

Pupil Detection in Eye Images

Semester Work for Anton Jokob Paris

Problem Formulation

This work is initiated by an industrial partner who plans to develop and market a therapy device involving eye tracking. Various methods are known for eye tracking. The most gentle one is based on a video of the face or the eye area and can, at least in principle, even be performed on a smartphone with a dedicated software. The key part of this work is an eye tracking software that captures the orientation of the eye-ball relative to the head. It can be assumed that the head is directed towards the camera. To be distinguished from eye-tracking is the term gaze-tracking which aims at identifying the focal point in space. The goal is to implement algorithms for the precise localization of the iris within the high resolution image of a human eye.



Working Steps

- Select pre existing and suited eye images from a public data set or record your own data set with an industry camera.
- Read the labels of the images or label the images, so that the performance of the algorithms can be evaluated automatically.
- Automatically identify edges and sort out those edge pixels that are part of a circle (iris) with the expected diameter.
- Compute the center of the circle (Iris) with a Hough transform or RANSAC algorithm or with a combination thereof
- Refine the center of the circle and its diameter with an active contour algorithm.
- Automatically assess the accuracy and reliability.
- Document your work.

Optionally, a segmentation algorithm can be realized that allows to segment the Purkinje reflections on the cornea. Ignoring those image regions that show reflections will make the iris localization more robust. Another option is the implementation of a fast version of the eye-tracking algorithm in C++ and with OpenCV.