the drivers' comprehensive driving capability and thus issuing the permanent licences accordingly.

Hence, this project proposes a more detailed approach to analyse one's driving skills and behaviour, which can be defined as the way a driver responds to his existing driving state (e.g., the vehicle's speed or distance to the vehicle in front) by performing a certain action (e.g., accelerate or steer), over a longer time period using some specific factors.

These factors include:

- Speed of the vehicle
- Acceleration of the vehicle
- Steering wheel movement
- Lane changing frequency
- Seat belt
- Traffic rule violations

We will use certain machine learning algorithms to perceive patterns from the datasets and then analyse those further using data science algorithms/methods to decide whether the driver is capable enough to be given a permanent driving licence or he needs to improve his driving skills and habits.

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CHAPTER 1: INTRODUCTION

1.1. Introduction

The massive development in the automobile industry has enhanced vehicle technology to ensure safe and secure travel. But still many accidents occur due to the unsafe, careless and dangerous driving of the driver. Even today, the problem of traffic safety concerns the worldwide. Hence, it becomes important to analyse both driver's skills and his behavioural pattern while driving to conclude his comprehensive driving capability and implementing the same criterion in issuing permanent driver licence.

In order to better educate, manage, and restrain driver behaviour, from the perspective of human factors and psychology, we have devised some parameters including speed of the vehicle, acceleration of the vehicle, steering wheel movement, lane changing frequency, seat belt and traffic rule violations.

In a real time scenario, we can collect data for these factors using a camera. The camera can help us collect information about the steering wheel movement, lane changing frequency, seat belt, speed and some traffic rule violations while data about other violations is already present in the RTO database.

1.2. Problem Statement

The current provision of providing a permanent driving licence in India majorly includes filing of the application, issuance of learner's licence and completion of a driving test within a month of the issuance of the learner's licence.

There are 997 regional transport offices (RTOs) in India issuing over 1.15 crore fresh or renewed driving licences every year. A rough calculation shows that, on an average, 40 licences are issued by each RTO on any working day and it can be as high as 130 licences

per day in case of Delhi. Six out of every 10 people with a driving licence in India never actually sat behind a wheel to get it, according to a sample survey done across 10 cities, including five metros which have the highest vehicle population.

These reports are enough to realise that, this one-time physical driving test is not an efficient criterion for issuing driving licences. It is necessary to further explore the relationship between driver behaviour, vehicle status and road traffic environment to determine the drivers' comprehensive driving capability and thus issuing the permanent licences accordingly.

1.3. Objective

This project proposes a more detailed approach to analyse one's driving skills and behaviour, which can be defined as the way a driver responds to his existing driving state (e.g., the vehicle's speed or distance to the vehicle in front) by performing a certain action (e.g., accelerate or steer), over a (comparatively) longer time period using some specific factors.
These factors aim at calculating:

- Driver's overtaking tendencies using the lane changing frequencies derived from the road images captured by the camera.
- Over speeding using the odometer images captured by the camera.
- Rash driving behaviour using the steering wheel movement captured by the camera.
- Safety rule violations using the seatbelt images captured by the camera.

These individual conclusions will help us develop a scoring system for drivers under observation through which we can score them and decide whether they should be given permanent driving licences or not.

1.4. Future Scope

This project has a lot of potential and can even be adopted as a standard procedure to issue permanent driver licences nationwide. As we proceed, there are several other factors that can be added to this project as a criterion improving its credibility and accuracy. We can also use this project to better understand driver's perspectives while driving, analyse a pattern in their driving habits and their relation with road accidents.

Thus, in future, with large amounts of real-time data available, we should be able to get higher accuracy as well as finer classification categories that will automatically improve the quality of the project resulting in the improvement of the driver's skills and habits.

CHAPTER 2: LITERATURE REVIEW

Paper 1

Analyzing objective and subjective data in social sciences: Implications for Smart Cities

Introduction

The research work done in this paper revolves around the integration of technology into the field of social studies. There are a lot of technologies available that help us collect data from the surroundings and later analyse the data to predict the behaviour. Several machine learning and data science techniques have been applied to perform the required task.

Summary

The study involves a field experiment carried out in UK on around 1870 people for two different time periods. Data for analysis is collected with the help of a Smartphone app. It is used to collect location of the user. Also it is used to collect some pictorial data for better understanding. With all this data in hand, it is analysed through data science techniques and then machine learning algorithms are applied to analyse how people interact with their surrounding green spaces.

Basically two types of data are collected: objective (sensor information) and subjective data (direct input from the users). Data is collected in different forms including location, text, image and time. Clustering is applied. With the help of different graphs and charts, the data is analysed.

Conclusion

Finally it concludes on how large scale social studies can be carried out and which type of techniques can be used for this purpose. With the help of this study, the behavioural

pattern analysis of people visiting green spaces is done.

Paper 2

Orderliness predicts academic performance: behavioural analysis on campus lifestyle

Introduction

The paper basically tells us about behavioural analysis of students evaluated with the help of a study that determines the relationship between student's behaviour with their academic performance. In contrast to previous studies done through surveys and questionnaires, this study mainly focuses on collection of digital data and its analysis.

Summary

The study tries to predict some qualitative data on campus lifestyle of students. A set of 18960 students are picked for the analysis. The data is collected through smart cards given to students for this purpose. This data basically includes their shower time and meal time to calculate their orderliness and their library in and out timings to calculate their diligence.

Shower time and meal time help us in evaluating the student's orderliness i.e. the quality of being well arranged or organized. Furthermore library in out timings help us to calculate diligence i.e. how persistent a student is towards their goal.
With the help of machine learning algorithm like linear regression, orderliness and diligence are analysed to predict their overall academic performance in terms of their GPA

Conclusion

Based on this data and its analysis, educational institutions can evaluate good and poor performance of their students and work accordingly to improve the performance of those students which are not doing well. Moreover, they can encourage students to work on their weaker parts.

Paper 3

Analysis of Distracted Driver Behaviour Using Self-Organizing Maps

Introduction

In this paper, different types of distractions of a driver are discussed and also it tells the effect of a particular distraction in driver's behaviour. Like how these distraction can change the behaviour of drivers. So for this they have used Self Organizing Maps (SOM) technique which is used for clustering and mapping the data. Thus they can reduce the dimensionality of the sequence data and through this they can easily visualize the clustering of different behaviour of the drivers.

Summary

The collected data, that was used for analyzing the driver's behaviour, included application of the brake(brake pressure) , velocity in three dimensions (X,Y,Z) , turning, lane gap, and above average velocity. These patterns are used to build a model for the behaviour of driver using the Self Organizing Maps (SOM). Each driver was subjected to three types of distraction which were music, hands-free verbal communication, and texting. For analyzing driver's behaviour the SOM is trained with all the 40 participants in the study and with the three types of distraction.

Conclusion

The SOM is able to represent the structure of a time series dataset. For the above three types of distraction, it is observed that the "music" distraction was the most visible distraction. While listening to the music it changes the mood and behaviour of driver. It suggested which type of distractions had the largest impact on the driver.

Paper 4

Behavioural Classification of Drivers for Driving Efficiency Related ADAS Using Artificial Neural Network

Introduction

This paper presents that the aggressiveness and the driving style of driver are majorly influence to vehicle control. The driver handles the vehicle according to their experience, emotional states, and driving preferences. Thus we get different types of behaviour and patterns. Sometimes driver unknowingly waste their energy because they do not drive in a precise manner. Therefore for improving behaviour of driver it will analyse the driving characteristics to instruct the driver.

Summary

The driving skills of driver will be divided into these three categories aggressive, normal and calm states through these three different driving inputs which are vehicle acceleration, speed, and throttle pedal angle. If the collected data is effectively analysed the resulting classification can majorly improve the effectiveness of Advanced Driving Assistance System (ADAS).

Conclusion

For an efficiency oriented analysis, artificial neural network (ANN) is used to classify drivers into aggressive, normal, and calm. The resultant models have fairly accurate classification according to different driving scenarios, with overall accuracy of 90%. The classification can be a reminder for the drivers of their current behaviour, in-order for the drivers to take necessary actions to improve the driving condition.

Paper 5

Driver Evaluation Based on Classification of Rapid Decelerating Patterns

Introduction

In this paper, the risk level of driving behaviour is evaluated by acceleration patterns. The driving styles were investigated with a driving simulator. This paper is mainly focused on braking action (i.e. acceleration and deceleration). It uses clustering algorithms for classifying braking patterns into groups.

Summary

This paper has proposed a new method for evaluating risk factors based on braking pattern clustering. This take the record of the brake pressure like how brake pedals were depressed and released. These actions are also reflects the traffic situation. Through these data it can be calculated the level of risk of driving behaviour based on the brake pattern.

Conclusion

The clustering technique is used to classify braking patterns and other algorithms are also used for the calculation of these things. They also captured the video images of vehicle through which we can be easily analyze the factors of accidents and also we can evaluate the risk level of the accident of driver.

CHAPTER 3: PROPOSED METHODOLOGY

3.1 Flowchart

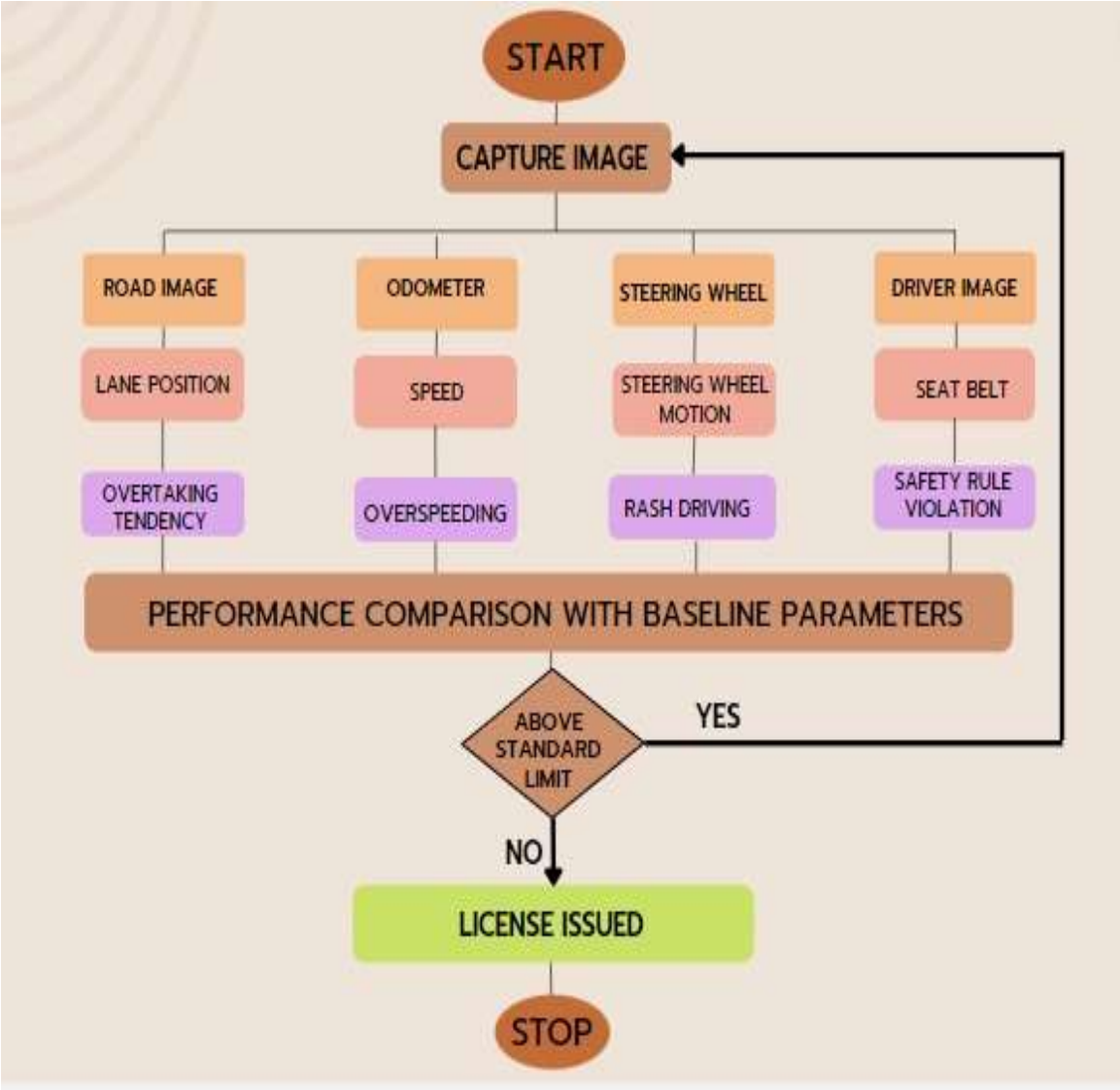

Fig.1. Flowchart of the proposed approach

3.2 Algorithm Proposed

To implement the model, two cameras will be used. One camera will be placed on the dashboard of the vehicle which will click images of road through the vehicle. The images collected by this camera will be used for the analysis of two factors namely steering wheel movement and lane position.

The other camera will be used to click images of the driver for seat belt check and later it will collect images of the odometer to keep a check on the speed and acceleration of the vehicle.

These parameters are checked over a certain period of time. If these parameters are within their specified/provided limit then the driver is issued with the permanent driving licence otherwise not.

CHAPTER 4: TECHNOLOGY USED

Computer Vision:

It is a field of artificial intelligence that deals with the real world images by interpreting the images. It gives the "dumb" machine (i.e. computers), the ability to see and understand. Using digital images from cameras, this field can process the data and behave according to what it "sees".

OpenCV:

OpenCV (Open Source Computer Vision Library) is a computer vision and machine learning library that is open-source and is available for multiple programming languages to implement in. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products.

Cloud Platform:

A cloud platform is used to store the generated data and to monitor the condition of the truck driver in this case. It is a robust replacement for the local storage as cloud computing allows multiple users to connect to the similar server and access the data securely. Some popular cloud services are: Amazon AWS, Google cloud Platform, Alibaba cloud, Microsoft Azure, etc. For IoT, we can also use Arduino cloud, Blynk IoT cloud, etc.

Internet of Things:

According to Wikipedia, "The Internet of things (IoT) describes physical objects (or groups of such objects) with sensors, processing ability, software, and other technologies that connect and exchange data with other devices and systems over the Internet or other communications networks. Internet of things has been considered a misnomer because devices do not need to be connected to the public internet, they only need to be connected to a network and be individually addressable."

CHAPTER 5: DIAGRAMS

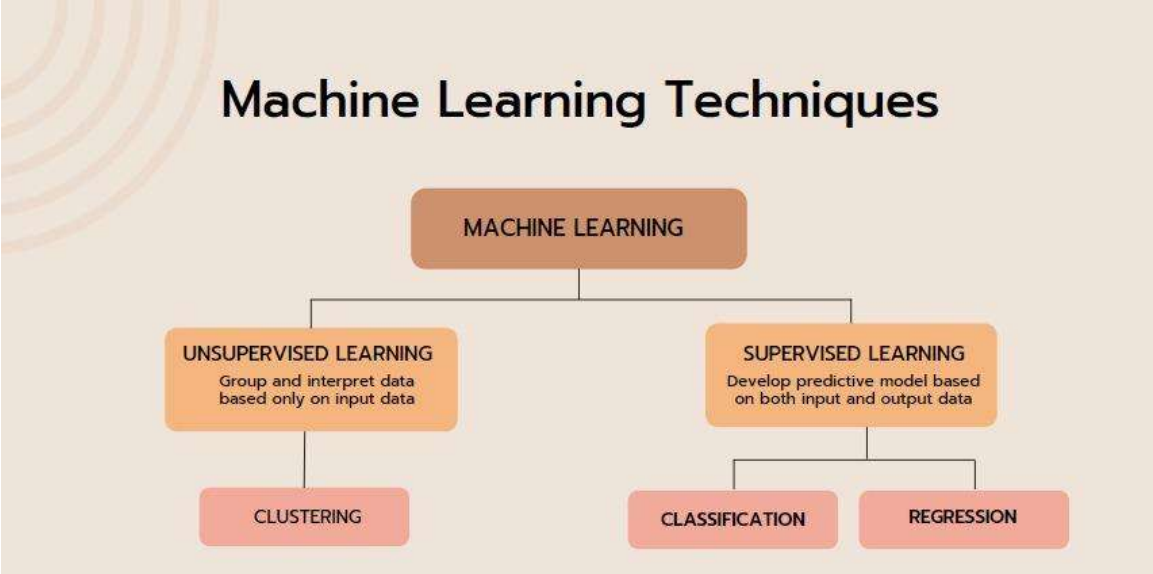

Fig.2. Classification of Machine Learning

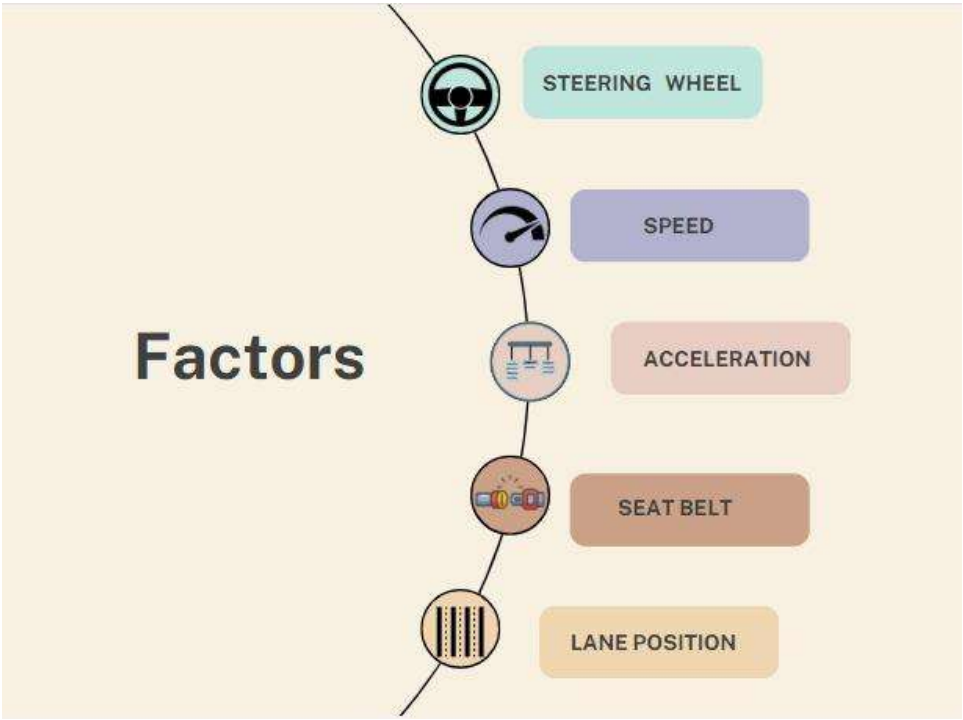

Fig.3. Factors for Behavioural Analysis

CHAPTER 6: CONCLUSION

The issuing of a permanent driving licence cannot be done based on a single test**.** Since driving a vehicle not only involves safety concerns regarding the driver's life but it also includes the safety of other people on the road**.** Therefore a person should be allotted with his permanent driving licence only after doing certain analysis on his driving behaviour.

This approach for issuing permanent driving licences will help considerably in reducing road accidents as the driving licence will be issued to only those whose skills have been analysed and hence it is considered that they will drive safely.

Although accidents are an unpredicted incident and we cannot be sure that a person with good driving skills for a certain period of time will never do an accident and always drive safe but still with the help of this model we can surely help in reducing them.

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