Modeling Eye Gaze of the Driver into a Multi-modal Emotion Recognition System

Background

Highly and fully autonomous driving is becoming a reality. The ability of a car to understand the feelings of occupants and provide a human-like driver assistance system can be expected to be a key factor for the success and acceptance of autonomous cars. Recognizing emotional factors and affective states are crucial to enhance safety and comfort. The overall aim of our research is to design a multimodal system to classify the emotional states of occupants in real-time and offline. The in-car scenario contains many potential modalities which can be incorporated into such a system to increase the robustness, such as the driver behavior.

Description

Since human face is the most informative component in emotion prediction, facial emotion recognition is considered as primary module of the our model. To recognize facial emotions, first histogram values from the key facial regions like mouth, eyes and nose are extracted and combined into single vector which is then used to train a SVM classifier with linear kernel. Our approach is able to predict driver's emotion in 7 frames per second on devices with limited computing resources like raspberry pi. Further using machine learning techniques and statistical methods additionally two modules as abrupt car maneuvers counter based on steering wheel rotation, and aggressive driver predictor based on a variation of acceleration are built. In the end, all three modules combined into one final driver emotion classifier which is capable of predicting driver’s emotion among main emotional groups. Our method demonstrates 94% accuracy during the evaluation of the system in a simulator where 15 drivers participated and each of them drove 36 minutes on average.

Now we are looking for a highly motivated student with a proper background in computer vision and machine learning whom can model the eye gaze of the driver (and in multi person scenarios, passengers), develop emotional profiles accordingly and integrate it into our system as a reliable modality, in order to increase the accuracy of our system as the main goal.

Tasks

This student project consists of the following tasks in general:

- Extensive literature review (2-4 weeks)
- Setting up the already developed system into an embedded device (2 weeks)
- Modeling the eye gaze according to the change in emotional state (2 month)
- Evaluation of the developed model (2 weeks)
- Integration of the eye gaze modality into the system (2 weeks)
- Evaluating on new participants of the simulator (2 weeks)
- Final Testing and documenting (2 weeks)