Alcon True Vision - NGENUITY 3D Visualization System

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Project Statement

Background

Traditional ophthalmic surgical cameras are analog which have many limitations that the digital image-based Ngenuity system does not. Having a digital system allows digital image processing to not only deliver an image that is a more accurate representation of what the human eye sees due to the wider dynamic range, but also opens the system to being automated. Operating any surgical camera system requires a team of medical professionals that must work together seamlessly while minimizing human error. Digital systems already decrease the amount of manual configuration required substantially but the camera still requires the user to manually position the camera over the patient. The Ngenuity system offers a more powerful and ergonomic alternative to the traditional analog system, and it will now also offer a new level of automation.

Goals and Vision

The ultimate goal of the capstone project is to automate robotic control of the surgical camera and to focus the camera on a single patient eye by developing a powerful yet safe machine-vision guided algorithm. Surgeons will be able to safely and efficiently use the surgical system without having to manually focus and position the camera in response to changes in the position of the surgeon and patient; automating this process decreases the amount of time the surgeon spends per surgery, allowing them to help more patients without compromising the quality of care.

Project Overview

Potential Technologies

Machine Learning:

- OpenCV, PyTorch, Scikit-learn, Matlab, Python

Ngenutiy APIs:

- Alcon Ngenuity Robotic Control and Image Streaming APIs

Milestones

1. Find a patient's face on a surgical bed in a static image.
2. Locate the patient's desired eye (left/right) in a static image.
3. Integrate the above algorithms with Ngenuity APIs (robotic control and image streaming).
4. Position camera over patient’s eye by moving robot’s arm to correct position
5. Adjust camera to display a clear 3D image on monitor

Sprint Overview

Sprint 1: 10/15 - 10/29

- Research facial detection software and algorithms
- Identify potential data sets and explore the option of creating our own data
- Create design specification and being development

Sprint 2: 10/29 - 11/13

- Develop face detection software
- Research on Alcon Ngenuity Image Streaming APIs
- Research eye detection software and algorithms

Sprint 3: 11/13 - 11/27

- Finish face detection
- Develop eye detection software
- Research on Alcon Ngenuity Robotic Control APIs

Sprint 4: 11/27 - 12/11

- Finish eye detection software
- Combine recognition softwares
- Further Research on Alcon Ngenuity Robotic Control and Image Streaming APIs
- Plan additional features and further improvements