Visualization of pathological changes in retinal layer thickness using optical coherence tomography

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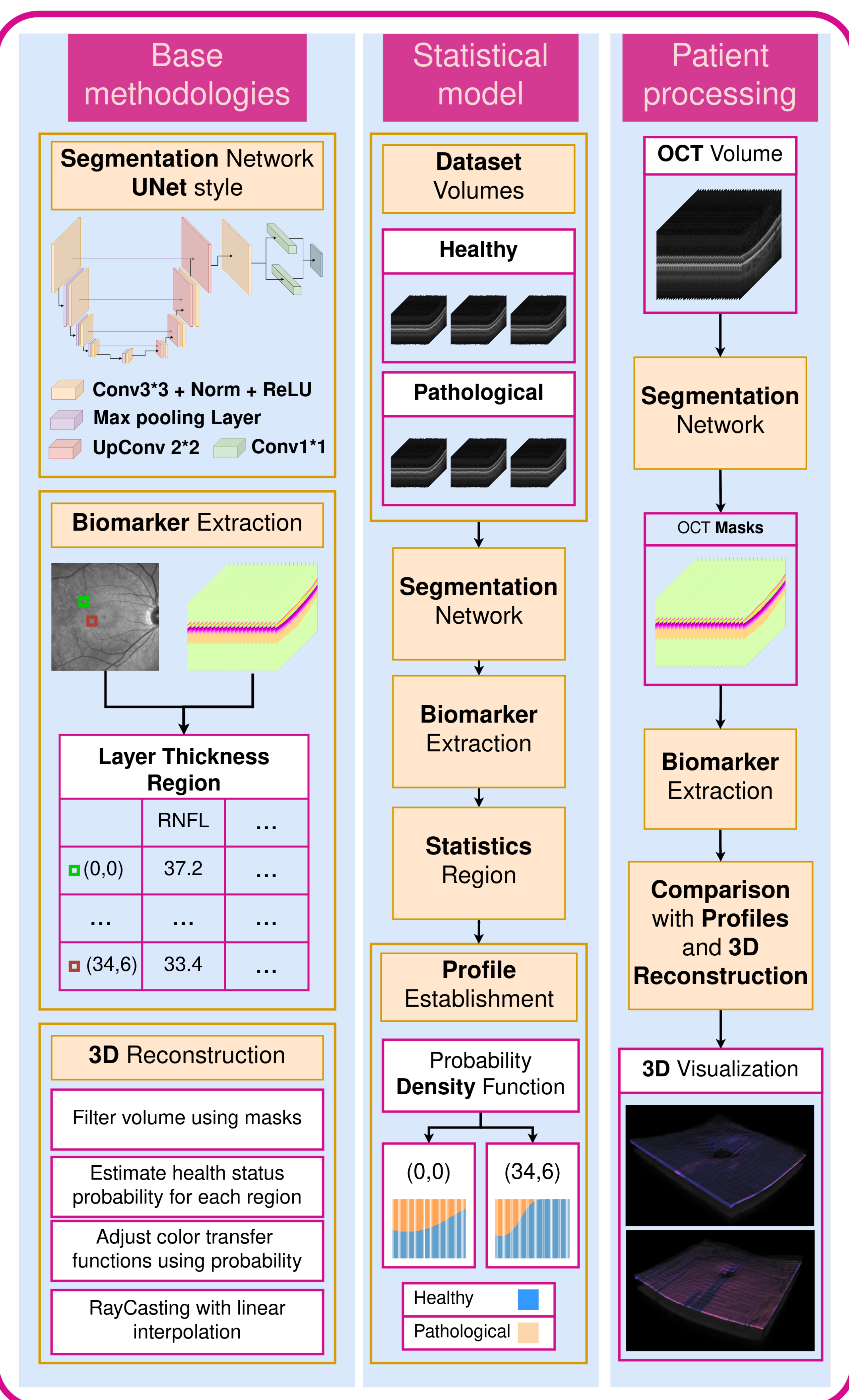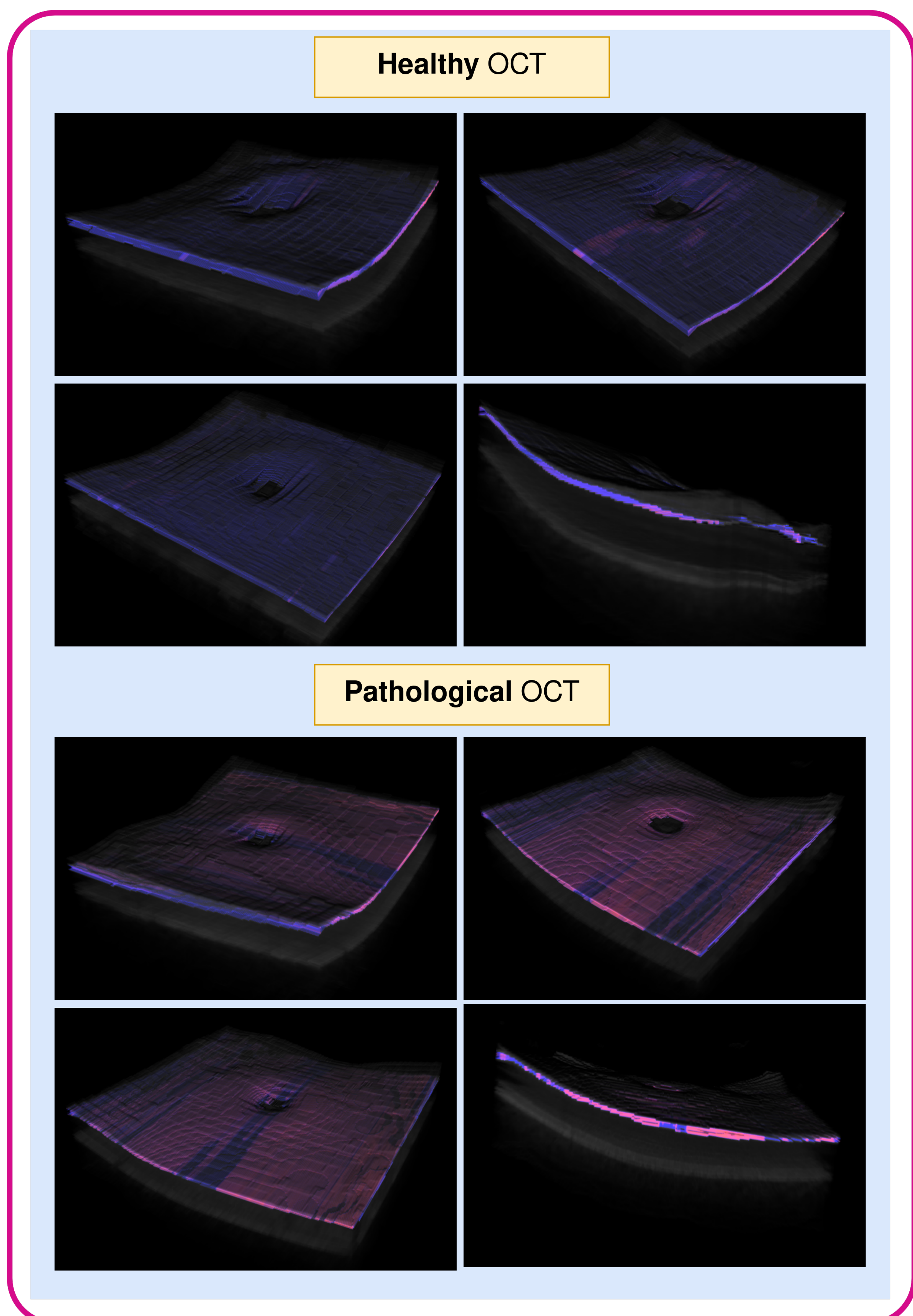
Abstract

Optical Coherence Tomography (OCT) is a non-invasive imaging technique that provides high-resolution cross-sectional images of biological tissues. Biomarkers such as the thickness of retinal layers can be used for the evaluation of several diseases such as glaucoma or multiple sclerosis. In this work, we create the thickness profiles of healthy and pathological eyes using a statistical model and developed a methodology to compare the thickness profiles of OCT images with the models and visually inspect the abnormal areas. This approach allows for a quick assessment of the retinal layers health, assisting clinicians and easing the diagnostic burden.

Methodology

Base methodologies

Segmentation Network UNet style

- Conv3*3 + Norm + ReLU
- Max pooling Layer
- UpConv 2*2
- Conv1*1

Biomarker Extraction

Layer Thickness Region

	RNFL	...
(0,0)	37.2	...
...	...	...
(34,6)	33.4	...

3D Reconstruction

- Filter volume using masks
- Estimate health status probability for each region
- Adjust color transfer functions using probability
- RayCasting with linear interpolation

Statistical model

Dataset Volumes

Healthy

Pathological

↓

Segmentation Network

↓

Biomarker Extraction

↓

Statistics Region

↓

Profile Establishment

Probability **Density** Function

(0,0)   (34,6)

- Healthy
- Pathological

Patient processing

OCT Volume

↓

Segmentation Network

↓

OCT **Masks**

↓

Biomarker Extraction

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Comparison with **Profiles** and **3D Reconstruction**

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3D Visualization

Results

Healthy OCT

Pathological OCT

Conclusions

► This **fully automatic system** utilizes segmentation networks and thickness profiling for a **3D intuitive visualization of retinal layer thickness**, accurately highlighting potential eye health issues.

► Our approach allows for the **quick identification** of **healthy or pathological conditions** in specific retinal regions, supporting clinicians in making timely diagnostic decisions.

Acknowledgements