Police Duty: A Drunk Driving Detection Simulation

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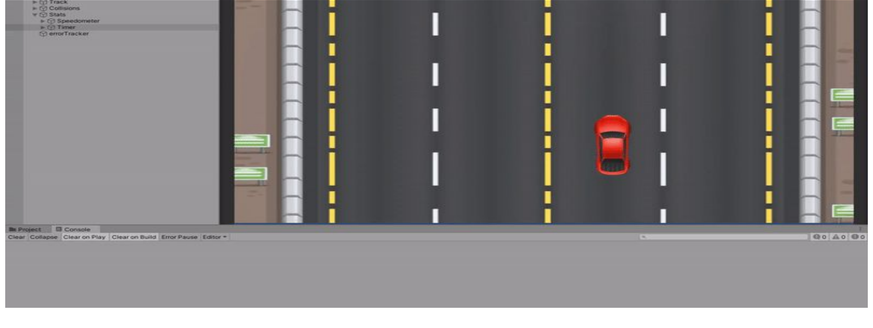
Abstract

Our grand challenge was reducing the number of car accident deaths related to drunk driving through the use of artificial intelligence and machine learning. To make our idea possible, we have created a simulation that uses vehicle-based detection methods to determine whether a person is driving unsafely or not. If an unsafe driving method has been detected, the simulation stops and the car gets pulled over. With this system implemented into cars, it could reduce the amount of drunk driving that occurs and decreases the amount of time the unsafe drivers are on the road, overall reducing the number of accidents that occur.

Introduction

- Over 1 million people die in drunk-driving related crashes crashes every year (Kit Wu et al. 2016).
  - Unless law enforcement officers are present on the road, drunk drivers often go undetected.
- Police officers have a difficult time accurately visually detecting if a person is drunk (Brick and Carpenter 2006).
- Vehicle-based measures that can be implemented in cars to detect drunk driving include (Hee Lee et al. 2019):
  - Swerving between lanes
  - Unusual acceleration
  - Lateral position of the car
  - Increased reaction time
  - Steering wheel angle
- If there was a police officer for every vehicle on the road, then detecting a drunk driver would be simple and would save many lives. Obviously there are not enough resources/officers for this scenario to be possible.
- Many cars are computerized and contain a CAN bus network that can send signals throughout the vehicle (Zhou et al. 2019).
  - We plan that the CAN bus network would be able to use our simulation as a prototype (or base example) as to how to detect unsafe driving through the algorithm we have used for our research

Game Play



Our Approach

- Decided to create this simulation by using the game engine platform, Unity
  - Allows users to create interactive 2D and 3D simulations
  - Gave our team a unique technique of creating a virtual reality of our research and what future detection vehicles may integrate and achieve
- Determined key factors we are detecting: speed changes and lane serving
- Used changes in vehicle-based measures averaged from multiple sources
- Built from ground-up simulation using triggers and different detection methods to determine if a person is safely driving → Displayed in Figure 1
- Tested the accuracy and durability of our simulation based upon the important detection components with the use of friends and family.

Simulation Guidelines

The simulation follows specific guidelines we obtained from our research as to what classifies as drunk driving. The controls used to operate the simulation includes:

- Four arrow keys on your keyboard
  - Up/Down keys to accelerate and decelerate the car
    - Includes a measurement to see how fast (MPH) the car is moving on the top right of the screen
  - Left and Right keys move the car left or right, respectfully
- A 60 second time limit per simulation period
  - As proper demonstration time, in a real world application, the AI would run as long as the car is in motion

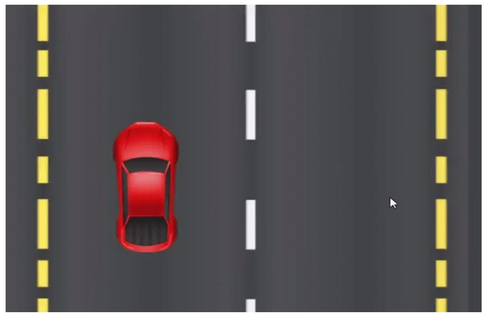
Methods

The simulation keeps track of the car's position and behavior to make statements about decisions the driver made that may be considered unsafe.

The car's position is read by comparing the car's distance from adjacent lane guides, similar to how a Tesla reads lanes.

Unsafe behavior in the simulation includes:

- Weaving without reason (changing lanes)
- Taking too long to change a lane
- Leaving legal road space
- Driving too fast or too slow at unreasonable speeds
- Frequently accelerating and decelerating



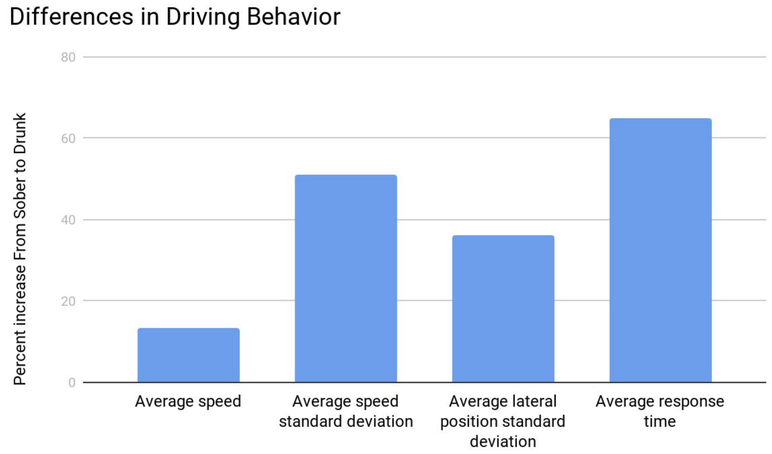


Figure 1: Changes Found in Drunk Driving Behavior Used to Set Simulation Triggers

Results/Conclusion

- A beginning step into the future for bigger things to come
- The rules and guidelines that we set up for our game on Unity can be transferred over to a car's CAN bus system, with more work of course (Zhou et al. 2019)
- The simulation shows you that monitoring a driver's actions by the car itself can prevent fatal accidents and even death
- Simulation accurately detects unsafe driving from known unsafe driving behaviors
- An error report is processed as soon as a driving fault is detected. We can implement this in a real life by either stopping the car or calling an officer to the location
- With this implemented into vehicles, there wouldn't be a need for officer patrols that look for drunk drivers. Therefore, we have formulated an efficient solution to benefit police officers and protect the lives of drivers

Bibliography

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