DriveSafe: A Driver Safety Software System

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INTRODUCTION

The problem of traffic overcrowding is becoming more alarming every day as the number of vehicles constantly increase around the globe. Road users are becoming more prone to accidents.

- The major cause of accidents on roadway is highly attributed to human error:
  1. Driver inattention
  2. Unintended manoeuvres
  3. Reckless and aggressive driving
- Use driver behaviour models to build software systems that issue warnings to drivers
- Provide drivers with accurate reports of their driving behaviour
- Improve traffic safety and enhance the driving experience as a whole

OBJECTIVES

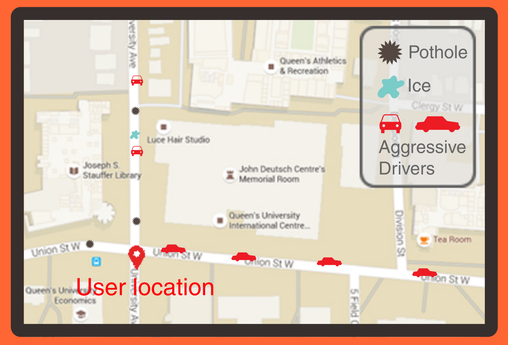
Implement a software system that detects driving hazards

- To detect hazardous driving situation:
  1. The profile of the driver in interest
  2. Road condition
  3. Profiles of the surrounding drivers
- Mobile application *DriveSafe*:
  For real time driving evaluation
- Web portal *Travel Viewer*:
  For post-driving data tracking

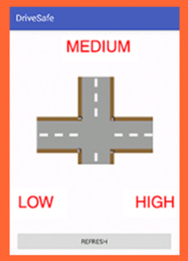
DriveSafe

USER INTERFACE

In order to raise the user's awareness if she becomes more aggressive or any road anomaly occurs, DriveSafe creates a dialog every time it updates if there is any pending warning message. The user is blocked from accessing other functionalities of DriveSafe until she acknowledges the message by pressing 'OK'.



When the user drives into an intersection, DriveSafe displays the 'Intersection' screen and provides information about the percentage of aggressive drivers from different directions. Since intersections are one of the most common accidents spots, the user could pay higher attention at a certain direction with more aggressive drivers.



ALGORITHM

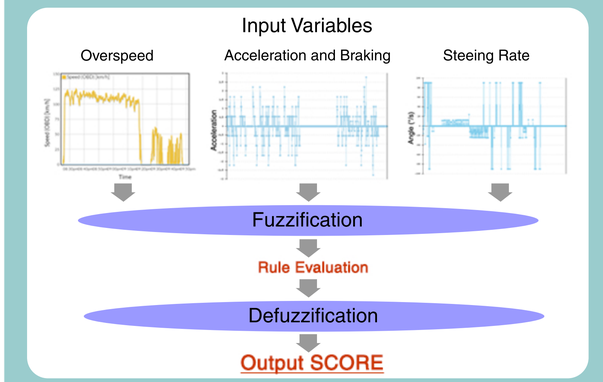


Fig. 1: Fuzzy Inference System

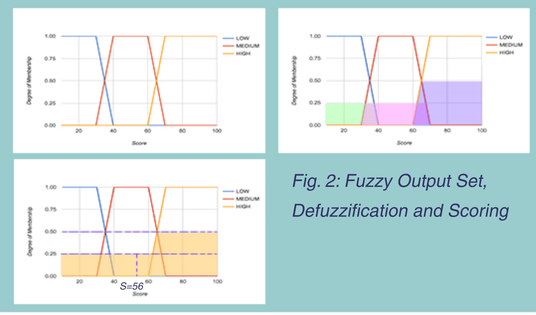


Fig. 2: Fuzzy Output Set, Defuzzification and Scoring

The architecture of the system is briefly illustrated in *Figure 1*. There are 4 measurements to determine driver profiling and each has 3 input variables:

1) **Overspeed**: relative overspeed time, average overspeed and maximum overspeed
2) Acceleration: maximum acceleration, moderate acceleration events and aggressive events per kilometer
3) Braking: maximum deceleration, moderate deceleration events and aggressive events per kilometer
4) Steering Rate: maximum observed steering rate, moderate steering events and aggressive steering events per kilometer

After collecting and calculating input variables, we consider the fuzzy sets for the input variables as three categories: LOW, MEDIUM, and HIGH.

Then, we define rules for all possible combinations of the four measurements to classify the driver's hazard level into three categories.

In the end, we apply COG (centre of gravity) algorithm to generate the defuzzified numeric score.

FUTURE WORK

- Use Google Maps API to retrieve any given location's speed limit, instead of estimating manually before every trip
- Improve warning message system: replace pop-up dialog with voice clips
  Further improvement: integrating mobile app with car audio system
- Fully implement the warning system for drivers entering intersections
  Develop methods to detect whether a user is located at intersections
  Gives the drivers more time to respond to the messages and promotes overall safety at intersections
  Further improvement: automatic route suggestion according to the number of aggressive drivers on different routes

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