

INTRODUCTION

- Vision based driver drowsiness detection using facial action units
- Non-intrusive, real time, low data requirements, robust to illumination conditions and occlusions

FACIAL ACTION UNITS (FAU)

- Movements of a particular muscle or a group of muscles in the face
- High correlation to EEG - a reliable indicator of drowsiness



Upper Lid Raiser*



Jaw Drop*



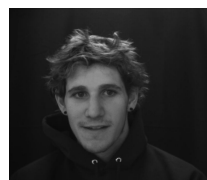
Outer Brow Raiser*

*"Facs - facial action coding system."
<https://www.cs.cmu.edu/~face/facs.htm>

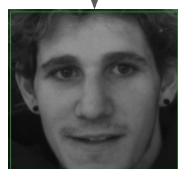
MOTIVATION

- End-to-end deep learning models for vision, like CNNs, do not always perform well on unseen subjects
- Subject-specific training is not practical due to large data requirements

PREPROCESSING

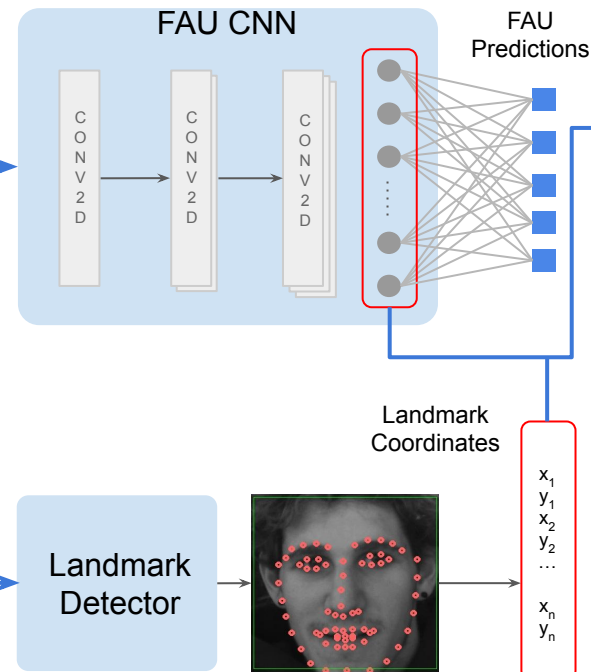


Face
Detector

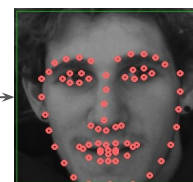


- Face Detection (with tracking)
- Rescaling
- Normalization

FEATURE EXTRACTION



Landmark
Detector



- Face embedding rich in information about FAUs extracted from penultimate layer of multilabel CNN trained to detect 12 FAUs (subject independent i.e. shared across all subjects)
- Normalized facial landmark coordinates

DROWSINESS CLASSIFICATION

XGB
Drowsiness
Classifier

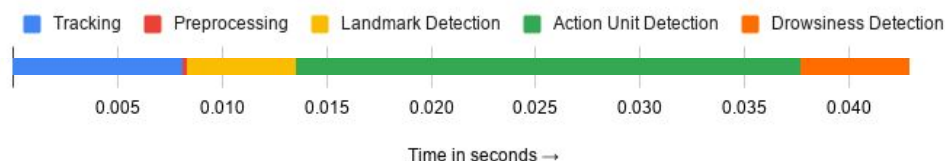
Drowsiness
Predictions

Drowsy

Non Drowsy

- Subject-specific
- XGBoost Classifier

RESULTS



99.43%

Mean Accuracy

0.36

Standard Deviation

24

Frames Per Second

~ 9

Minutes Training Data

Metrics computed on 4 test subjects from NTHU DDD** dataset

**C.-H. Weng, Y.-H. Lai, and S.-H. Lai, "Driver drowsiness detection via a hierarchical temporal deep belief network," pp. 117–133, 03 2017.