

Gaze Estimation with Pupil Tracking in Real-Time

Project Management and Software Development
for Medical Applications

General Info

Project Title: Gaze Estimation with Pupil Tracking in Real-Time

Contact Person: Benjamin Busam

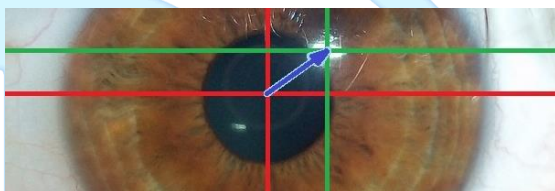
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Project Abstract

Using infrared illumination, the goal of this project is to establish a framework for real-time gaze estimation with pupil tracking techniques. A camera observes the user's face and the eye is tracked. The gaze vector is estimated and visualized on screen.

Background and Motivation

Gaze estimation has a vast field of applications reaching from attention estimation for marketing and empirical psychology to human-computer interfaces and virtual reality games.



[B. Markmann. 2015.](#)

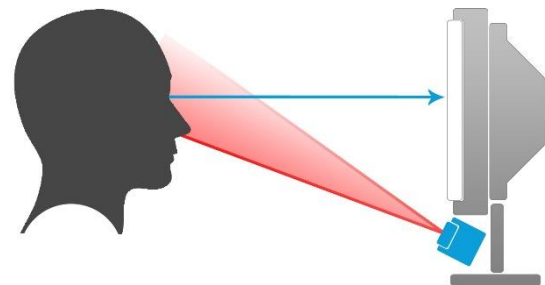
One key ingredient to estimate the users gaze is pupil tracking which correctly identifies the location to which the user pays most attention (see the image above). This knowledge can then be used either for passive measurements such as attention estimation or for active reaction by introducing a certain stimulus.

In this project, a greyscale camera together with an active IR illumination is used to locate the user's pupil and estimate the gaze direction.

Student's Tasks Description

After getting familiar with the hardware and the camera acquisition framework, the first target for the student is to study the corneal reflection based pupil tracking method and to implement a pupil tracking pipeline based on it.

A calibration procedure for screen-to-camera calibration is then applied and tested in the scenario illustrated below.



[P. Geiger. 2014.](#)

Finally, a system prototype is set up to visualize the results and to allow for interactive real-time illustration of the principle.

After this project, the student can work with industrial camera hardware and gained some experience with real-time image processing. The study of the human eye gives some bio-medical background of the human vision apparatus which has been embedded in in a 3D scenario. Moreover, the constant coordination with FRAMOS gives some insight into the working procedures in the industry.

Please send the completed proposal to b.busam@framos.com. Please note that this proposal will be evaluated by the BMC coordinators and will be assigned to a student only in case of acceptance.



Technical Prerequisites

- Basic knowledge of MATLAB / C++
- Basic skills in linear algebra

Optional requirements that can also be learned during the project are:

- Real-time image processing
- Ability to work with versioning tools such as GIT

References

F. Timm, E. Barth. "Accurate Eye Centre Localisation by Means of Gradients". VISAPP 2011.

M. Kassner et al. "Pupil: an open source platform for pervasive eye tracking and mobile gaze-based interaction". UbiComp 2014.

D. Witzner Hansen, J. Qiang. "In the Eye of the Beholder: A Survey of Models for Eyes and Gaze". TMPAMI 2010.