CAPSTONE Presentation
Driver Drowsiness detection

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Introduction

- Driver Drowsiness detection system is a car safety technology designed to help prevent drowsy driving.

- Drowsy driving or fatigue driver is a severe cause of traffic accident.
- Accoring to the National Highway Traffic Safety Administration. About 100,000 police-reported crashes are relevant to drowsy driving.
- Those accidents result in 1,550 fatalities and 71,000 injuries.
- AAA Foundation has estimated that 328,000 crashes are caused by drowsiness annually.
- NHTSA estimates the drowsiness-related crashes could result in injury or fatality cost of $109 billion annually without the count of property damage.

Practice of intervention

Technologies

- drowsiness alert and lane departure warnings

How: detect drowsiness pattern through sensors or monitors, warn drivers there is dangerous driving behavior

Medication

How: physiologically avoid sleepyness.

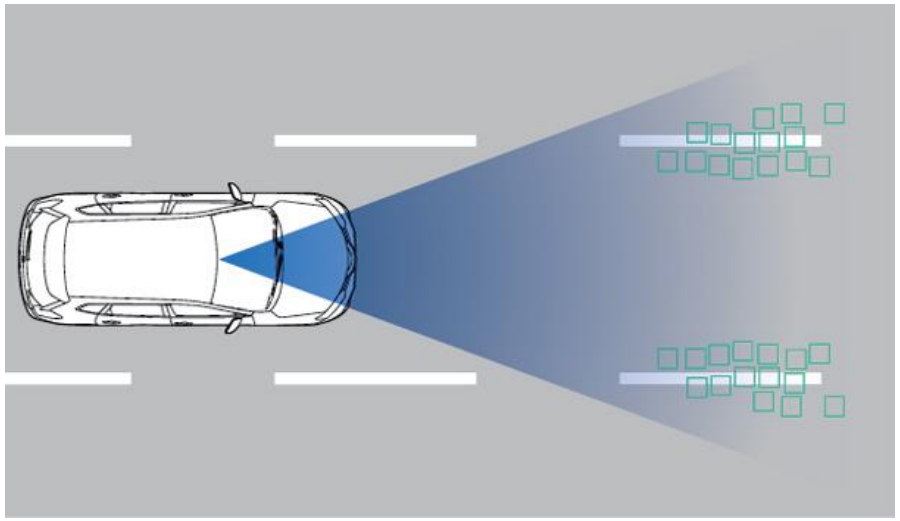
More technologies in the future

Road Constructions

- service area and curbside parking

How: give drivers more choices to take a rest, when they feel tired after long-time driving

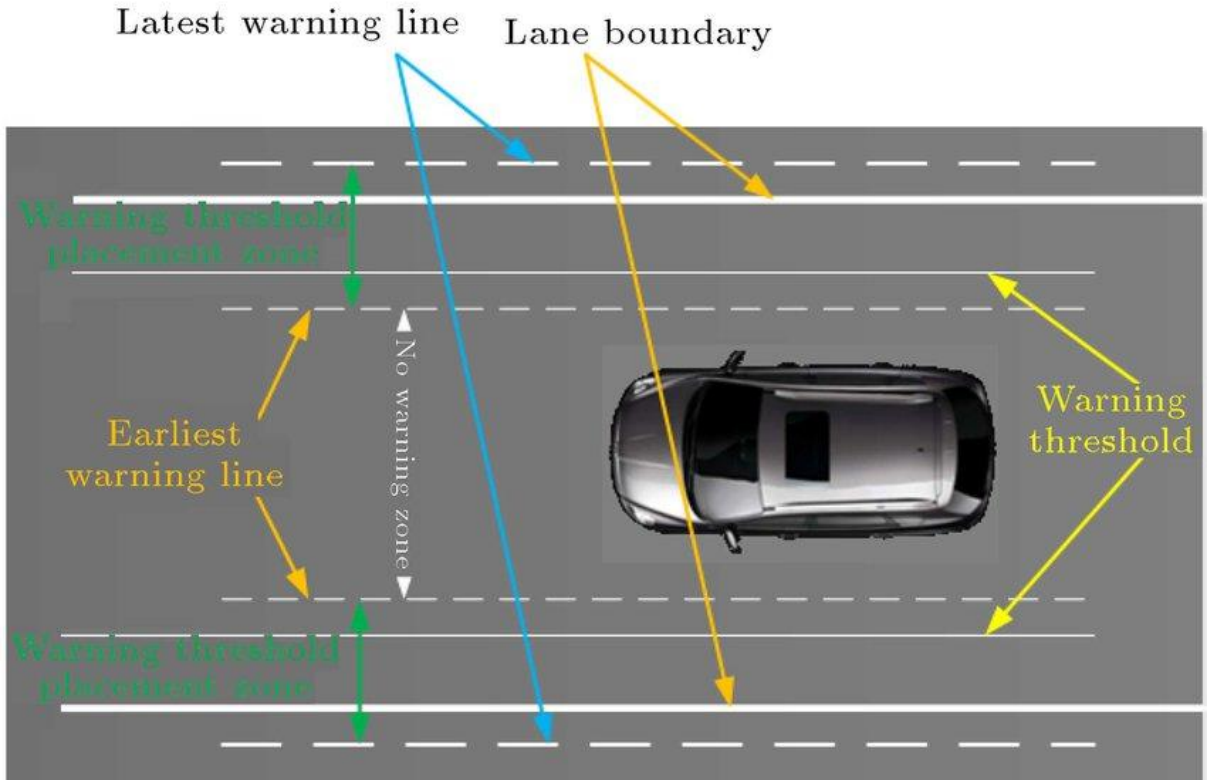
Technology



Nissan

- Lane departure warning has become a standard function in vehicle, NHTSA recommend all manufacturer to add this technology.
- lane keeping system, a premium technology to automaticly keep the position of the vehicle within the lane.

Lane Departure Warning



Technology

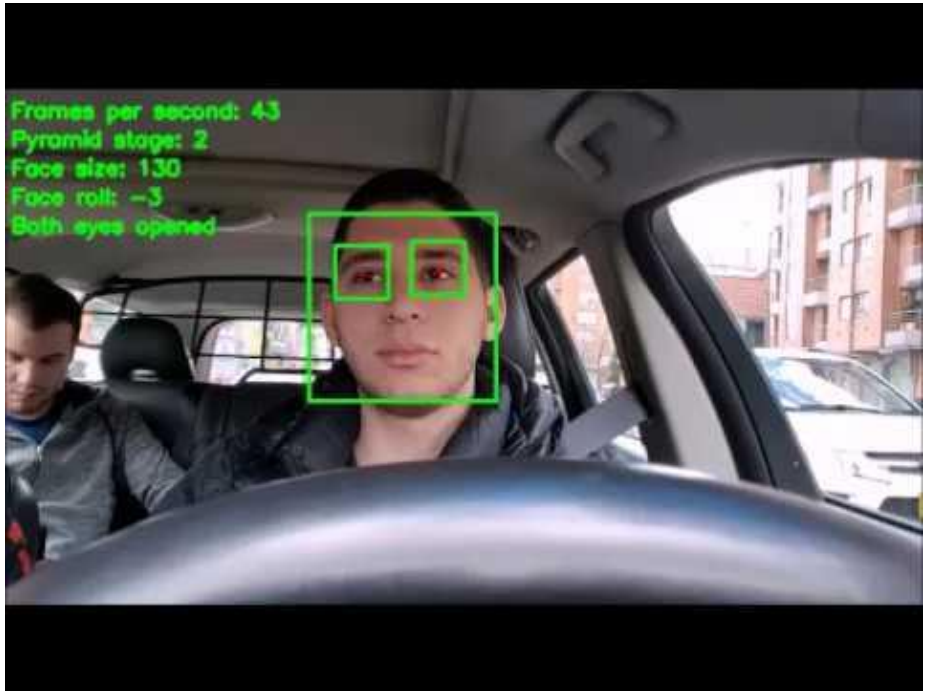
Driver Drowsiness detection

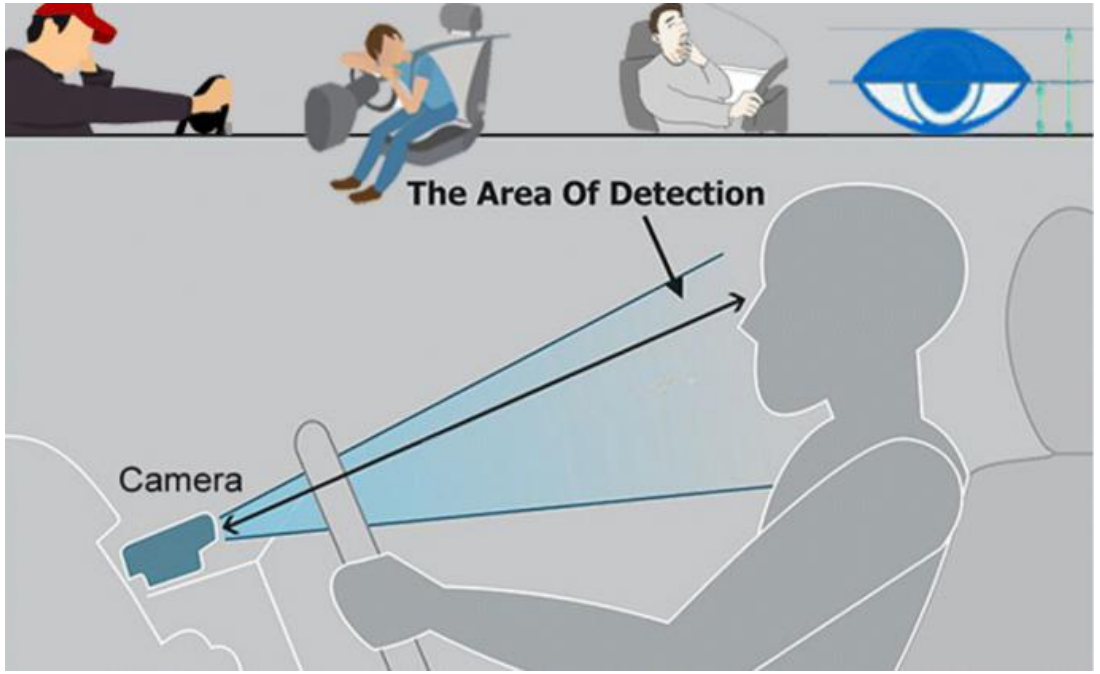
Audi: Rest recommendation system

Nissan: Driver Attention Alert (DAA)

Driver Drowsiness Detection

Uses computer vision to observe the driver's face, either using a built-in camera or on mobile devices.





Products

BOSCH Mobility

Warns based on a calculated level of fatigue, which consists of different parameters like eye and steering movements, driving duration or the use of turn signals

approximately

70 signals

are evaluated by the function's algorithm to assess the driver's level of drowsiness.

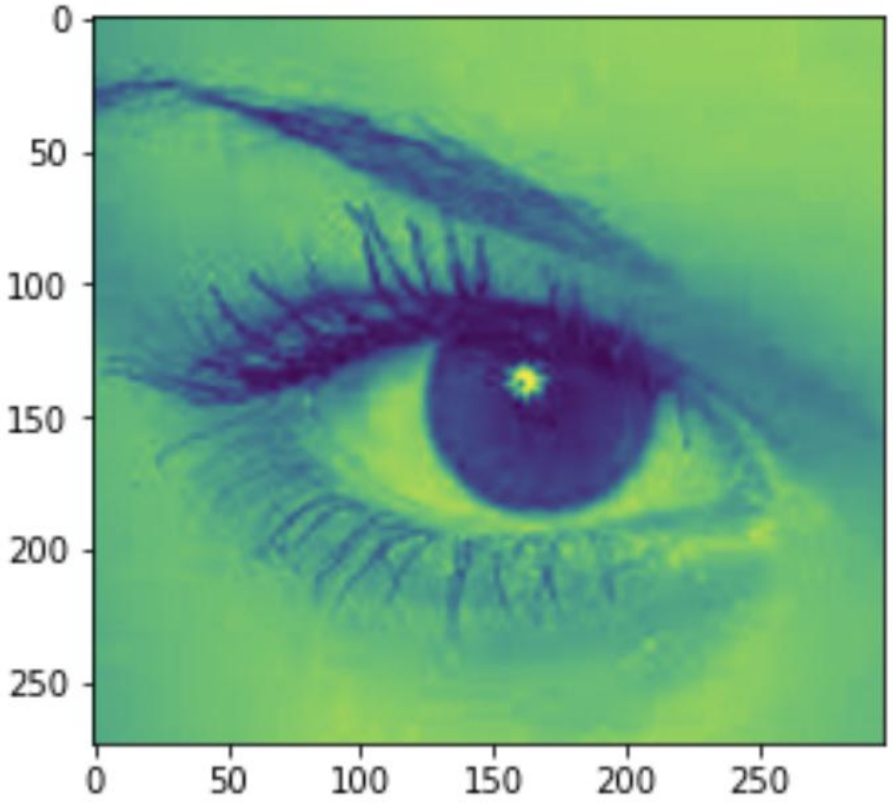
Convolutional Neural Network

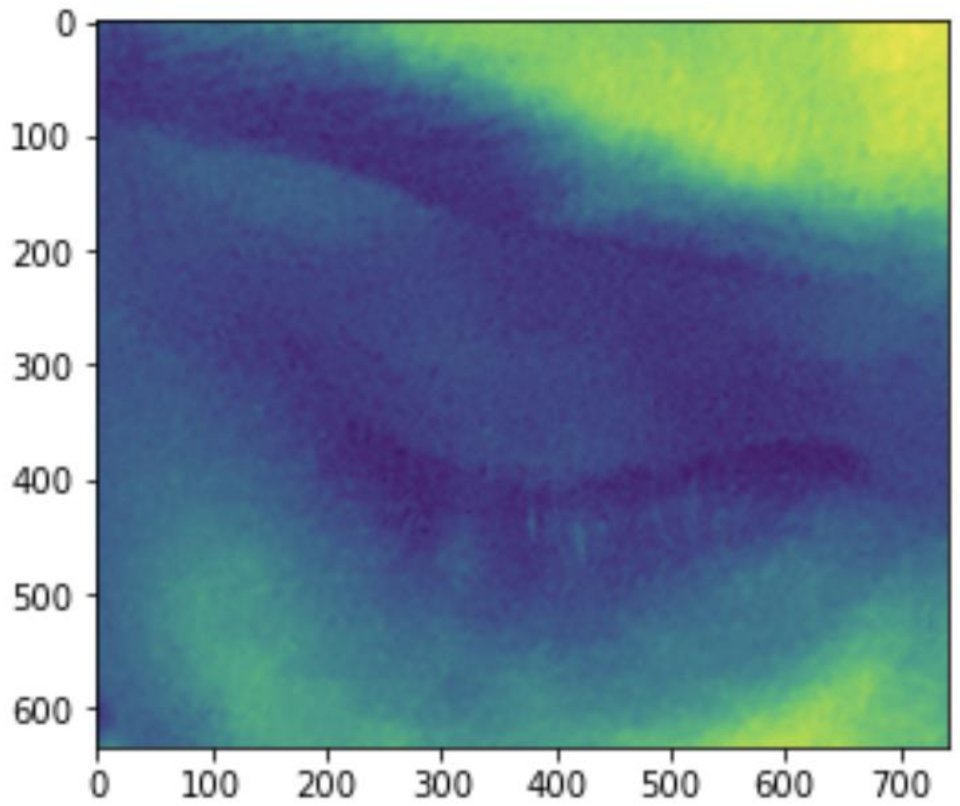
- Image collection and Transformation
- Build CNN model and save for prediction
- Test accuracy
- Use the model to predict

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d (Conv2D)              (None, 222, 222, 256)     7168
_________________________________________________________________
max_pooling2d (MaxPooling2D) (None, 111, 111, 256)     0
_________________________________________________________________
conv2d_1 (Conv2D)            (None, 109, 109, 128)     295040
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 54, 54, 128)       0
_________________________________________________________________
flatten (Flatten)            (None, 373248)            0
_________________________________________________________________
dense (Dense)                (None, 64)                23887936
_________________________________________________________________
dense_1 (Dense)              (None, 1)                 65
=================================================================
Total params: 24,190,209
Trainable params: 24,190,209
Non-trainable params: 0
_________________________________________________________________
```

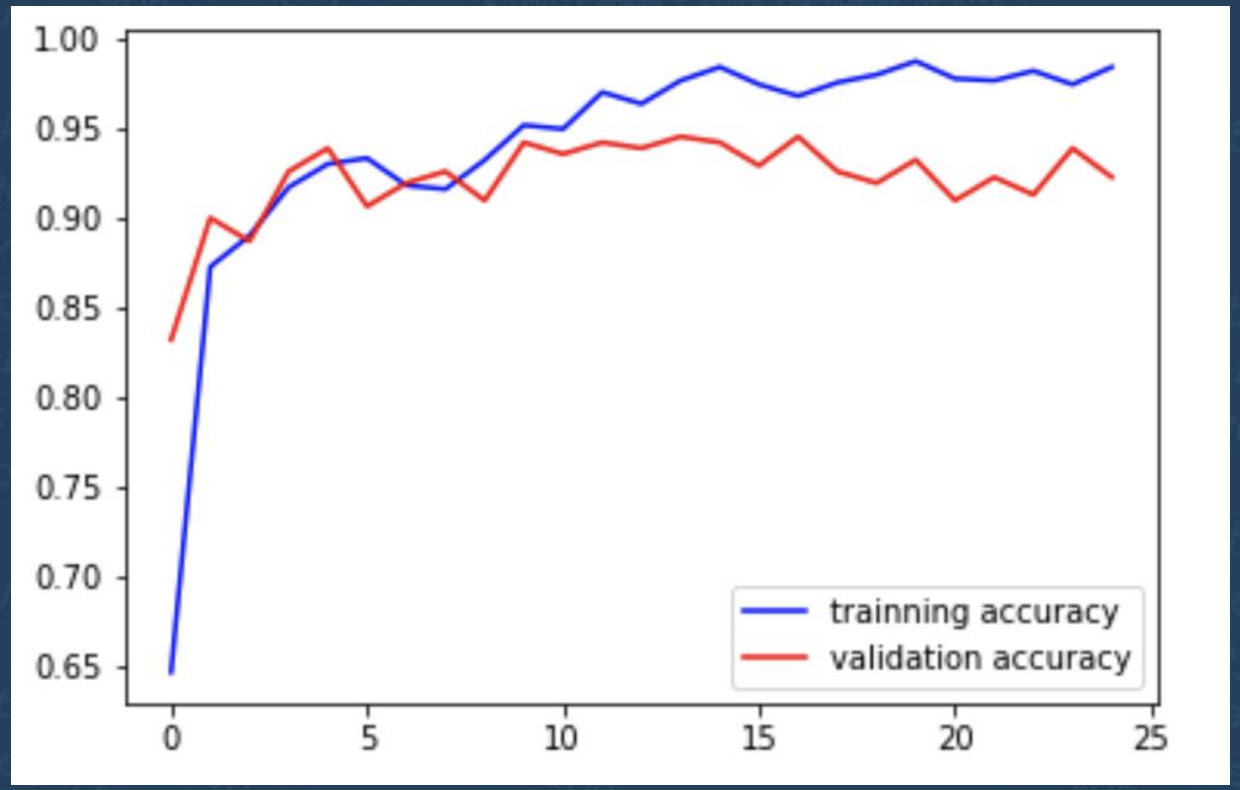
Model

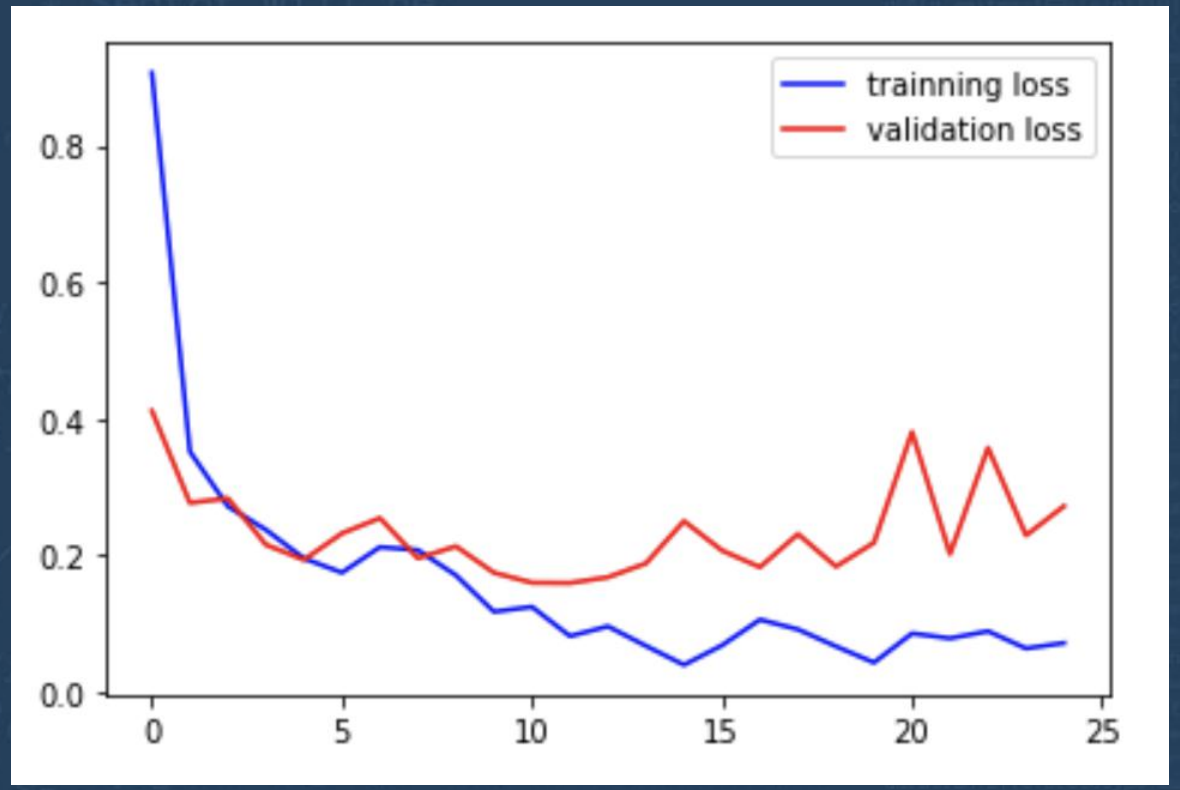
The model is a binary classification model,
The model only has two classes open and closed eye.





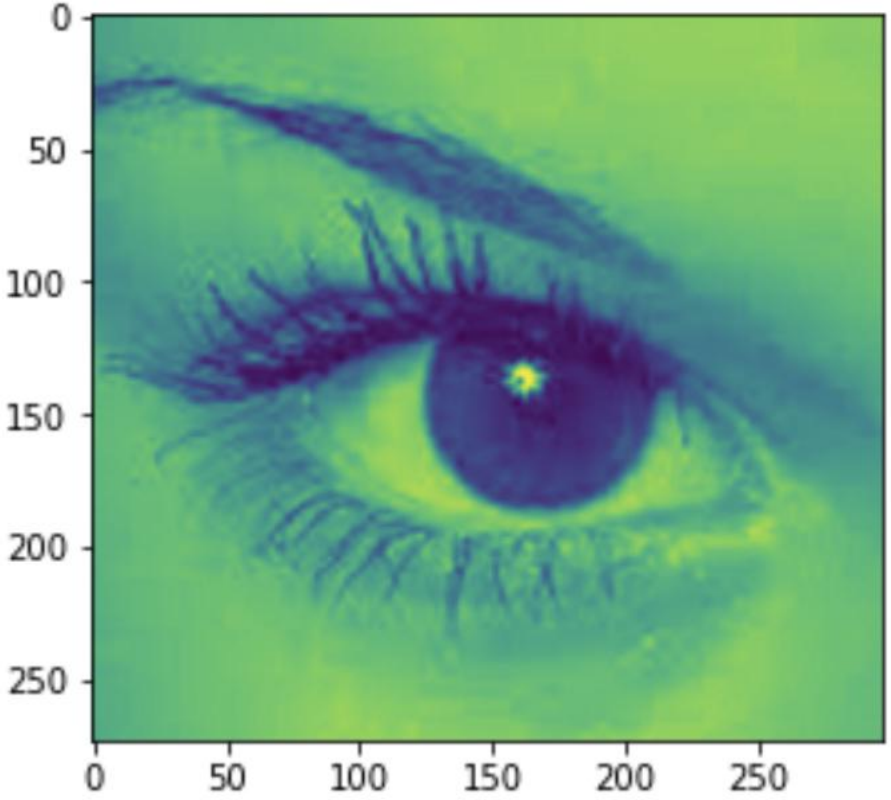
Accuracy





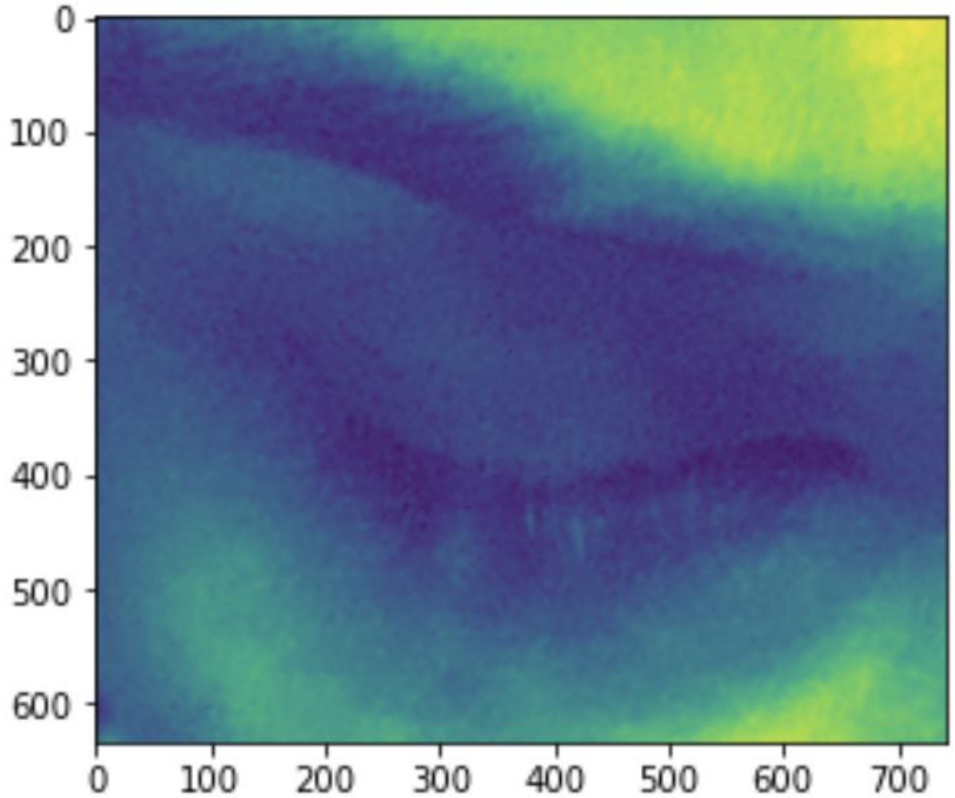
Accuracy: 0.9838 Validation_accuracy: 0.9223

Prediction




```
array([[1]], dtype=int32)
```

Open




```
array([[0]], dtype=int32)
```

Closed

Expectations

1. To overcome overfitting, try L1/L2, dropout, and early stopping regularizations.
2. CNN Model can also predict yawn and no-yawn, which are another good factors for drowsiness.
3. Build a deep learning algorithms to predict drowsiness with all factors we have.
4. Build a program to get access to camera and collect images for model fitting.
5. Make an App with all the functions, that users can predict drowsiness with a connected camera.