UCSB

Save Visions

Team Panda

Alcon Company

Scoring mechanism for cataract surgeries

Our Team

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Motivation & Goals

01 Problem

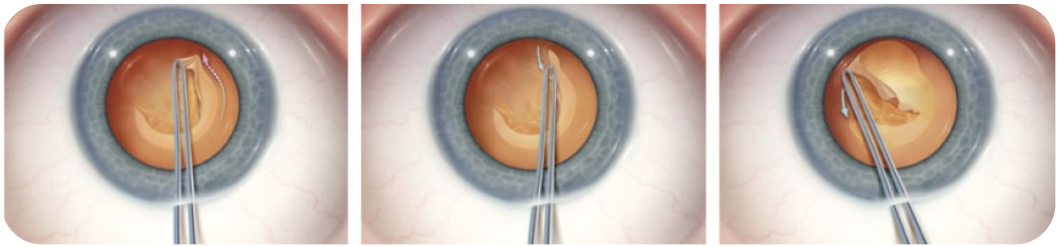
Surgeons do not have a good way to reflect on their past surgical performances given the complication of the cataract surgery.

02 Goal

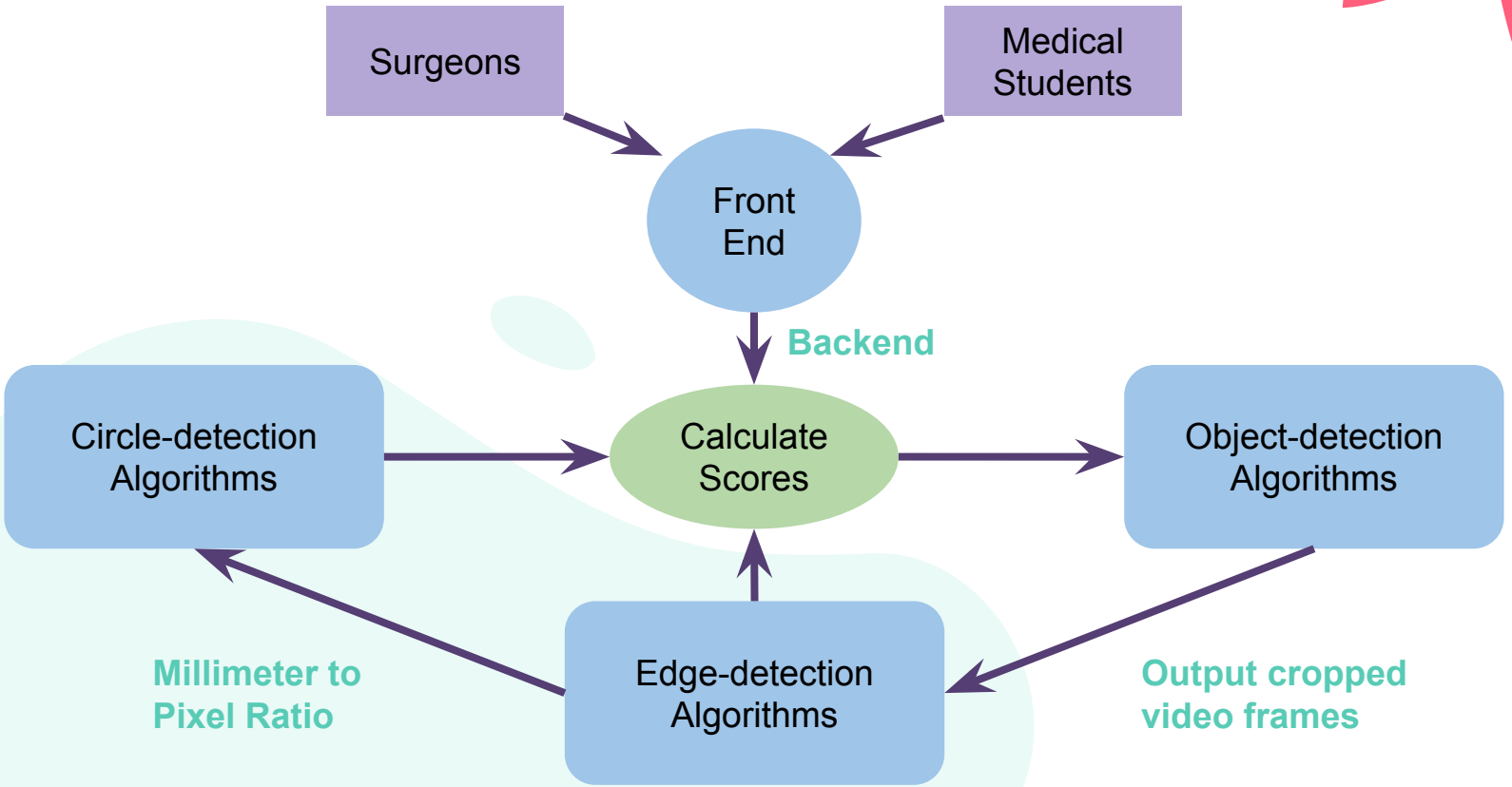
Scoring models for surgeons and educators. (input: surgery videos)

03 Capsulorhexis

A technique used to remove the capsule of the lens from the eye during cataract surgery by shear and stretch forces. It generally refers to removal of a part of the anterior lens capsule.

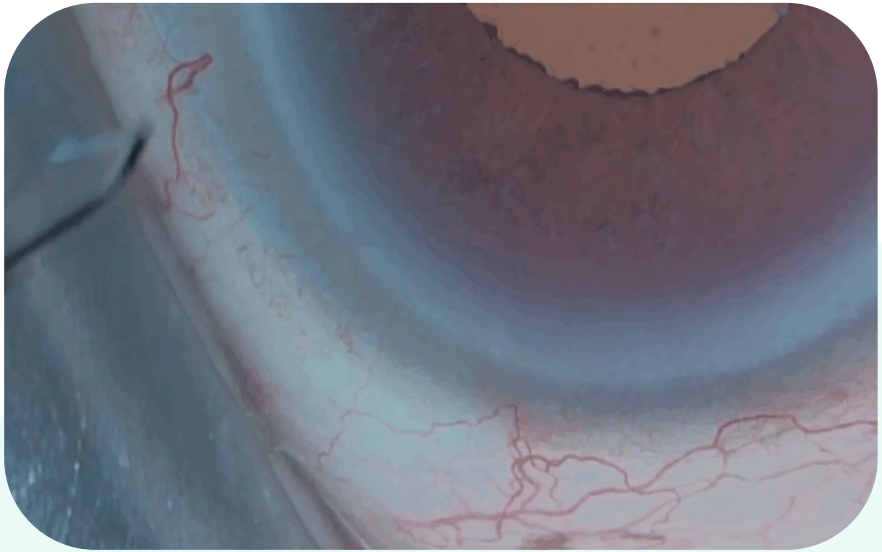


Our Solution



Technical Details:
Detect the Scalpel

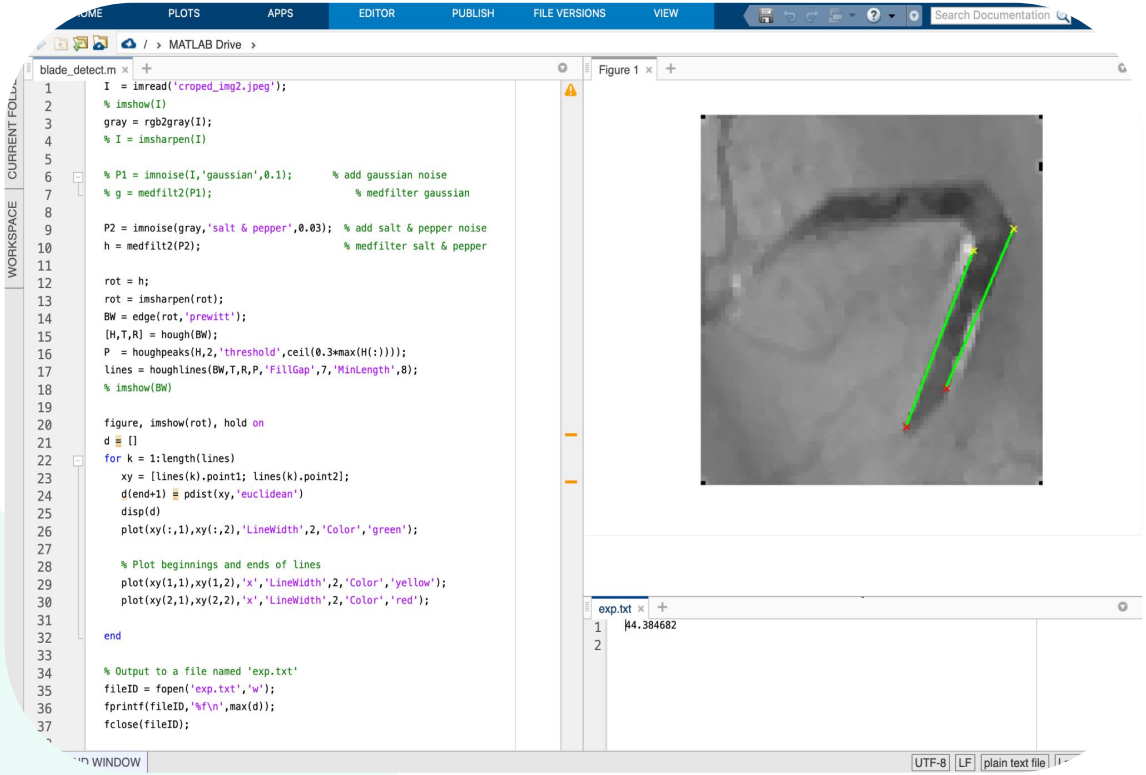
- Haar-Cascade Detection(opencv)
- Classifier Model is trained based on 150 positive & 240 negative cases.
- 24 Training Stages
- Output a cropped image of the scalpel



All video snippets and screenshots are Alcon properties

Technical Details: Measure the Blade

- Take in the output from the last step
- Add different filters to intensify the edge of the blades
- Use hough transformation to detect straight lines
- Output the max length we detect as the pixel length per mm to file “exp.txt”




```
I  = imread('croped_img2.jpeg');
% imshow(I)
gray = rgb2gray(I);
% I = imsharpen(I)

% P1 = imnoise(I,'gaussian',0.1);       % add gaussian noise
% g = medfilt2(P1);                        % medfilter gaussian

P2 = imnoise(gray,'salt & pepper',0.03);  % add salt & pepper noise
h = medfilt2(P2);                         % medfilter salt & pepper

rot = h;
rot = imsharpen(rot);
BW = edge(rot,'prewitt');
[H,T,R] = hough(BW);
P  = houghpeaks(H,2,'threshold',ceil(0.3*max(H(:))));
lines = houghlines(BW,T,R,P,'FillGap',7,'MinLength',8);
% imshow(BW)

figure, imshow(rot), hold on
d = []
for k = 1:length(lines)
   xy = [lines(k).point1; lines(k).point2];
   d(end+1) = pdist(xy,'euclidean')
   disp(d)
   plot(xy(:,1),xy(:,2),'LineWidth',2,'Color','green');

   % Plot beginnings and ends of lines
   plot(xy(1,1),xy(1,2),'x','LineWidth',2,'Color','yellow');
   plot(xy(2,1),xy(2,2),'x','LineWidth',2,'Color','red');

end

% Output to a file named 'exp.txt'
fileID = fopen('exp.txt','w');
fprintf(fileID,'%f\n',max(d));
fclose(fileID);
```

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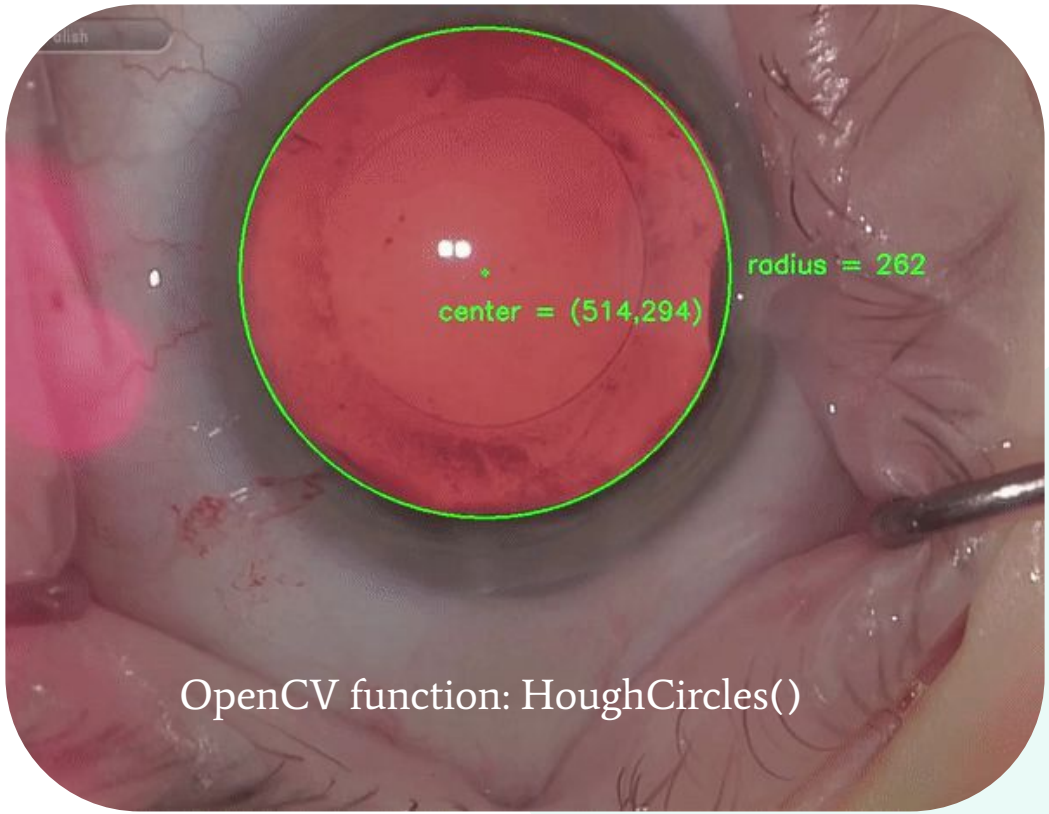
Technical Details: Detect the Rhexis



OpenCV function: HoughCircles()

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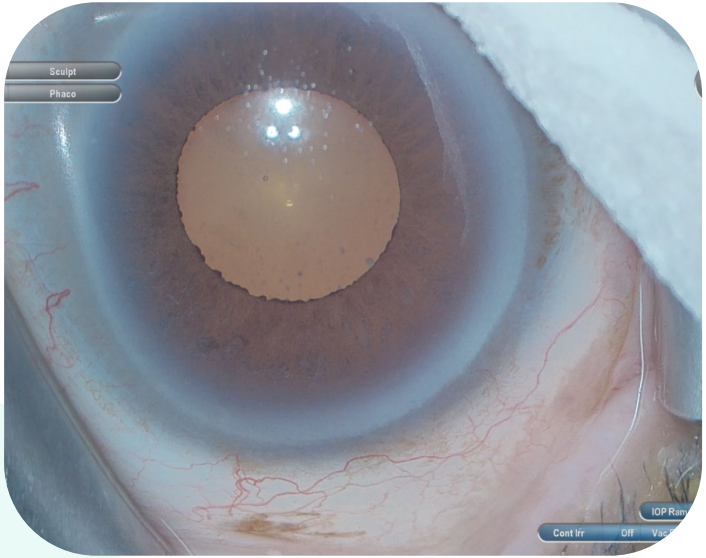
Challenges

1. **Noise: capillary vessels and muscles on the eye.**
    a. **Hard to perform edge detections and detect capsulorhexis due to capillary vessels around the eye.**
    b. **Hard to calculate the cross sectional area of scalpel due to noises.**

2. **MATLAB and Python interface**
    a. **Some algorithms can be designed easily in Matlab but not in Python.**



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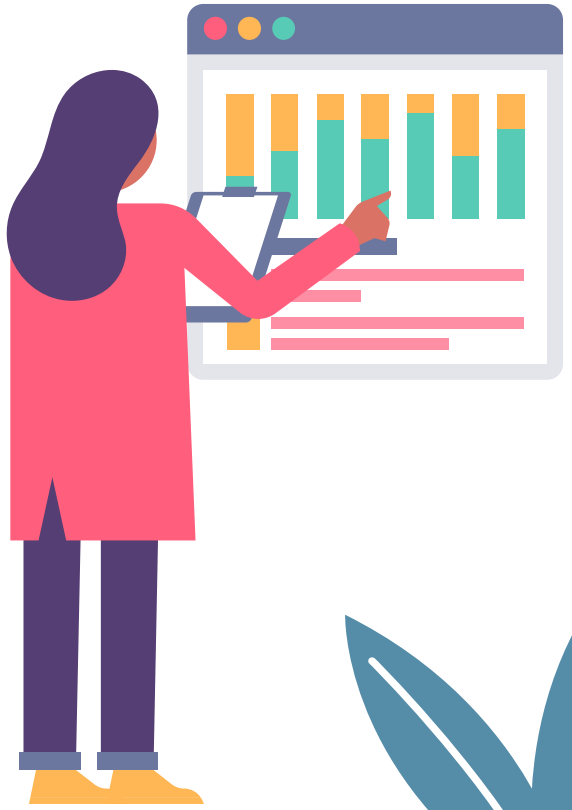
Next Step

1. Complete the roundness calculation algorithms.
2. Improve the centration algorithm.
3. Interface the Matlab and Python code together.
4. Integrate the four diameters together and design the scoring mechanism.
5. Design a front end for our scoring algorithms.



Thank you for listening!