

UCSB

Saving Vision

Team Panda

Alcon

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

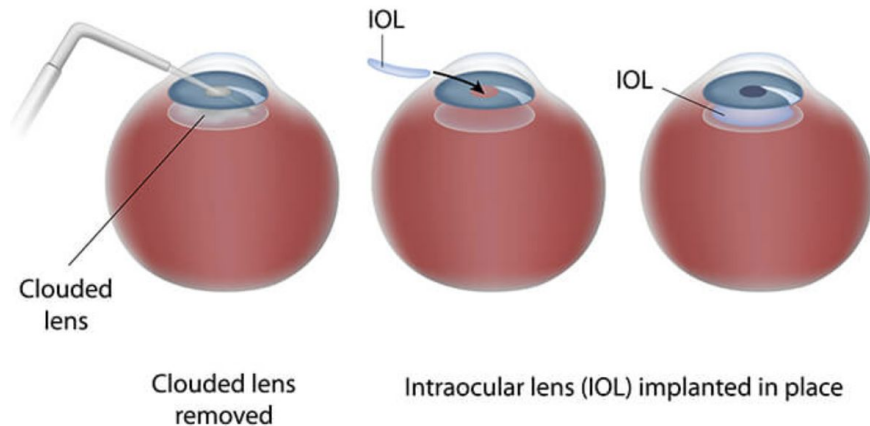
Motivation & Goals

01 Problem

- Surgeon side
- Patient side

02 Goal

Scoring models for cataract surgery (input: surgical video clips)



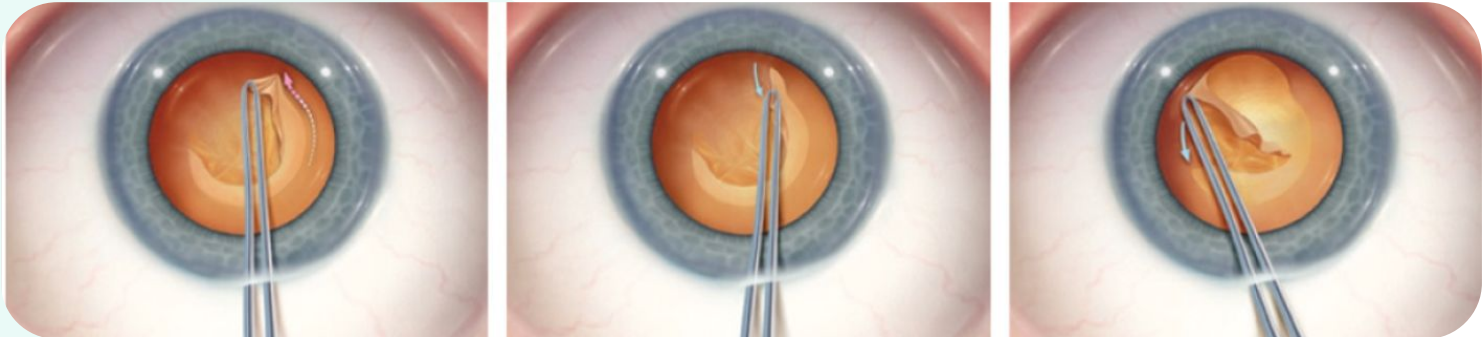
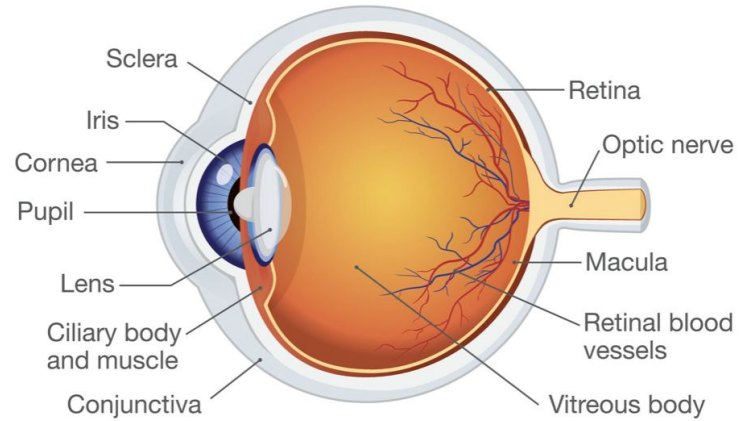
Basic Knowledge

Eye anatomy

Iris and Pupil

Capsulorhexis

A technique used to remove the capsule the lens from the eye

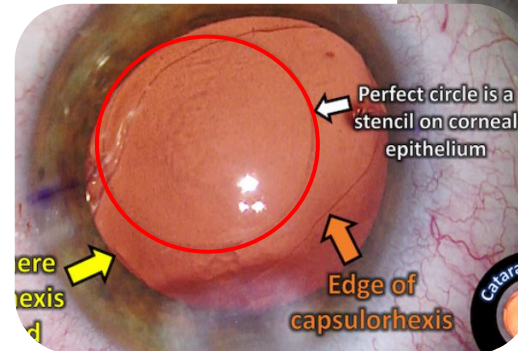
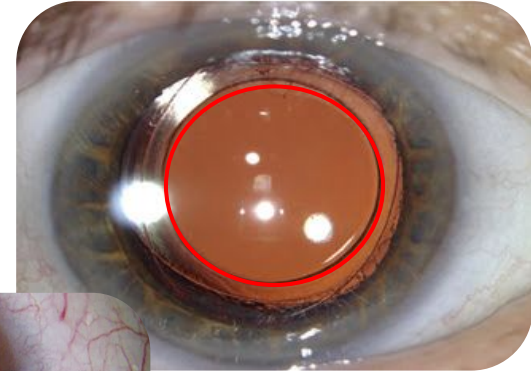


Our Solution

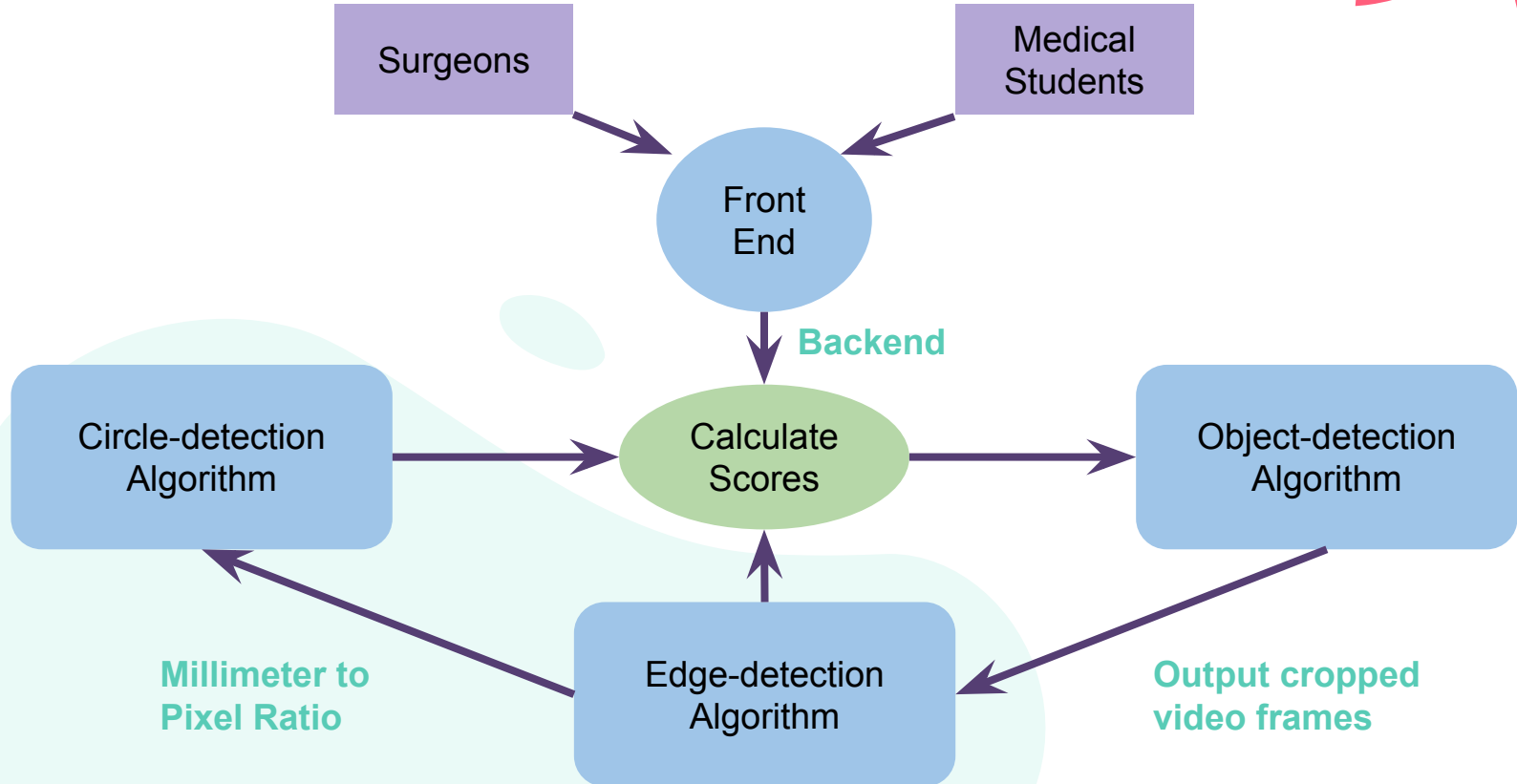
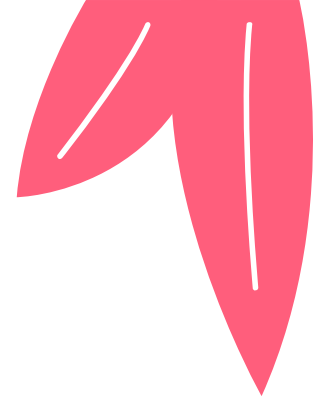


A scoring system that can evaluate the following four parameters

- **Diameter**
 - diameter of the rhexis
- **Centration**
 - how centered the rhexis is compared to pupil
- **Roundness**
 - how round the rhexis is
- **Speed**
 - duration of the capsulorhexis



Our Solution



Web Page Introduction

Technology used: React

Details Page:

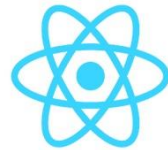
Explaining parameters: centration, roundness, duration, and diameter

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.

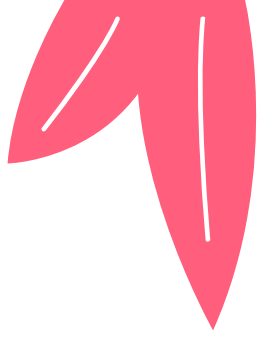


React

web application development



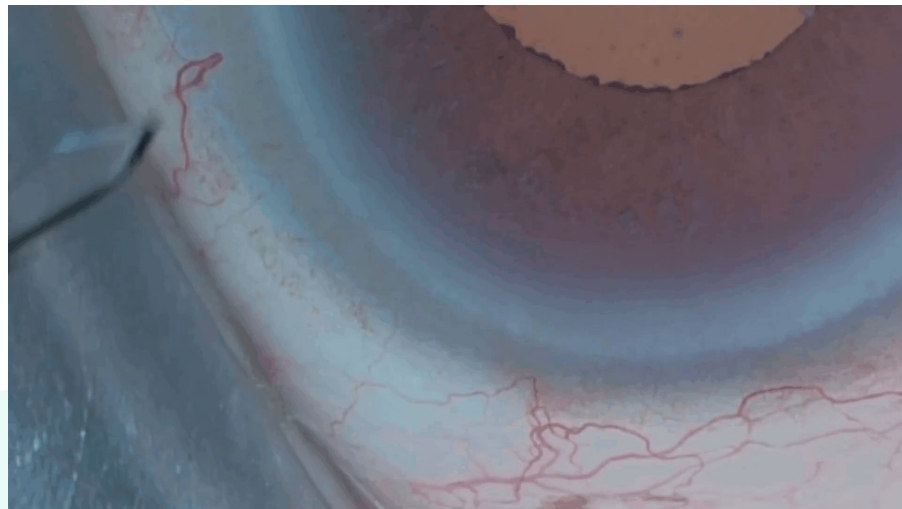
LIVE Demo



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



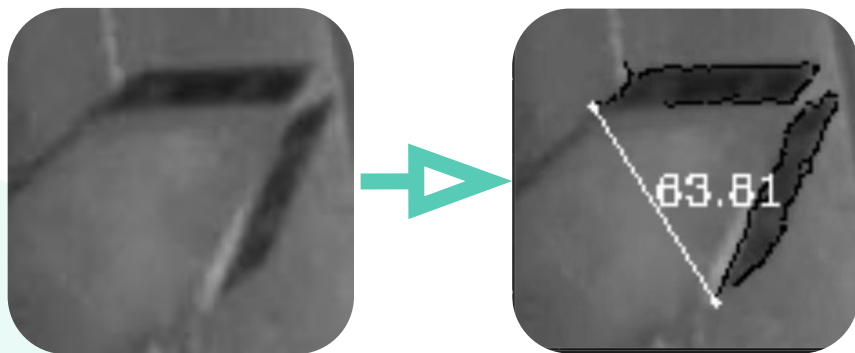
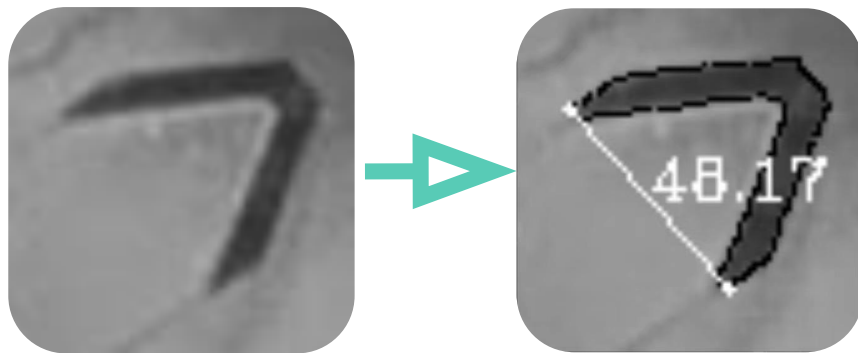
All video snippets and screenshots are Alcon proprietary

Technical Details: Unit Translation

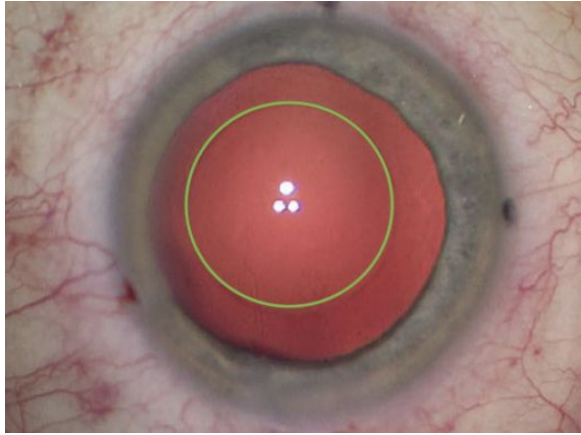
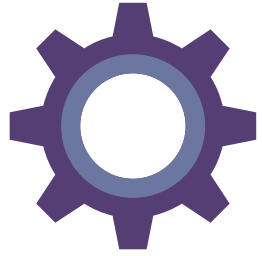
As a reference from pixel length to 1 mm

- 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

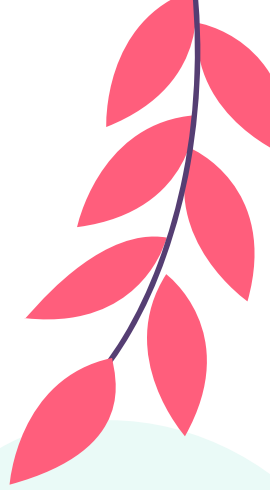
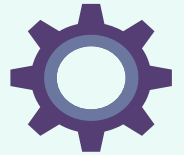
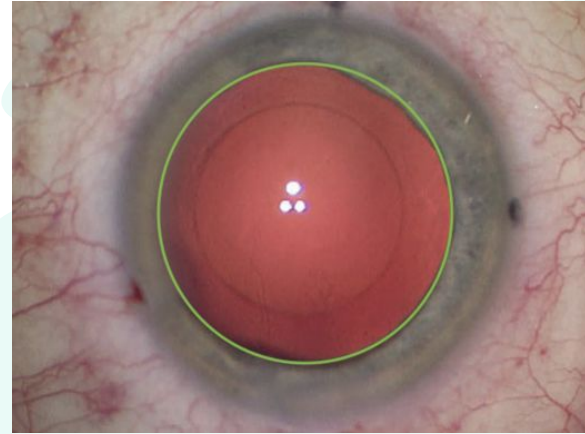


Technical Details: Detect the Circles



Rhexis Detection

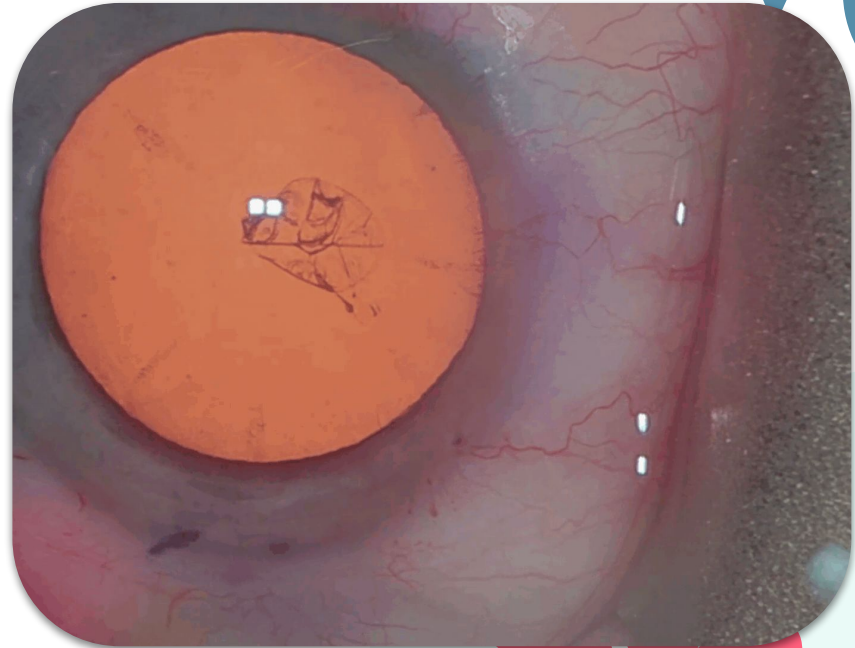
Pupil Detection



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

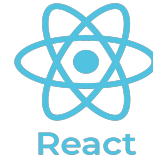
Conclusion

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

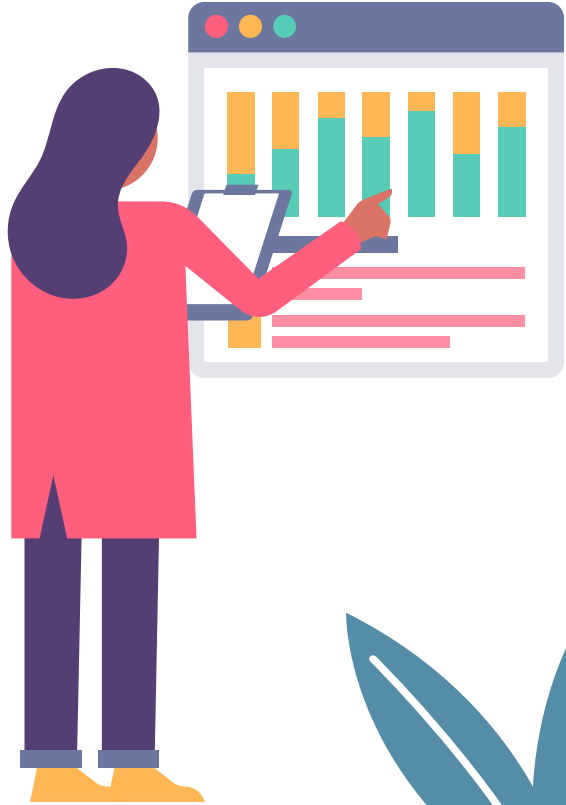


Technology Used

Frontend: React, Flask

Backend: Python, OpenCV

Agile: GitHub, Trello



**Thank you
for listening!
Questions?**