Saving Vision
Team Panda
Alcon Company
Scoring mechanism for cataract surgeries
Our Team

Jiayu Chen (Lead) | Jessica Zhang (Scribe) | Zilie Huang | Zora Jiang | Yinglong Wang | Grace Zhang

Mentors: Burton Tripathi, Jason Jennett, Franz Hampp, Lu Yin

Professors: Chandra Krintz, Jianwen Su

TA: Mason Corey
Motivation & Goals

01 Problem
- Surgeon side
- Patient side

02 Goal
Scoring models for cataract surgery (input: surgical video clips)
Basic Knowledge

Eye anatomy

Iris and Pupil

Capsulorhexis
A technique used to remove the capsule of the lens from the eye
Our **Solution**

A scoring system that can evaluate the following **four** parameters:

- **Diameter**
  - diameter of the rhexit

- **Centration**
  - how centered the rhexit is compared to pupil

- **Roundness**
  - how round the rhexit is

- **Speed**
  - duration of the capsulorhexis
Our Solution

Circle-detection Algorithm

Edge-detection Algorithm

Calculate Scores

Object-detection Algorithm

Surgeons

Medical Students

Front End

Backend

Millimeter to Pixel Ratio

Output cropped video frames
Technology used: React

Details Page:
Explaining parameters: centration, roundness, duration, and diameter

Upload page:
Upload surgery video for analysis, and a score will return at the form below

History Page:
Comprehensive record of a doctor’s past performance, including surgery date and time and scores for four parameters.
LIVE Demo
Technical Details: Detect the scalpel

- Haar-Cascade Classifier(opencv)
- Model is trained based on 150 positive & 240 negative cases.
- 24 Training Stages
- Output a cropped image of the scalpel

All video snippets and screenshots are Alcon proprietary
Technical Details: Unit Translation

As a reference from pixel length to 1 mm

- Choose 1+ image as input
- Intensify the edges
- Use edge detection to contour the blade
- Measure the intersection

All video snippets and screenshots are Alcon proprietary
Technical Details: Detect the Circles

Rhexis Detection

Pupil Detection
Technical Details: **Measure speed**

**Goal: measure speed of the Capsulorhexis Process**

- We calculate the time difference between the forcep is first shown and last seen.
- Haar cascade classifier is used to track the forcep.

All video snippets and screenshots are Alcon proprietary.
Conclusion

Challenges

❖ Background Noise for Edge Detections
  ➢ Contrast enhancement filters
❖ Front-end and Back-end interaction
  ➢ Send videos between front and back

Achievements

★ A web app for surgeons to view their scores on cataract surgeries
★ A measuring system that scores the capsulorhexis process based on 4 key criteria

Technology Used

Frontend: React, Flask
Backend: Python, OpenCV
Agile: GitHub, Trello
Thank you for listening! Questions?