

# **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.
- According 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.



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# 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

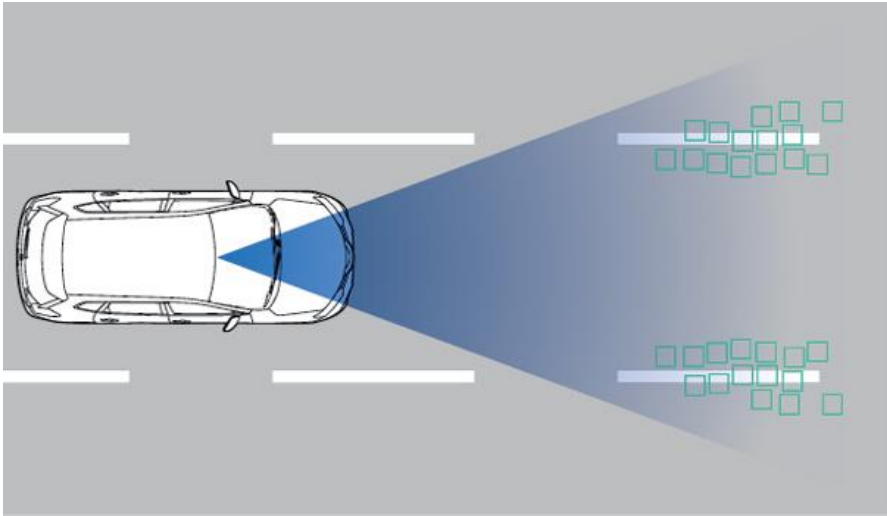
How: physiologically avoid sleepyness.

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

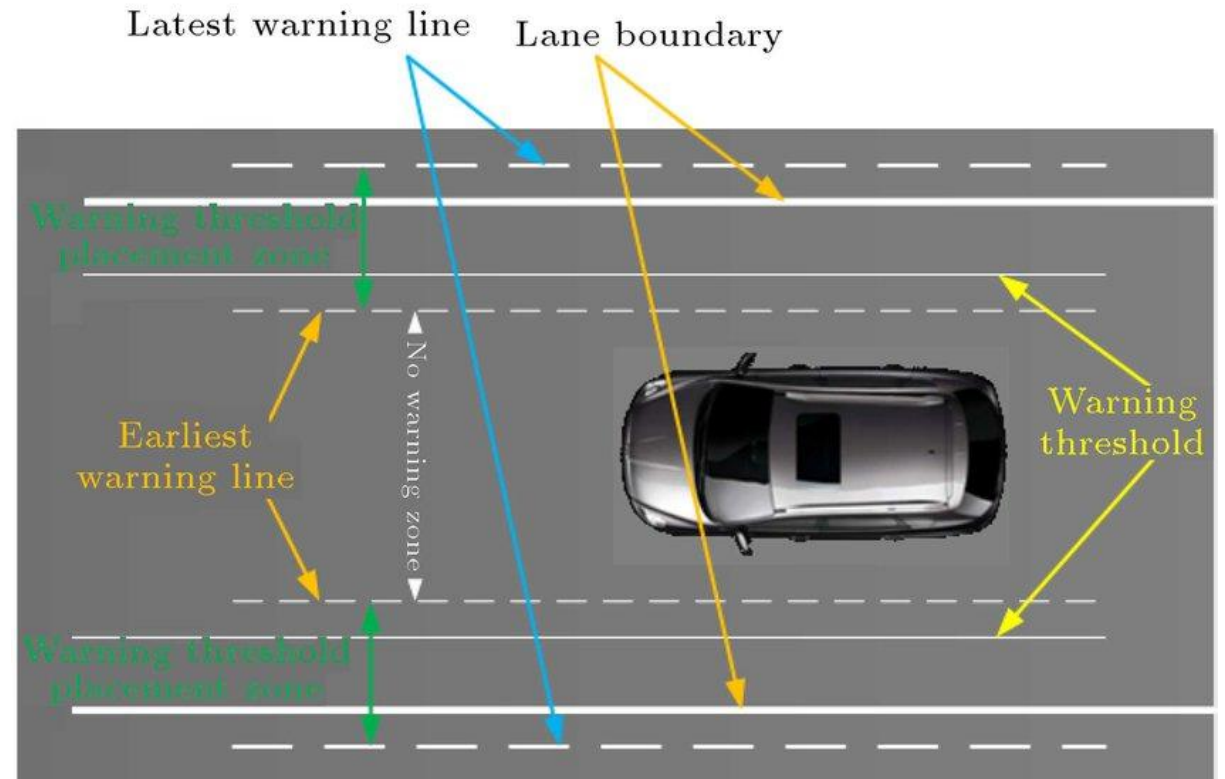
# Technology



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 automatically keep the position of the vehicle within the lane.

## Lane Departure Warning



# Technology

## Driver Drowsiness detection



Audi: Rest recommendation system

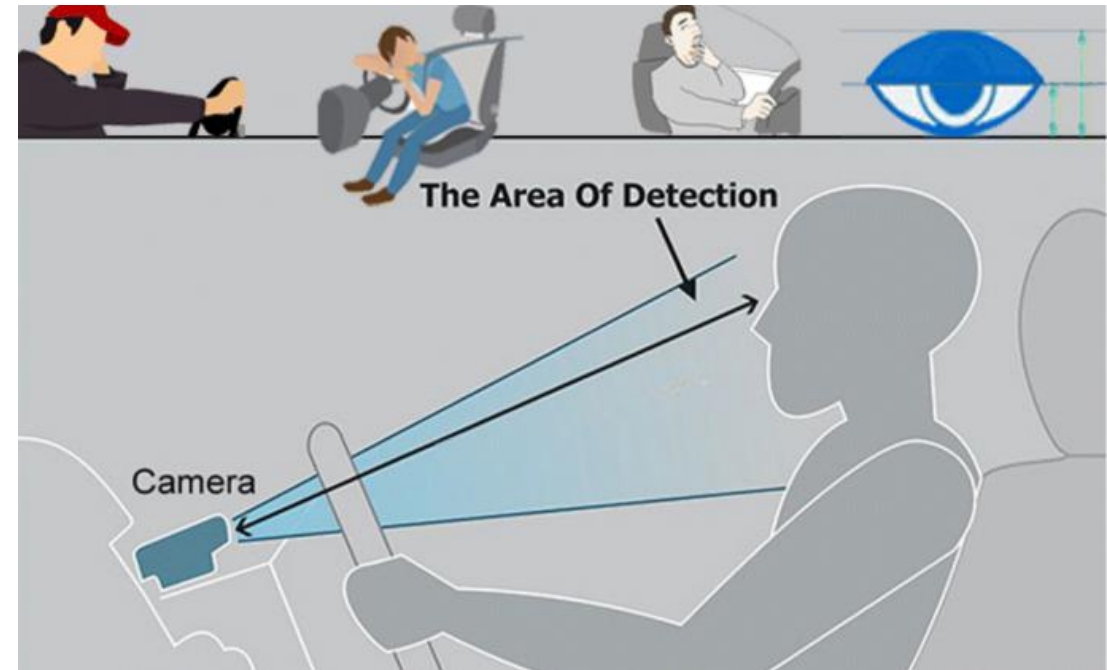
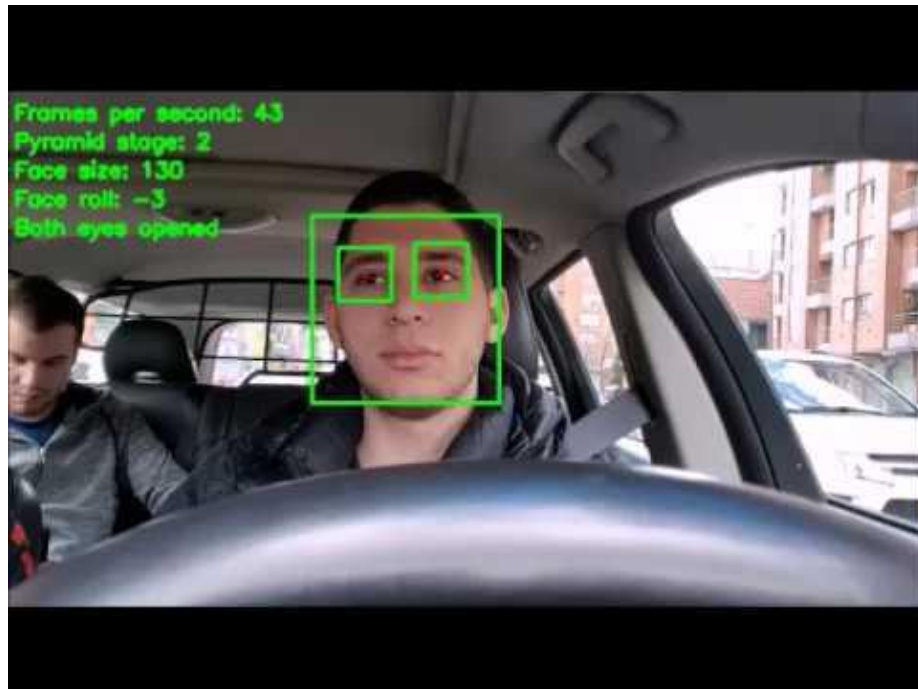


Nissan: Driver Attention Alert (DAA)



# 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 (MaxPooling2D)	(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

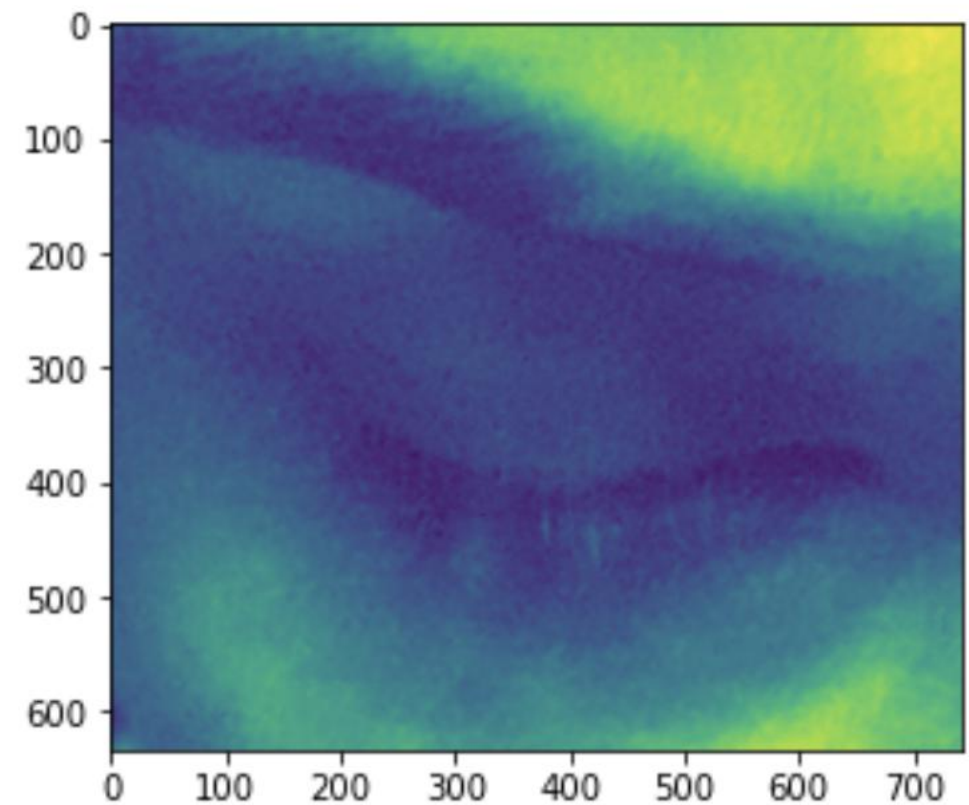
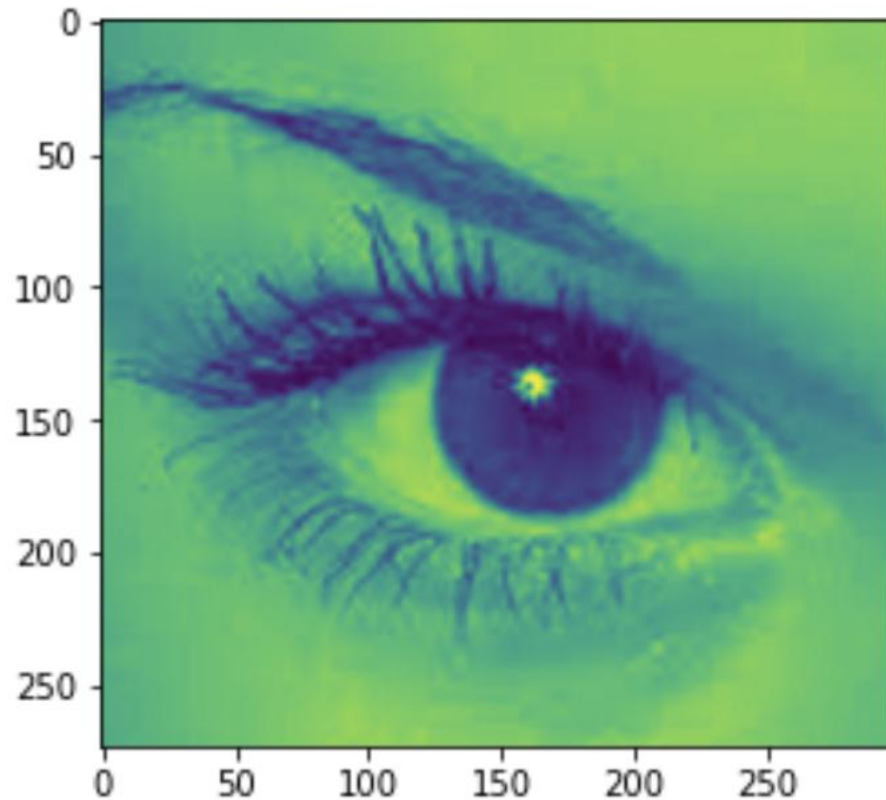
Non-trainable params: 0



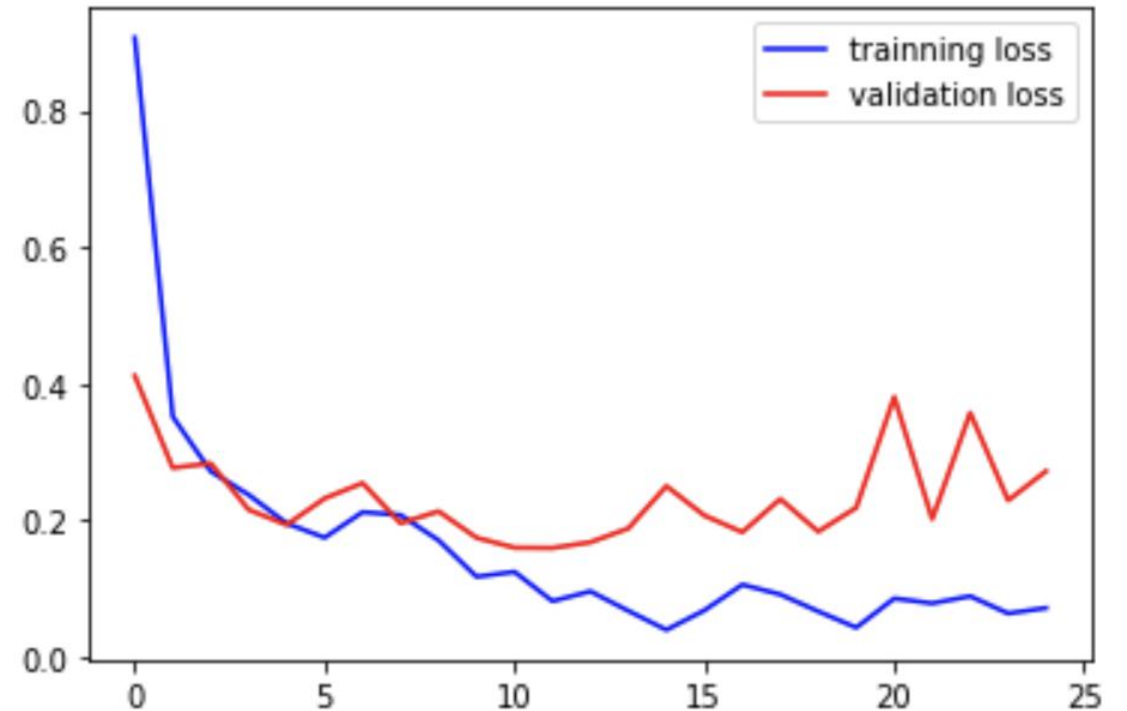
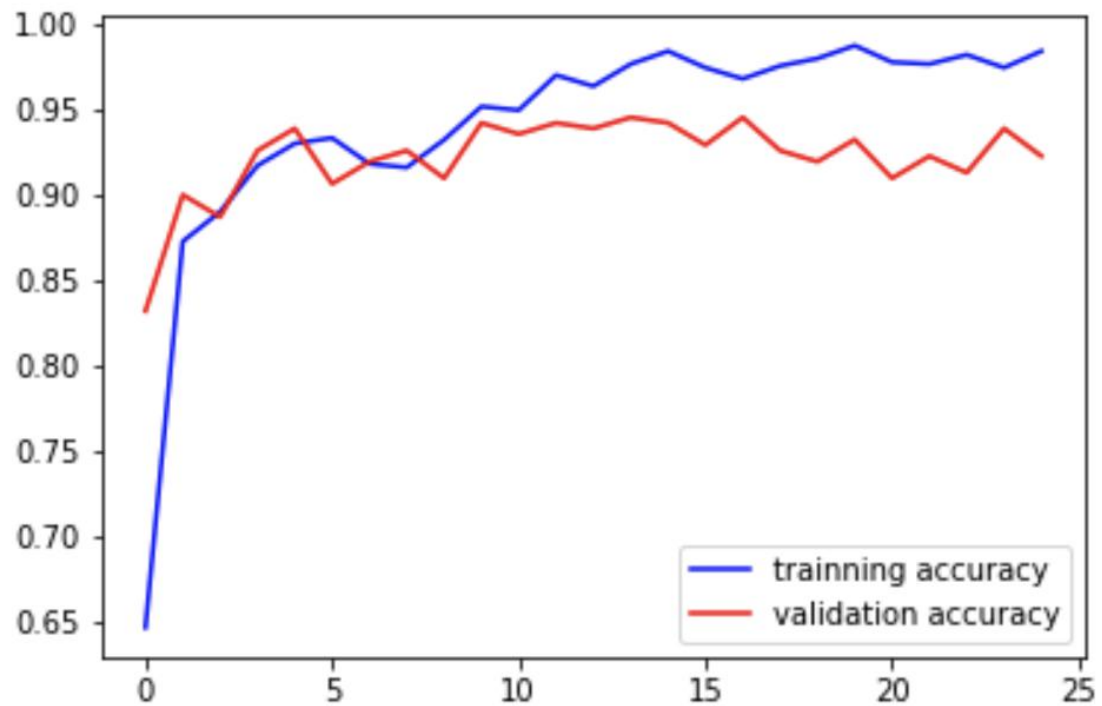
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# Model

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



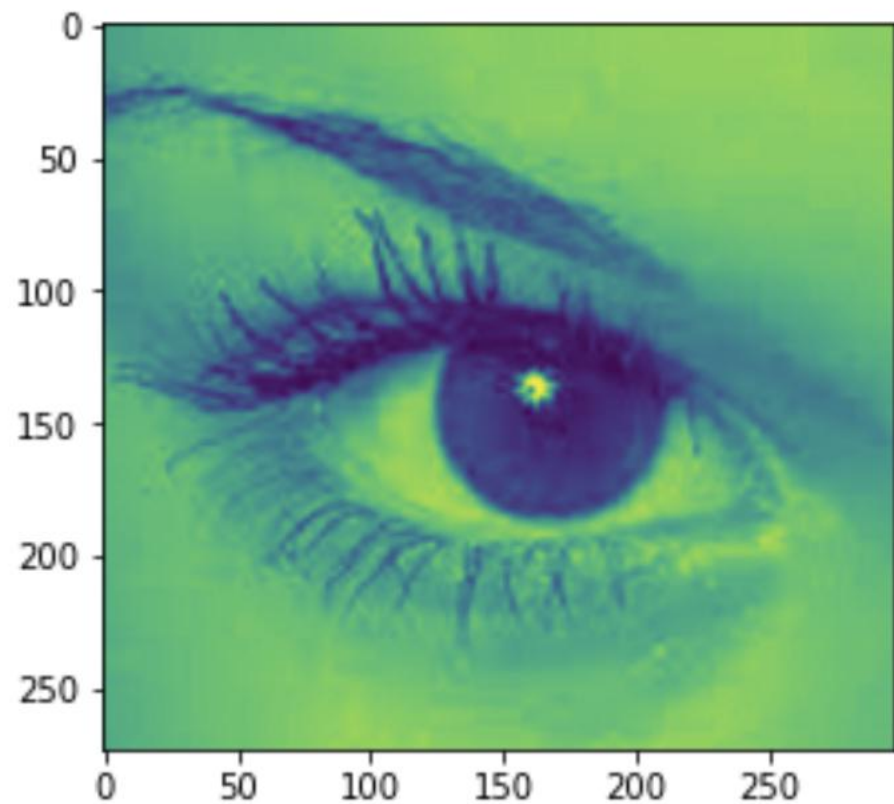
# Accuracy



Accuracy: 0.9838

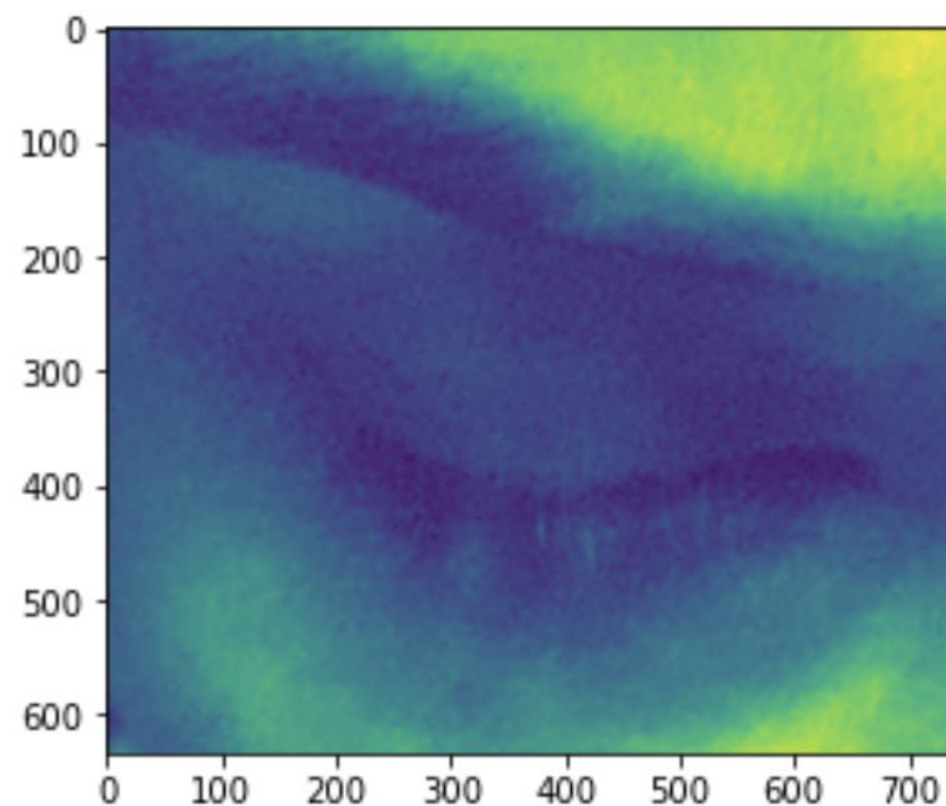
Validation\_accuracy: 0.9223

# Prediction



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

Open



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

Closed

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# 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.