Dr. Pakinee Aimmanee

AUTOMATIC NEOVASCULARIZATION DETECTION

IN OPTICAL COHERENT TOMOGRAPHY (OCT) IMAGES

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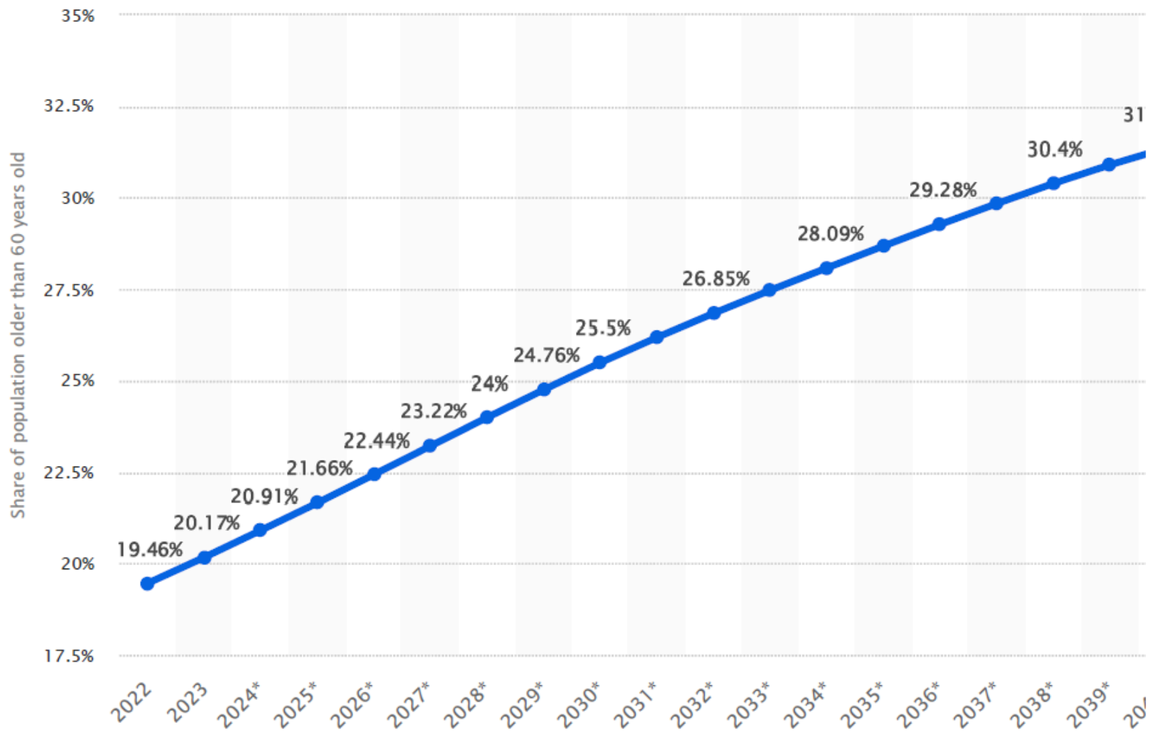
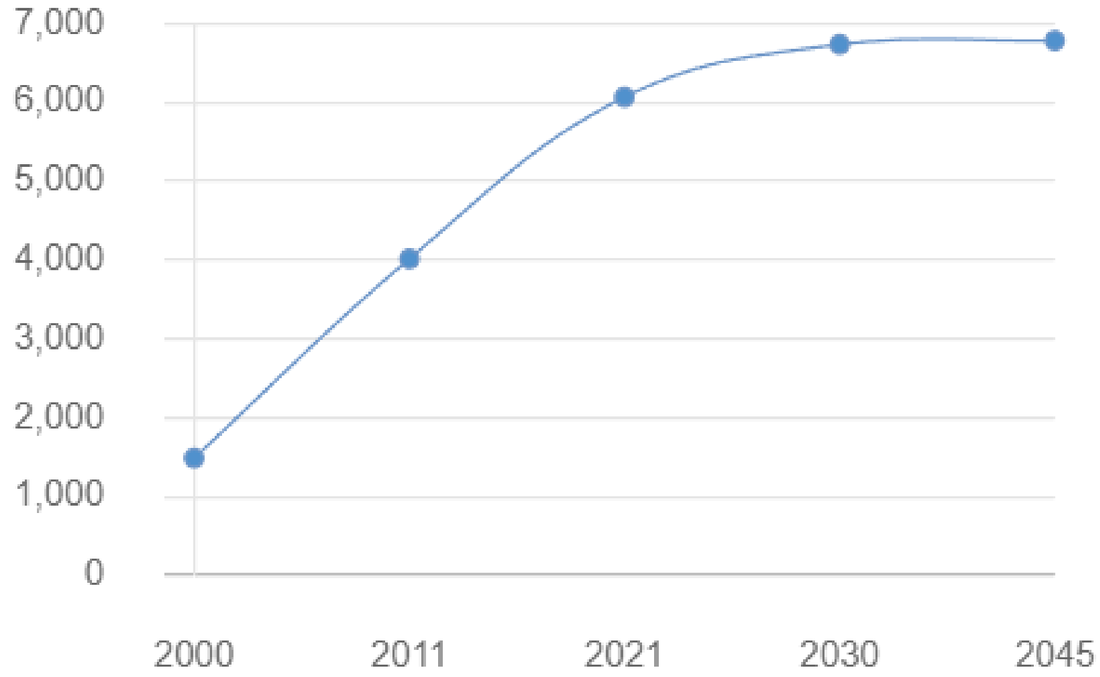
NUMBER OF AGING POPULATION IN THAILAND 2022-2040



PEOPLE WITH DIABETES, IN 1,000S: THAILAND, DIABETES REPORT 2000-2045



1,660

NUMBER OF OPHTHALMOLOGISTS IN THAILAND

1,660

ACCORDING TO THE KEN RESEARCH

KEN RESEARCH
YOUR SEARCH ENDS WITH OUR RESEARCH

Problem

WHY EARLY DETECTION OF NEOVASCULARIZATION IS IMPORTANT.

1. NV is a critical indicator of diseases like diabetic retinopathy and AMD.
2. Manual detection is time-consuming and prone to error.
3. Increasing prevalence of diabetes and aging population.

NEOVASCULARIZATION & OCT IMAGE

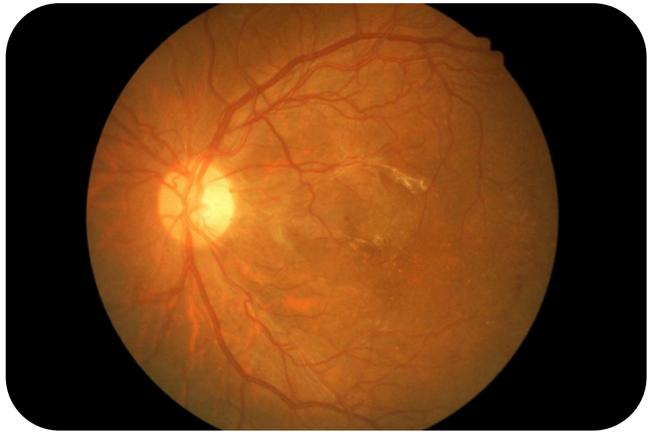
NEOVASCULARIZATION

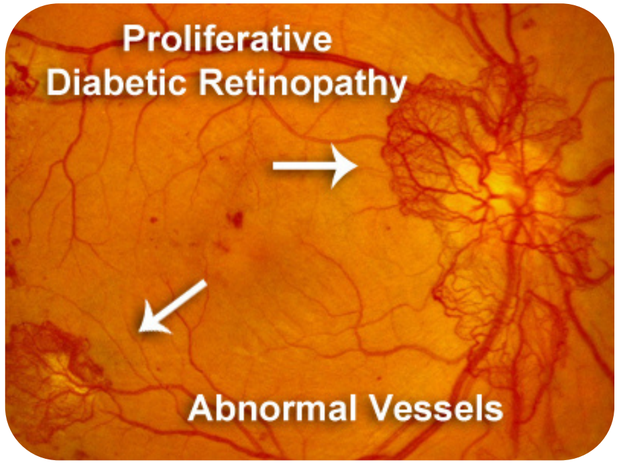
DEFINITION: FORMATION OF NEW BLOOD VESSELS, OFTEN DUE TO LOW OXYGEN (HYPOXIA).

NATURAL ROLE: SUPPORTS WOUND HEALING AND TISSUE REPAIR.

PATHOLOGICAL NEOVASCULARIZATION:

- COMMON IN DIABETIC RETINOPATHY AND AGE-RELATED MACULAR DEGENERATION (AMD).
- NEW VESSELS ARE FRAGILE AND PRONE TO LEAKAGE, RISKING VISION LOSS.



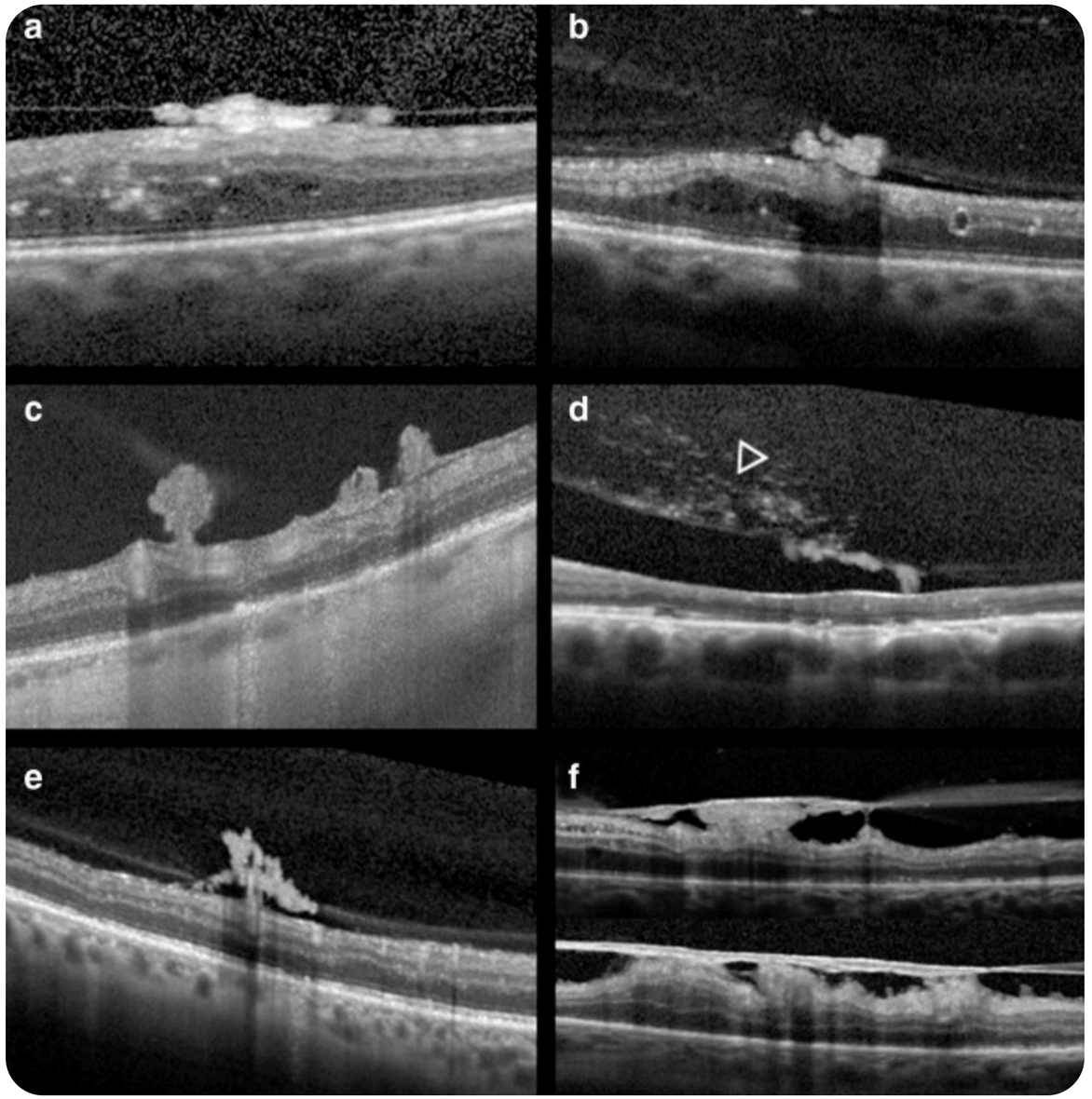


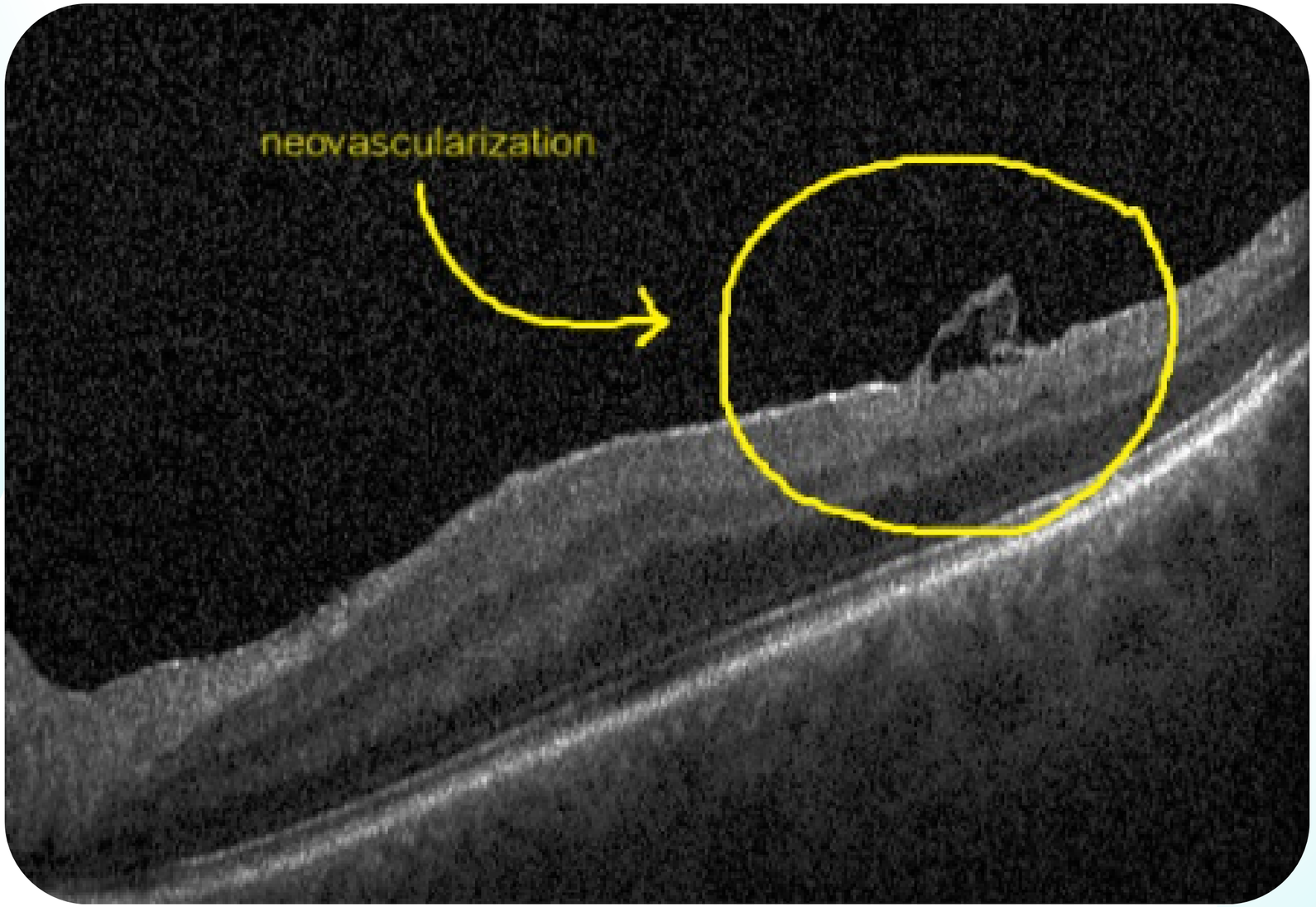
OCT IMAGES

Offers a detailed view of retinal structure to detect abnormalities like neovascularization.

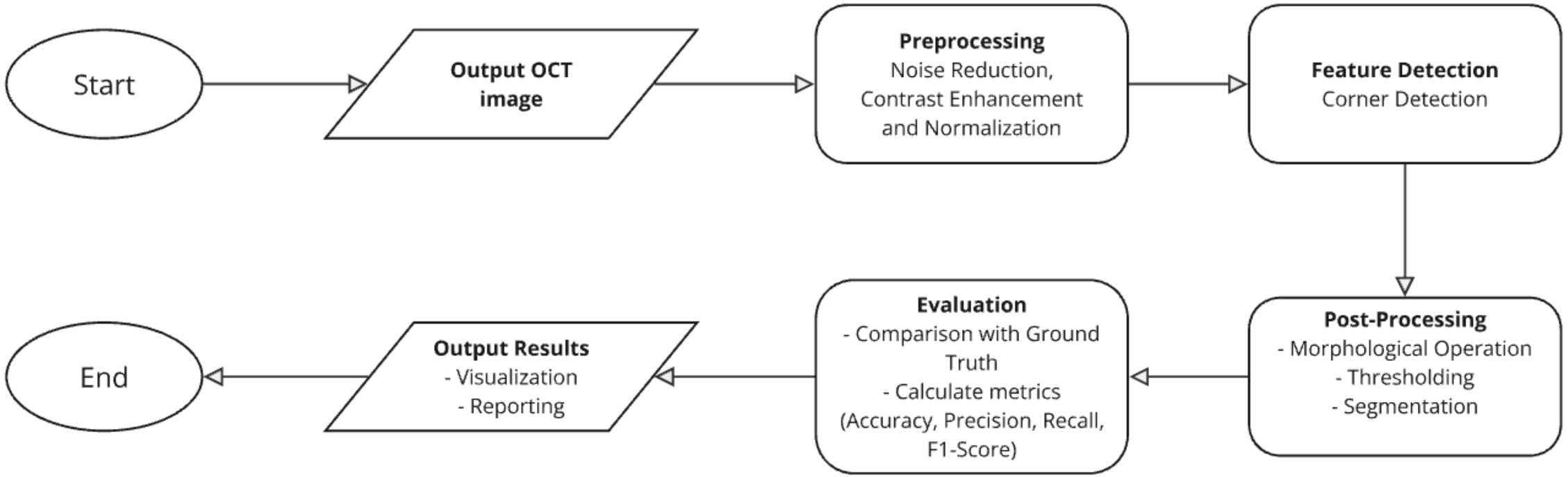
CHARACTERISTICS OF OCT IMAGES:

- **HIGH RESOLUTION:** ESSENTIAL FOR DIAGNOSING AND MONITORING EYE CONDITIONS.
- **LAYERED STRUCTURE:** REPRESENTS SPECIFIC RETINAL LAYERS (E.G., NERVE FIBER, PHOTORECEPTOR, PIGMENT EPITHELIUM).
- **GRAYSCALE IMAGING:**
  - BRIGHT AREAS: HIGH REFLECTIVITY, DENSER TISSUES.
  - DARK AREAS: LOW REFLECTIVITY, LESS DENSE REGIONS.
- **THICKNESS MEASUREMENTS:** IMPORTANT FOR DIAGNOSING MACULAR EDEMA, GLAUCOMA, AND OTHER RETINAL CONDITIONS.

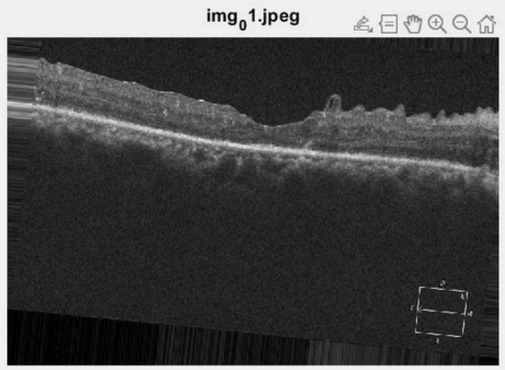

a
b
c
d
e
f

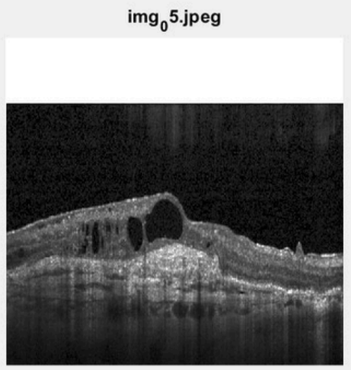

neovascularization

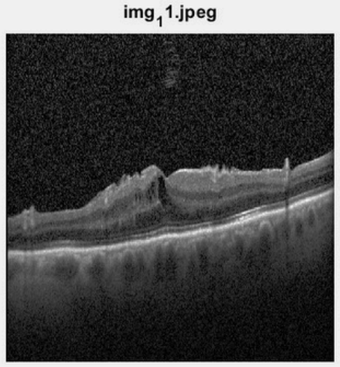
FRAME WORK

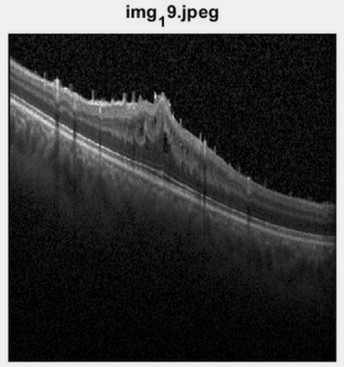

Start
Output OCT image
Preprocessing
Noise Reduction, Contrast Enhancement and Normalization
Feature Detection
Corner Detection
Post-Processing
- Morphological Operation
- Thresholding
- Segmentation
Evaluation
- Comparison with Ground Truth
- Calculate metrics (Accuracy, Precision, Recall, F1-Score)
Output Results
- Visualization
- Reporting
End

METHODOLOGY - IMAGE PREPROCESSING (RAW IMAGE LOADING)



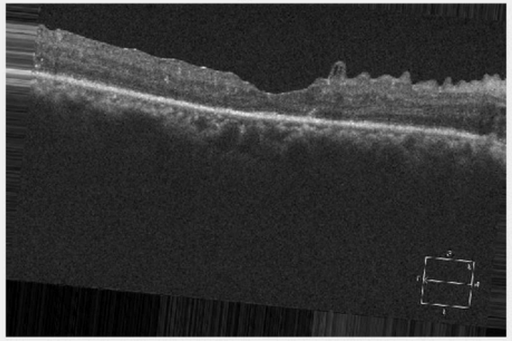




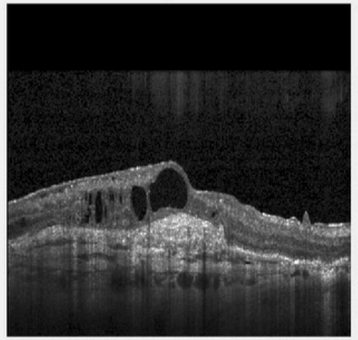


METHODOLOGY - IMAGE PREPROCESSING (WHITE BORDER REMOVAL)

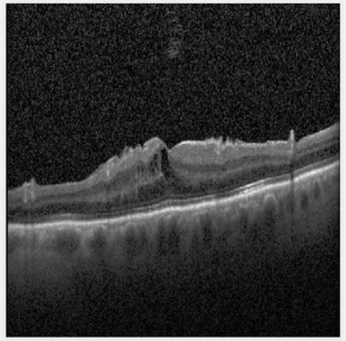
img$_0$1.jpeg



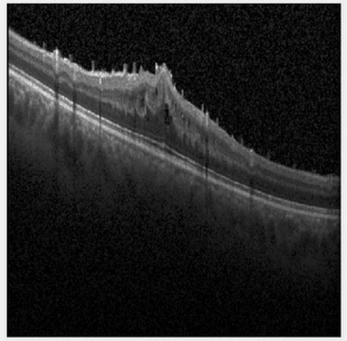
img$_0$5.jpeg



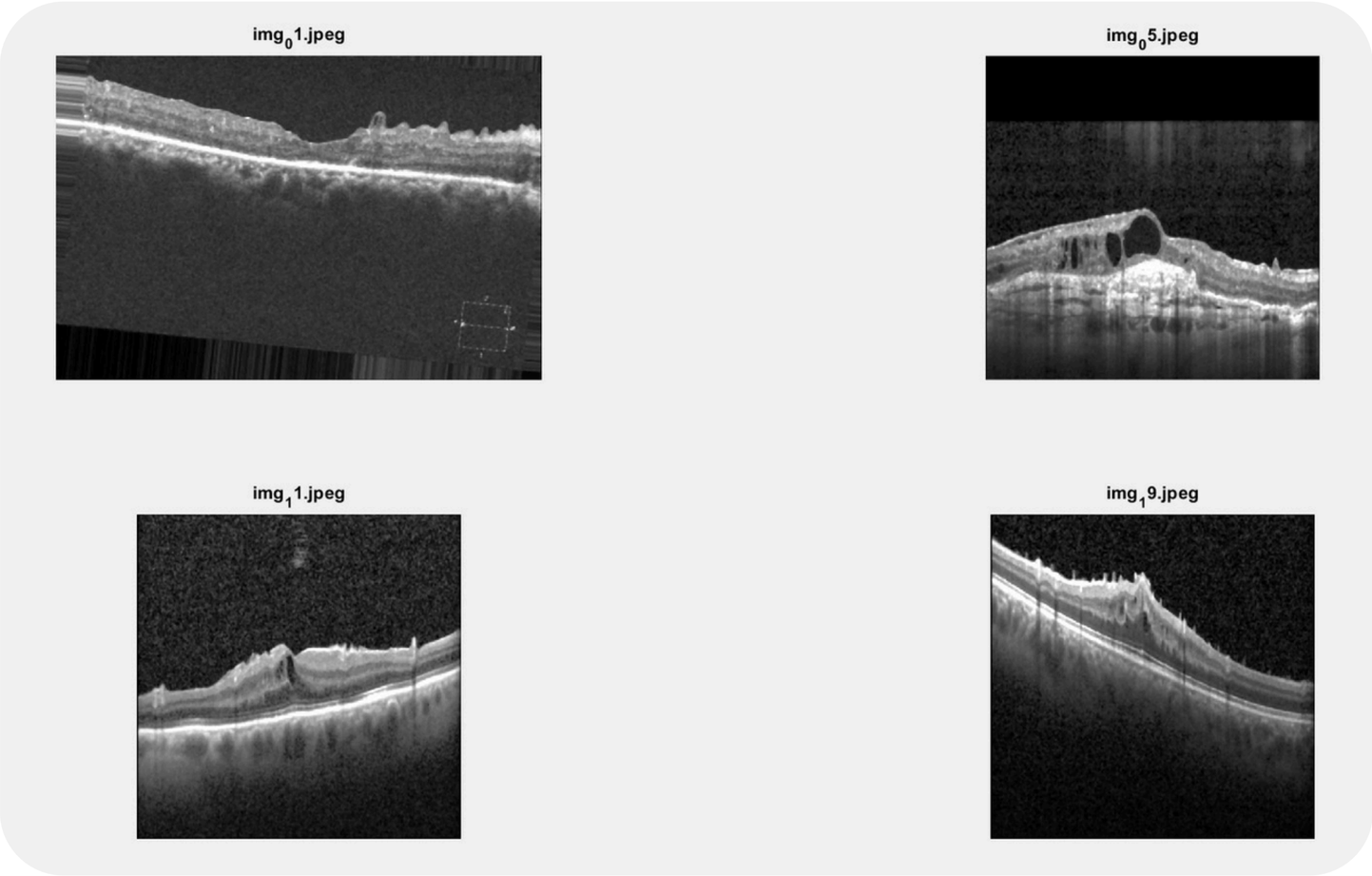
img$_1$1.jpeg



img$_1$9.jpeg



METHODOLOGY - IMAGE PREPROCESSING (NOISE FILTERING)



METHODOLOGY - BINARIZATION

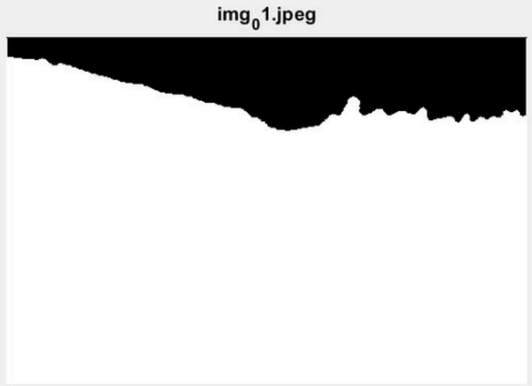
img$_0$1.jpeg

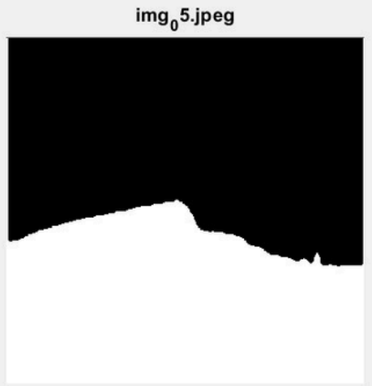
img$_0$5.jpeg

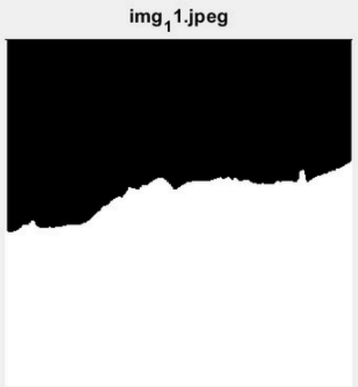
img$_1$1.jpeg

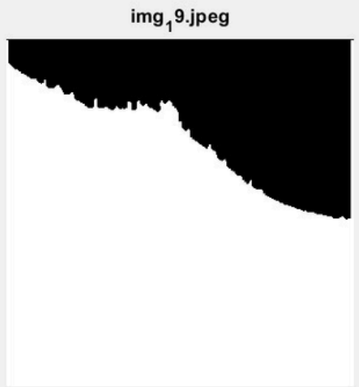
img$_1$9.jpeg

METHODOLOGY - MORPHOLOGICAL CLOSING AND FILLING

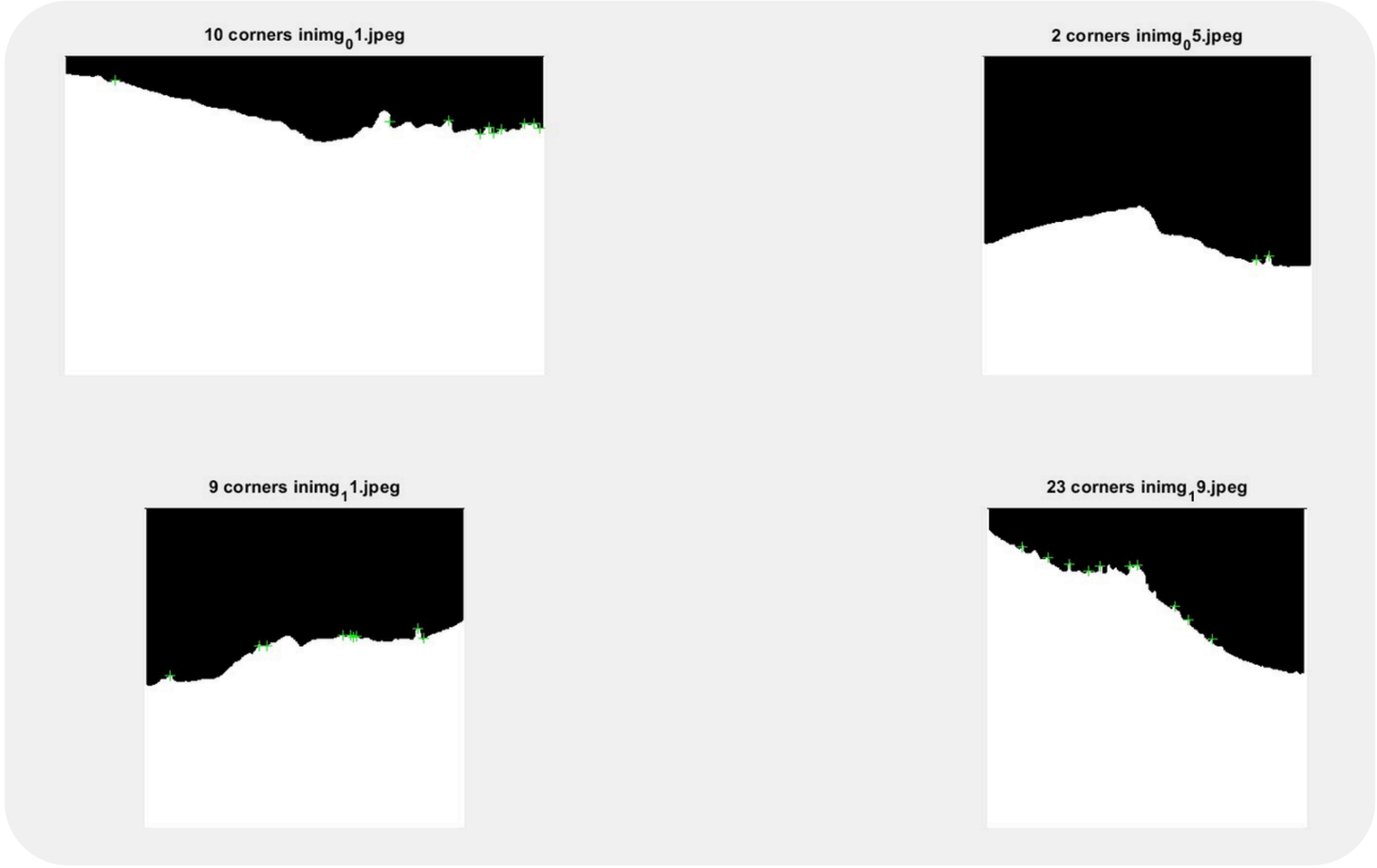




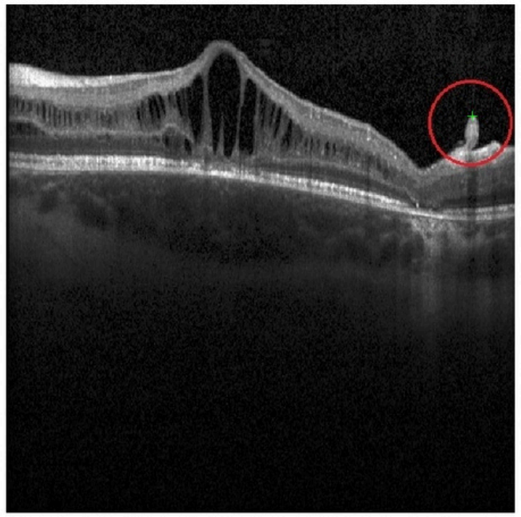


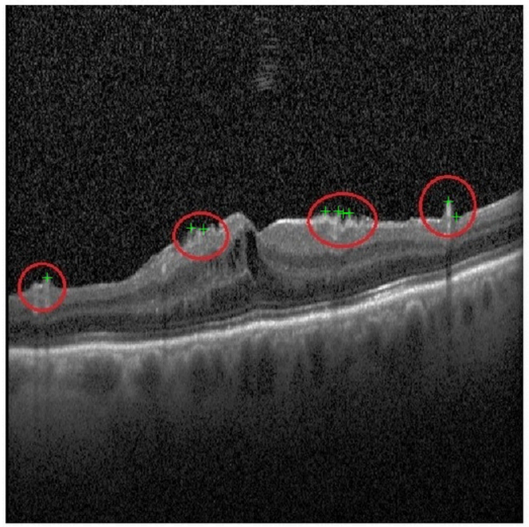


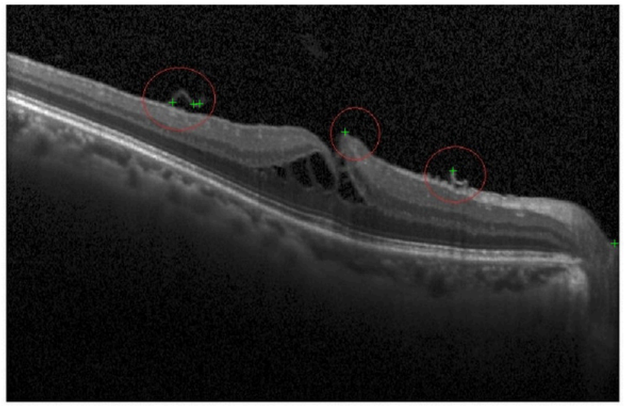
METHODOLOGY - CORNER DETECTION (HARRIS CORNER DETECTION TECHNIQUE)

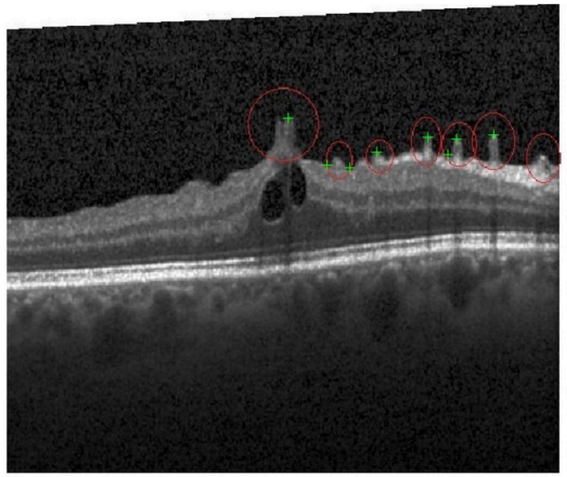


METHODOLOGY - VALIDATION AGAINST GROUND TRUTH





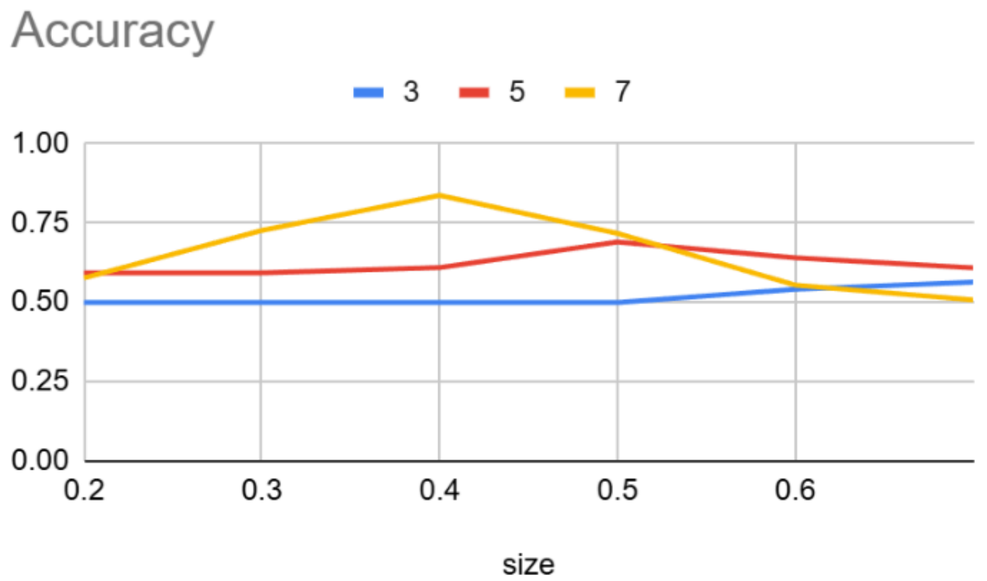




RESULTS

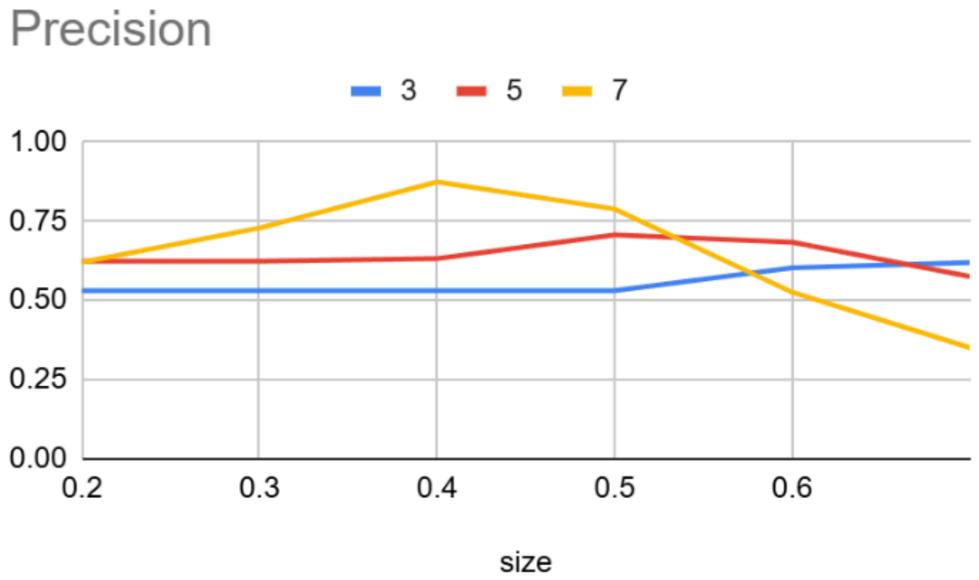
ACCURACY

Kernel Size	0.2	0.3	0.4	0.5	0.6	0.7
3	49.85%	49.85%	49.85%	49.85%	54.05%	56.30%
5	59.22%	59.22%	60.89%	68.97%	63.97%	60.80%
7	57.63%	72.63%	**83.67%**	71.67%	55.34%	50.67%



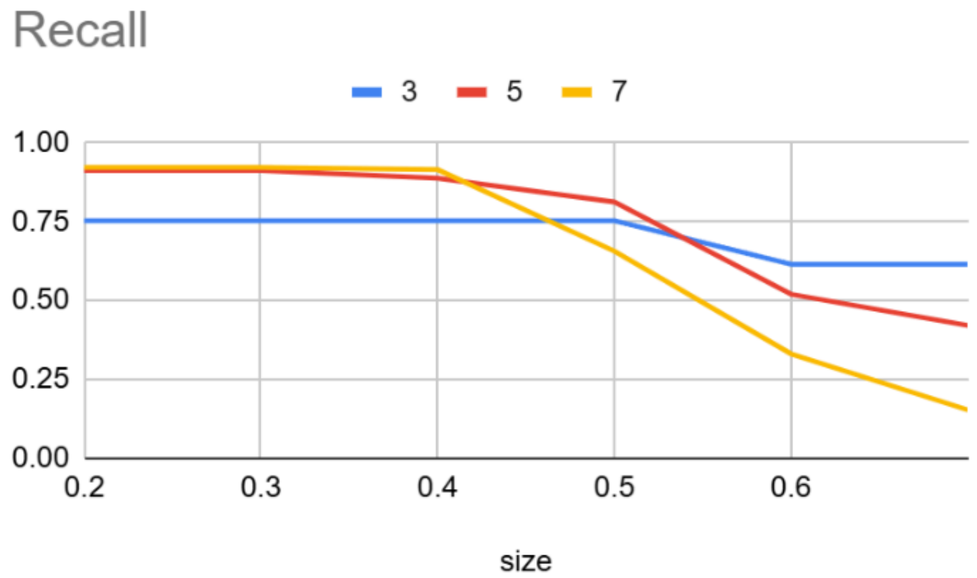
PRECISION

Kernel Size	0.2	0.3	0.4	0.5	0.6	0.7
3	53.04%	53.04%	53.04%	53.04%	60.25%	61.92%
5	62.33%	62.33%	63.17%	70.67%	68.33%	57.50%
7	62.02%	72.86%	**87.44%**	78.83%	52.50%	35.00%



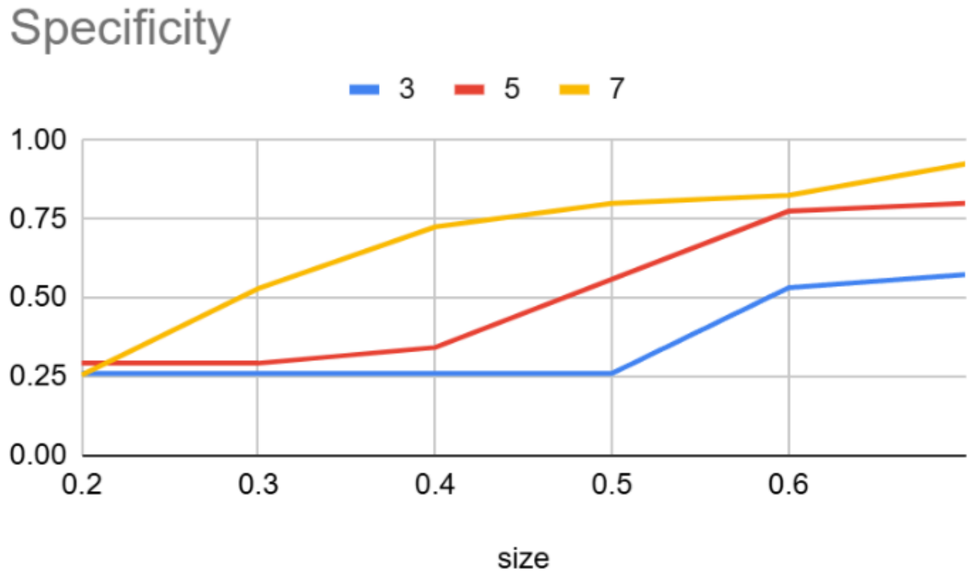
RECALL

Kernel Size	0.2	0.3	0.4	0.5	0.6	0.7
3	75.31%	75.31%	75.31%	75.31%	61.48%	61.48%
5	91.28%	91.28%	88.78%	81.28%	51.94%	42.05%
7	**92.24%**	**92.24%**	91.53%	65.66%	33.01%	15.23%



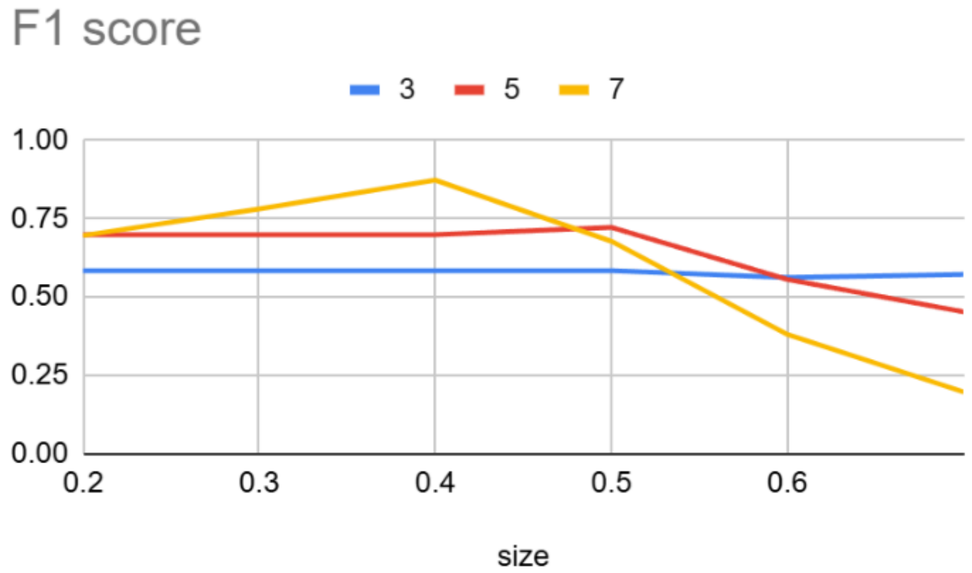
SPECIFICITY

Kernel Size	0.2	0.3	0.4	0.5	0.6	0.7
3	25.92%	25.92%	25.92%	25.92%	53.17%	57.33%
5	29.17%	29.17%	34.17%	55.83%	77.50%	80.00%
7	25.42%	52.92%	72.50%	80.00%	82.50%	**92.50%**



F1 SCORE

Kernel Size	0.2	0.3	0.4	0.5	0.6	0.7
3	58.39%	58.39%	58.39%	58.39%	56.18%	57.18%
5	69.87%	69.87%	69.87%	72.21%	55.56%	45.24%
7	69.61%	78.11%	**87.28%**	67.76%	37.97%	19.61%



CONCLUSION

A	B	C	D	E	F	G
Accuracy	quality					
size	0.2	0.3	0.4	0.5	0.6	0.7
3	0.498538961	0.498538961	0.498538961	0.498538961	0.540487013	0.562987013
5	0.5922468735	0.5922468735	0.6089135402	0.6897468735	0.6397468735	0.608020683
7	0.5762662338	0.7262662338	0.8367424242	0.7167424242	0.5534415584	0.5067364117
Precision	quality					
size	0.2	0.3	0.4	0.5	0.6	0.7
3	0.5303571429	0.5303571429	0.5303571429	0.5303571429	0.6025	0.6191666667
5	0.6233333333	0.6233333333	0.6316666667	0.7066666667	0.6833333333	0.575
7	0.6202380952	0.7285714286	0.8744047619	0.7883333333	0.525	0.35
Recall	quality					
size	0.2	0.3	0.4	0.5	0.6	0.7
3	0.7530663781	0.7530663781	0.7530663781	0.7530663781	0.6148088023	0.6148088023
5	0.9128066378	0.9128066378	0.8878066378	0.8128066378	0.5193542569	0.420544733
7	0.9224116162	0.9224116162	0.915268759	0.6565566378	0.3300865801	0.1523448773
Specificity	quality					
size	0.2	0.3	0.4	0.5	0.6	0.7
3	0.2591666667	0.2591666667	0.2591666667	0.2591666667	0.5316666667	0.5733333333
5	0.2916666667	0.2916666667	0.3416666667	0.5583333333	0.775	0.8
7	0.2541666667	0.5291666667	0.725	0.8	0.825	0.925
F1	quality					
size	0.2	0.3	0.4	0.5	0.6	0.7
3	0.5838644689	0.5838644689	0.5838644689	0.5838644689	0.5618406593	0.5718406593
5	0.6987355455	0.6987355455	0.6987355455	0.7220688788	0.5556248408	0.4523564426
7	0.6961309524	0.7811309524	0.872760989	0.6775641026	0.3796969697	0.1960664336

Kernel size

7

+

Quality threshold

0.4

=

Ideal

Key Achievements

Improved Diagnostic Efficiency

Optimal Performance Settings

Quantitative Insights

Challenges and Limitations

Noise Sensitivity

Limited Generalizability

Future Directions

Integration of Deep Learning Techniques

Refinement of Detection Algorithms

Expansion of Dataset Diversity

THANK YOU