Performance assessment in cataract surgery training
Project Management and Software Development
for Medical Applications

General Info
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Project Abstract
Implementation of an algorithm capable of measuring the performance of surgeons in microscopic eye-surgery procedures, using tool tracking and image processing and other computer vision applications.

Background and Motivation
Although 80 percent of blindness is preventable, due to lack of resources, treatment and doctors, blindness grows rapidly around the world. Cataract is the most common cause of blindness and responsible for more than 20 million people with vision loss. It describes a condition in which the lens inside the eye will become cloudy. If no measurements are taken, this will lead to complete blindness.

To avoid blindness, the patient must undergo a 20-minute surgery. Although cataract surgery is a relatively fast procedure, the surgery itself is quite hard to perform. Due to the dimensions of the eye, microscopes and other expensive equipment are required to visualize the different structures of the eye. Therefore, cataract surgery has a long training curve. Younger surgeons require constant assessment of experienced teachers to master the different techniques.

Before being able to operate on real patient eyes, the fellow students also must master several skills. Current developments in Virtual and Augmented reality provide alternative approaches to cataract surgery training by creating a training environment, in which fellow doctors can practice by themselves.

We propose a smartphone-based training system for cataract surgery, which incorporates the above-mentioned functionalities and can be used as a lightweight and cost-effective alternative to existing VR training devices.

Student’s Tasks Description
The student should be capable of undergoing the following:

1. Implement a tool tracking algorithm on python capable of tracking the movement of tools used in eye surgery. The videos will be recorded in our offices, and any modifications to the tools that do not interfere with the surgical process, are accepted.
2. Implement an image processing algorithm capable of analyzing the result of corneal sutures and cataract surgery procedures.
3. Migrate the algorithms to Android Studio and generate an apk to be tested with a smartphone connected to a microscope.

During the entire process, the student is invited to the laboratory of Custom Surgical GmbH to test and discuss his/her findings with the engineers of the company and our clinical consultants.

The student will learn about the following topics:

1. Surgical procedures in ophthalmology
2. Tool tracking using OpenCV
3. Image processing with OpenCV
4. Microscopy
5. App development for Android

Please send the completed proposal to ardit.ramadani@tum.de, zl.jiang@tum.de, jennart.bastian@tum.de and tianyu.song@tum.de. 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

Previous knowledge in:

- Python
- OpenCV
- Optional – Java or C++

References


