Drowsiness Detection using Contactless Heart Rate Monitoring and Eye Tracking

Kartik Prabhu Bradley Barnhart Arun Seetharaman

- Motivation: Driving while fatigued is very dangerous and leads to 10-30% of road deaths (Rios-Aguilar et al). Biometric indicators can be used to detect drowsiness in drivers.
- Ocular indicators of drowsiness include blink rate, blink duration, and percentage of eye closure (Ftouni et al).
- Heart rate variability is another useful indicator, which can be measured by analyzing changes in RGB components of images of the face (Rios-Aguilar et al).

Measurement of Heart Rate

Goal: Detect heart rate variability using frames from a video in real time

Methodology:

1. Collecting data:
    a. Record videos of our faces
    b. Use HCI database
2. Measuring heart rate:
    a. Detect face and identify region of interest
    b. Use ICA to find the blood volume pulse (BVP)
    c. Filter the signal with a bandpass filter, and remove artifacts with noncausal of variable thresholds
    d. Compute heart rate using time between peaks
3. Determining measurement accuracy:
    a. Compare results with EEG from dataset, or by manually determining heart rate

Measurement of Ocular Indicators

Goal: Detect ocular indicators of drowsiness using frames from a video in real time

Methodology:

1. Collecting data:
    a. Record videos of our faces
    b. Use HCI database
2. Measuring ocular indicators:
    a. Extract and segment eyes from image of face
    b. Determine aspect ratio of the eye from orientation and eccentricity of region
    c. Keep track of aspect ratio over time to determine blink duration, length, etc.
3. Determining measurement accuracy:
    a. Manually annotate videos when eyes are open or closed and compare to algorithm results