Sleepy Driver Detection System (SDDS)

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Our goal

The SDDS is a device that tracks the drivers face while driving and detects when the driver falls asleep and wakes him up if necessary.

Models

We use 3 models to determine if the eyes are open or closed. 2 pre-built classifiers (haar- cascade) and a new CNN model that we create.

1. Face identifier – A model that receives a greyscale image from the devices camera and recognizes the face. (haarcascade_frontalface_default)

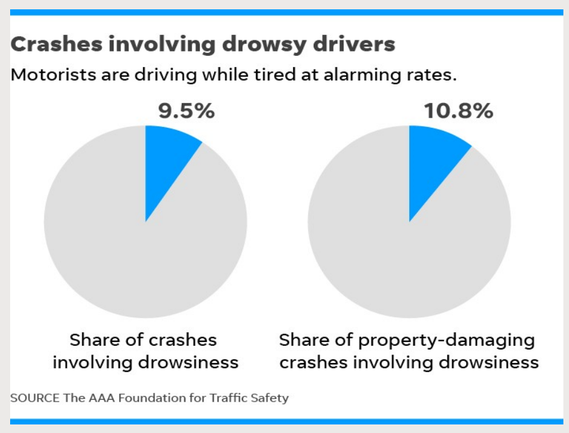
2. Eyes identifier - A model that receives the face image from the face model and recognizes the eyes. (haarcascade_righteye/lefteye)

3. A CNN binary classification model that receives an eye image from the eye model and predicts if they are closed (0) or open (1).

Introduction

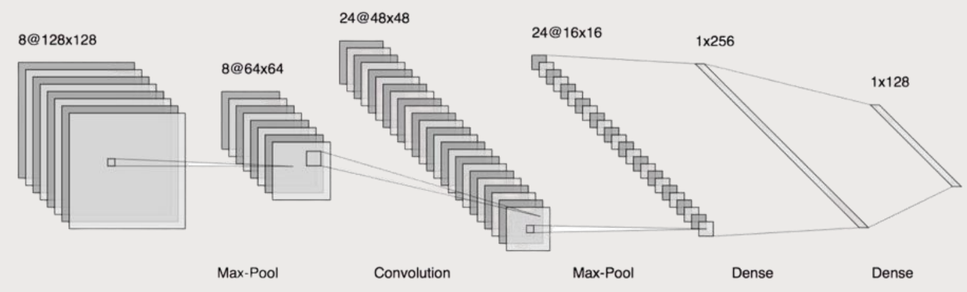
Each year, drowsy driving accounts for about 100,000 crashes, 71,000 injuries, and 1,550 fatalities, according to the National Safety Council (NSC). Drowsy driving contributes to an estimated 9.5% of all crashes.

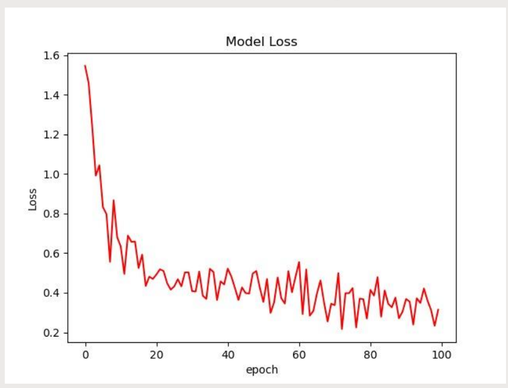
- About **27% of drivers report driving while being so tired,** they have difficulty keeping their eyes
- **1 in 25 drivers admit to falling asleep** behind the wheel
- Being awake for at least 18 hours has the same effect as someone having a blood content (BAC) of 0.05% (the legal limit in Israel is up to 0.05%)

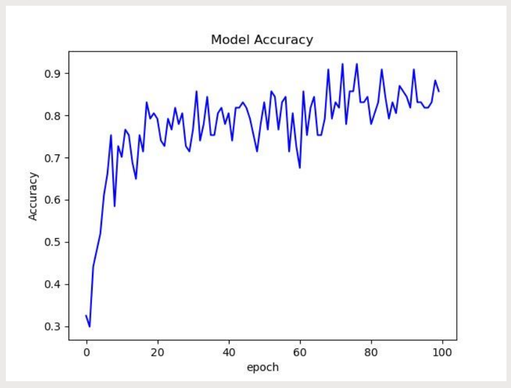


Our model

We created a deep learning model for eye classification (open, closed), this model get the output of the Eye identifier model as input and classify if they open or closed



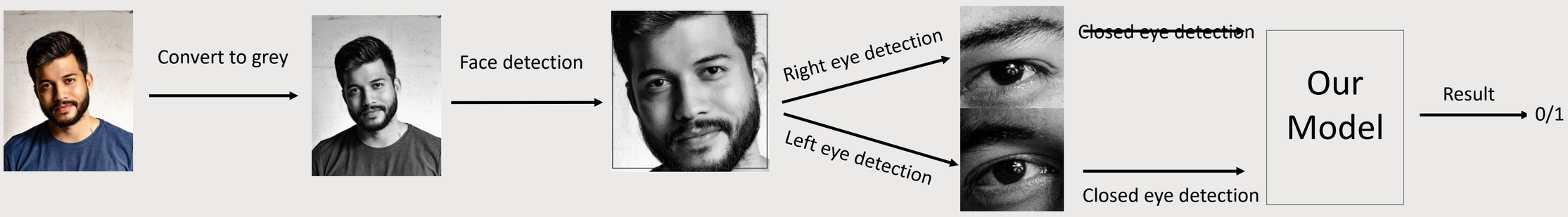




The Main Algorithm

Model prediction

1. Every frame from the camera is sent to the model for prediction.
2. For every frame with closed eyes in a row, it increases the closed eye counter (if the eyes are open the counter resets)
3. If the counter passes a certain threshold the alarm starts in order to alert the driver.



Learning and improvement:

For every situation where the system recognizes a sleepy/drowsy driver, the information is stored in a database for the purpose of learning and improving the model by analysis of statistics, hours when people are more tired, etc.

```
started,ended,total_duration,right_eye_open,right_eye_closed,left_eye_open,left_eye_closed,faces_detected,alarm_activate
d_counter
2022-03-22 20:48:44,2022-03-22 20:48:52,8.6625,14,11,14,11,1,5
2022-03-22 20:50:47,2022-03-22 20:55:27,280.5762,793,73,784,87,1,24
2022-03-22 21:30:32,2022-03-22 21:30:43,11.36,35,6,19,22,1,5
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2022-05-25 19:03:23,2022-05-25 19:04:39,76.3232,296,26,301,20,7
2022-05-25 20:28:36,2022-05-25 20:28:45,8.98,24,6,23,7,3
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