



# DriveAware

DRIVER DROWSINESS DETECTION SYSTEM

מספר פרויקט: 211206

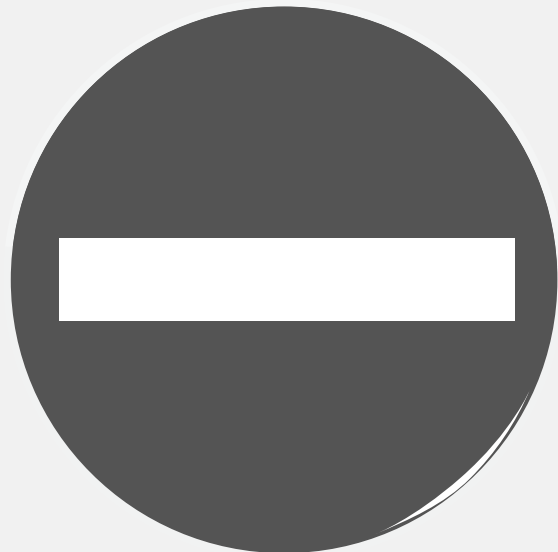
שם הסדנה: ארכיטקטורת ביג דאטה

שם הסטודנטים: יהלי יעקב, יוני מלכך, רבקה טובמן

שם המנחה: ד"ר רועי קרקובסקי

Every year about 100,000 police-reported crashes involve drowsy driving, resulting in more than 1,550 fatalities and 71,000 injuries - National Highway Traffic Safety Administration (NHTSA).

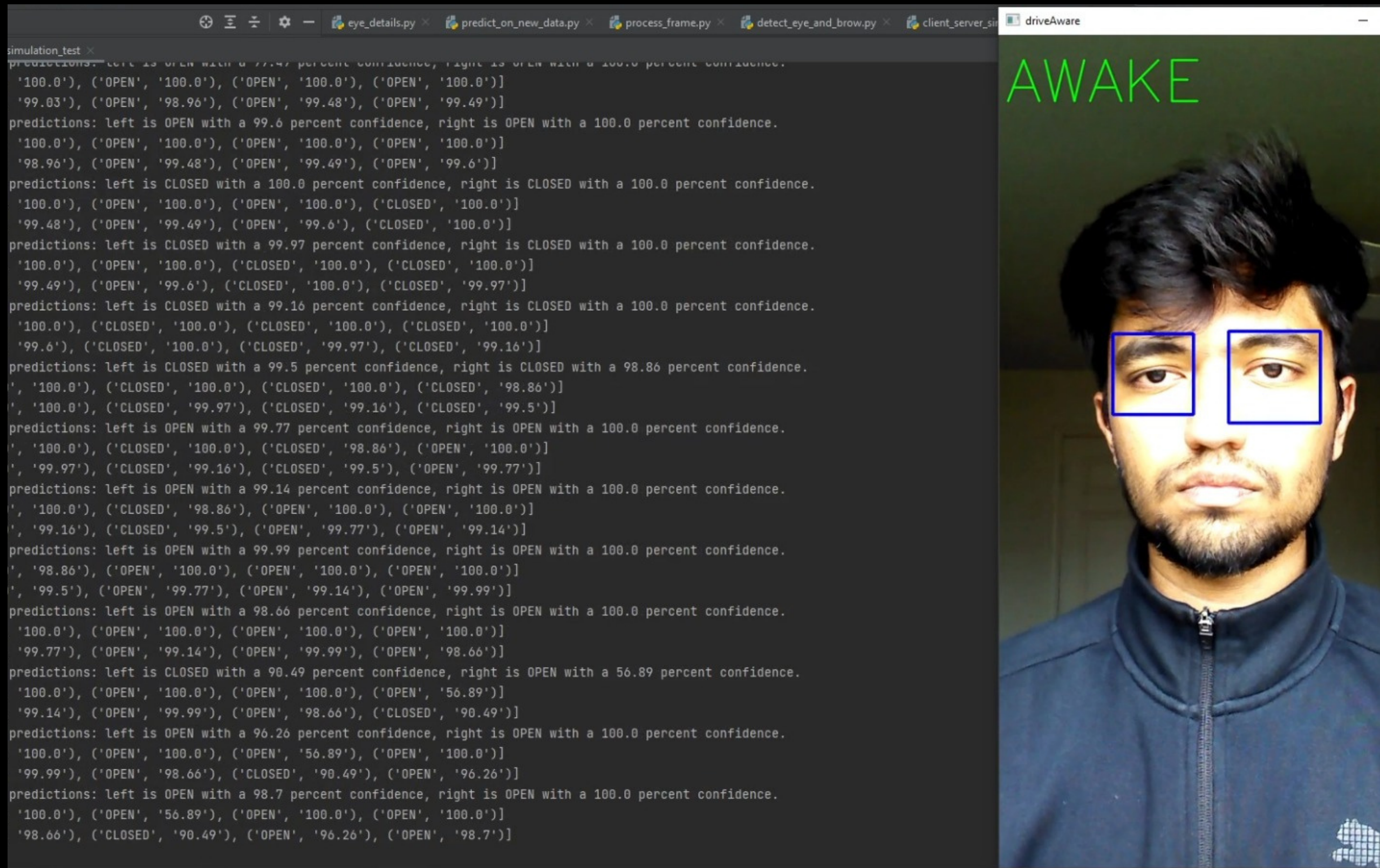
1 in 25 drivers admit to falling asleep behind the wheel - Centers for Disease Control and Prevention (CDC).



**DANGER**

328,000 drowsy driving crashes occur annually. 109,000 of those drowsy driving crashes resulted in an injury and about 6,400 were fatal - AAA Foundation for Traffic Safety.

# Demonstration



The screenshot displays a software interface with two main components. On the left, a terminal window shows the output of a Python script named 'simulation\_test'. The output consists of multiple lines of text, each starting with 'predictions:' followed by a list of confidence percentages and eye states (OPEN or CLOSED) for the left and right eyes. For example, 'predictions: left is OPEN with a 99.6 percent confidence, right is OPEN with a 100.0 percent confidence.' The script appears to be testing various eye states and confidence levels. On the right, a video feed window titled 'driveAware' shows a man's face. Two blue rectangular boxes are overlaid on his eyes, indicating the system's eye-tracking capabilities. The word 'AWAKE' is written in large green letters in the top left corner of the video feed window.

```
simulation_test x
predictions: left is OPEN with a 97.97 percent confidence, right is OPEN with a 100.0 percent confidence.
'100.0'), ('OPEN', '100.0'), ('OPEN', '100.0'), ('OPEN', '100.0')]
'99.03'), ('OPEN', '98.96'), ('OPEN', '99.48'), ('OPEN', '99.49')]
predictions: left is OPEN with a 99.6 percent confidence, right is OPEN with a 100.0 percent confidence.
'100.0'), ('OPEN', '100.0'), ('OPEN', '100.0'), ('OPEN', '100.0')]
'98.96'), ('OPEN', '99.48'), ('OPEN', '99.49'), ('OPEN', '99.6')]
predictions: left is CLOSED with a 100.0 percent confidence, right is CLOSED with a 100.0 percent confidence.
'100.0'), ('OPEN', '100.0'), ('OPEN', '100.0'), ('CLOSED', '100.0')]
'99.48'), ('OPEN', '99.49'), ('OPEN', '99.6'), ('CLOSED', '100.0')]
predictions: left is CLOSED with a 99.97 percent confidence, right is CLOSED with a 100.0 percent confidence.
'100.0'), ('OPEN', '100.0'), ('CLOSED', '100.0'), ('CLOSED', '100.0')]
'99.49'), ('OPEN', '99.6'), ('CLOSED', '100.0'), ('CLOSED', '99.97')]
predictions: left is CLOSED with a 99.16 percent confidence, right is CLOSED with a 100.0 percent confidence.
'100.0'), ('CLOSED', '100.0'), ('CLOSED', '100.0'), ('CLOSED', '100.0')]
'99.6'), ('CLOSED', '100.0'), ('CLOSED', '99.97'), ('CLOSED', '99.16')]
predictions: left is CLOSED with a 99.55 percent confidence, right is CLOSED with a 98.86 percent confidence.
', '100.0'), ('CLOSED', '100.0'), ('CLOSED', '100.0'), ('CLOSED', '98.86')]
', '100.0'), ('CLOSED', '99.97'), ('CLOSED', '99.16'), ('CLOSED', '99.55')]
predictions: left is OPEN with a 99.77 percent confidence, right is OPEN with a 100.0 percent confidence.
', '100.0'), ('CLOSED', '100.0'), ('CLOSED', '98.86'), ('OPEN', '100.0')]
', '99.97'), ('CLOSED', '99.16'), ('CLOSED', '99.55'), ('OPEN', '99.77')]
predictions: left is OPEN with a 99.14 percent confidence, right is OPEN with a 100.0 percent confidence.
', '100.0'), ('CLOSED', '98.86'), ('OPEN', '100.0'), ('OPEN', '100.0')]
', '99.16'), ('CLOSED', '99.55'), ('OPEN', '99.77'), ('OPEN', '99.14')]
predictions: left is OPEN with a 99.99 percent confidence, right is OPEN with a 100.0 percent confidence.
', '98.86'), ('OPEN', '100.0'), ('OPEN', '100.0'), ('OPEN', '100.0')]
', '99.55'), ('OPEN', '99.77'), ('OPEN', '99.14'), ('OPEN', '99.99')]
predictions: left is OPEN with a 98.66 percent confidence, right is OPEN with a 100.0 percent confidence.
'100.0'), ('OPEN', '100.0'), ('OPEN', '100.0'), ('OPEN', '100.0')]
'99.77'), ('OPEN', '99.14'), ('OPEN', '99.99'), ('OPEN', '98.66')]
predictions: left is CLOSED with a 90.49 percent confidence, right is OPEN with a 56.89 percent confidence.
'100.0'), ('OPEN', '100.0'), ('OPEN', '100.0'), ('OPEN', '56.89')]
'99.14'), ('OPEN', '99.99'), ('OPEN', '98.66'), ('CLOSED', '90.49')]
predictions: left is OPEN with a 96.26 percent confidence, right is OPEN with a 100.0 percent confidence.
'100.0'), ('OPEN', '100.0'), ('OPEN', '56.89'), ('OPEN', '100.0')]
'99.99'), ('OPEN', '98.66'), ('CLOSED', '90.49'), ('OPEN', '96.26')]
predictions: left is OPEN with a 98.7 percent confidence, right is OPEN with a 100.0 percent confidence.
'100.0'), ('OPEN', '56.89'), ('OPEN', '100.0'), ('OPEN', '100.0')]
'98.66'), ('CLOSED', '90.49'), ('OPEN', '96.26'), ('OPEN', '98.7')]
```

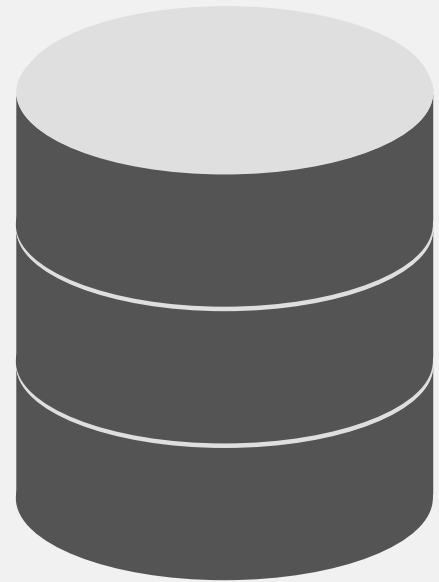


# Demonstration

The screenshot displays a software interface with two main components. On the left, a terminal window shows the output of a Python script named 'simulation\_test'. The output consists of multiple lines of text, each starting with 'predictions: left is OPEN with a [confidence] percent confidence, right is OPEN with a [confidence] percent confidence.' followed by a list of confidence values for 'OPEN' and 'CLOSED' states. For example, one line reads: 'predictions: left is OPEN with a 99.99 percent confidence, right is OPEN with a 99.99 percent confidence. '100.0', ('OPEN', '100.0'), ('OPEN', '100.0'), ('OPEN', '100.0'), ('OPEN', '99.99')'. The script eventually predicts 'CLOSED' states with 100.0% confidence.

On the right, a video feed window titled 'driveAware' shows a person with dark hair and a beard, wearing a dark blue zip-up jacket, looking down. Two blue rectangular boxes are overlaid on the person's eyes, indicating the detection of closed eyes. The word 'SLEEPING' is written in large, green, capital letters at the top of the video feed.

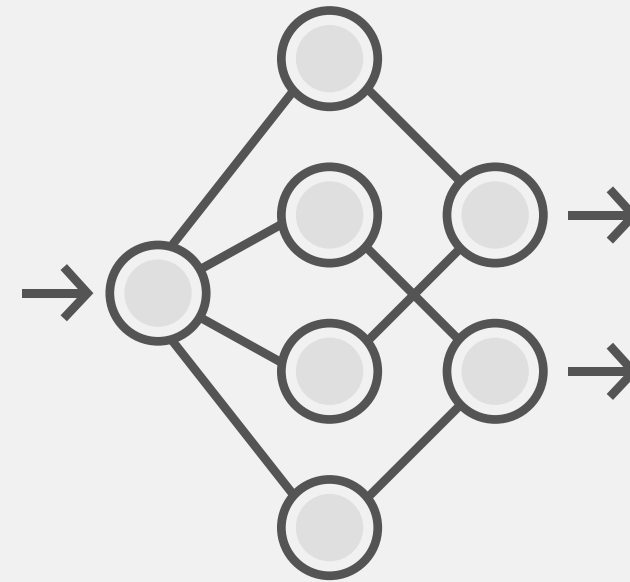
# Supervised Learning



## Dataset

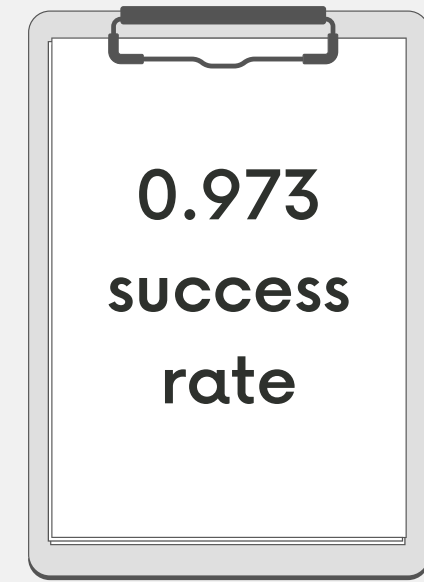
MRL eye dataset with  
~84,000 images of  
eyes divided by eye  
state.

60% training  
20% validation  
20% test



## Neural Network

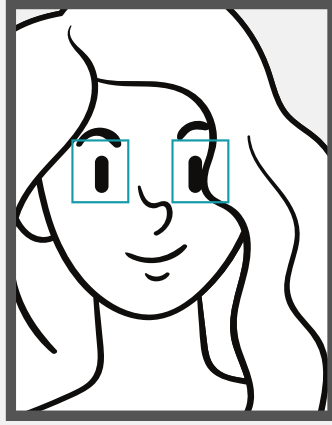
Using Keras and  
TensorFlow.  
3 hidden layers with a  
depth of 92 and 2  
output layers.



## Results

0.973  
success  
rate

Based on the test  
dataset.  
Out of 16,981, 465  
wrong predictions  
were made.



## Classifier

The classifier detects the eyes of the driver. The eyes are then cropped, reshaped, and sent to the neural network.



## Neural Network

Our neural network makes a prediction for each eye and returns the results to the driver's device.

## Real Time



### Webcam

Every second, 2 frames of the driver's face are captured and sent to the face classifier.



### Alert

Alerts the driver if the algorithm decides the results from the neural network imply the driver is drowsy.





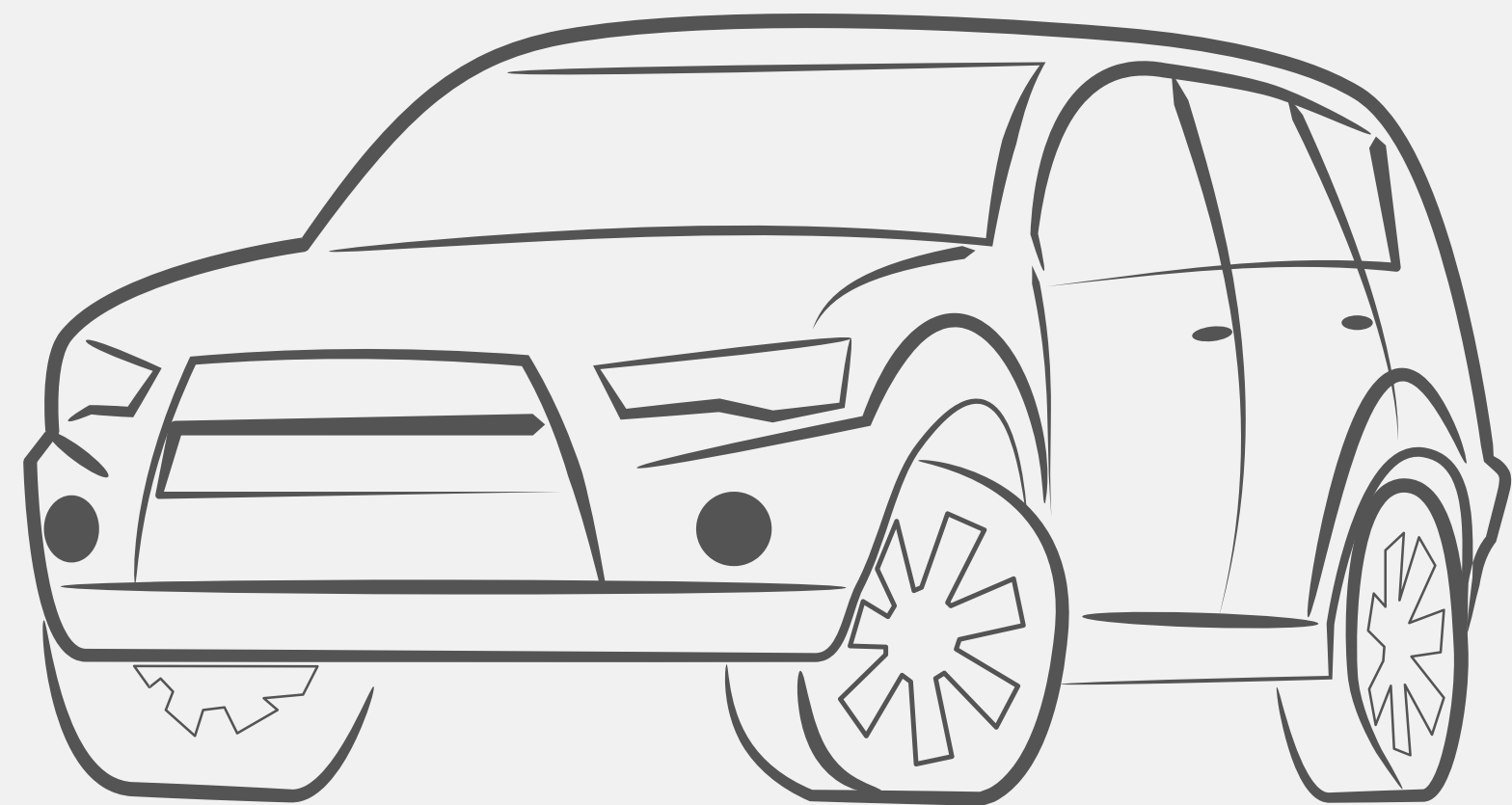
# Comparison

Most cars these days have some sort of driver assistance systems that target driver drowsiness.

- **BMW:** Active Driving Assistant with Attention Assistant analyses driving behaviour and, if necessary, advises the driver to rest.
- **Bosch:** "Driver drowsiness detection" takes input from the steering angle sensor, front-mounted lane assist camera, vehicle speed and turn signal stalk.
- **Jaguar Land Rover:** Driver Condition Monitor and Driver Fatigue Alert, both evaluate driving technique for signs of driver fatigue.

The driver drowsiness detection systems that are available today rely on various sensors within the vehicle, while our product makes use of [the person behind the wheel](#).

We consider the driver's eyes to be the most important and reliable source of information regarding the driver's awareness state.



# Conclusions

- We have created a system that is capable of successfully recognizing the driver's awareness state using his eyes with high accuracy.
- We enjoyed learning about the Big Data field, diving into Machine Learning, Supervised Learning using Convolutional Neural Networks, and image processing.
- We learned new technologies, frameworks and libraries:





**Thank You!**

**DRIVE SAFELY!**