



This project has received funding through the EURIZON project, which is funded by the European Union under grant agreement No.871072.



“ICTM-2024: Integrated Computer Technologies in Mechanical Engineering” – Synergetic Engineering

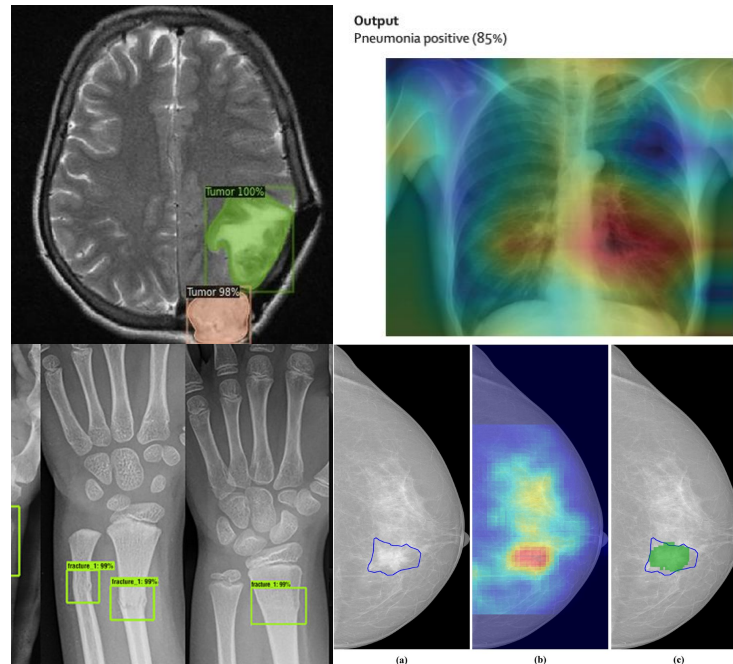
Analysis of Optical Coherence Tomography Images of Human Arteriosclerotic Vessels Using Computer Vision and Deep Learning Algorithms

Danylo Krasii, Oleksiy Larin, Ievgen Gorovyi

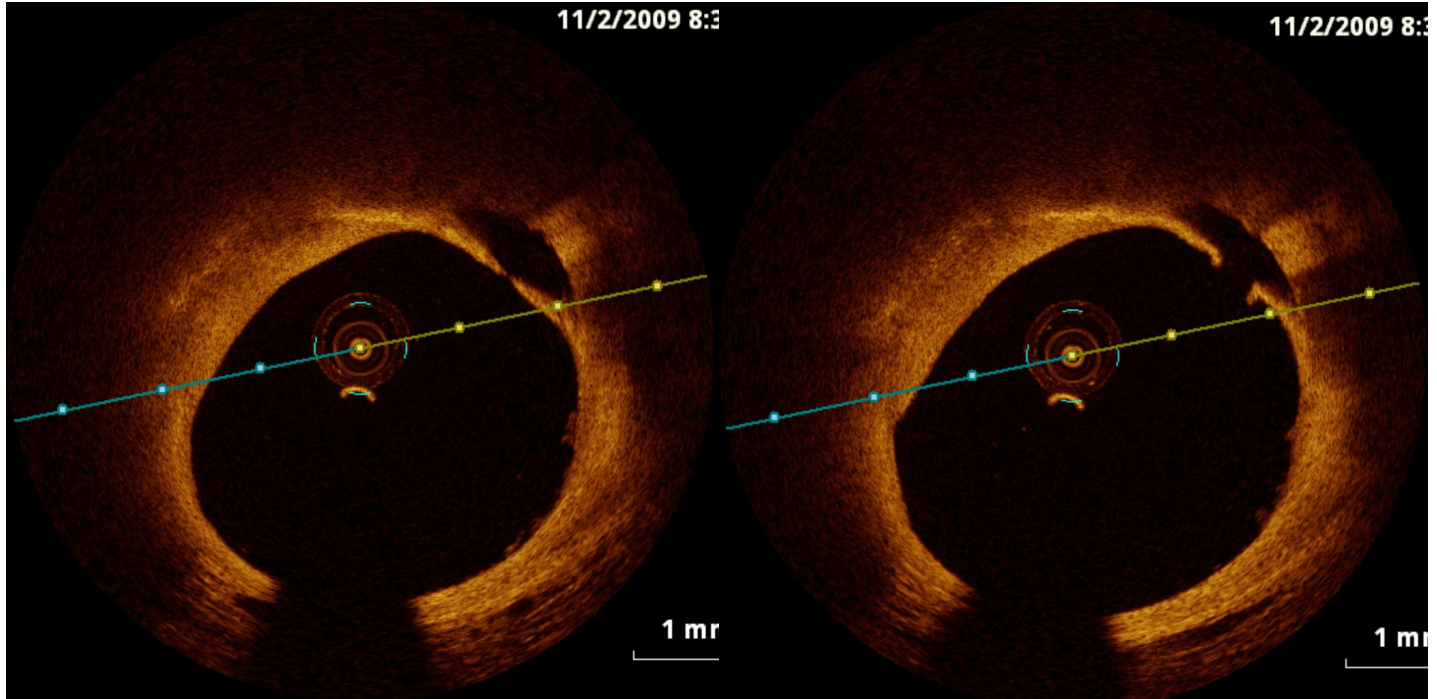
20 December 2024, Kharkiv, Ukraine

Problem Statement

- Detection and classification of tumors in mammograms and X-rays;
- Identifying bone fractures and abnormalities;
- Lung nodule detection for early cancer screening;
- Brain lesion detection and segmentation in MRI scans,

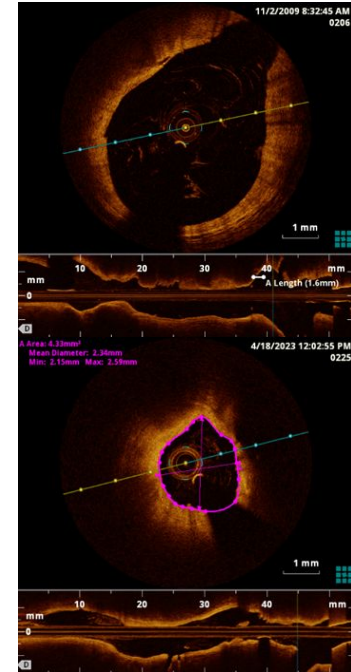


Problem Statement



Project Goals

- Decrease human involvement in OCT image annotation;
- Create a streamlined preprocessing pipeline;
- Develop user-friendly web interface;
- Leverage existing computer vision approaches and pre-trained networks.



Pipeline Overview

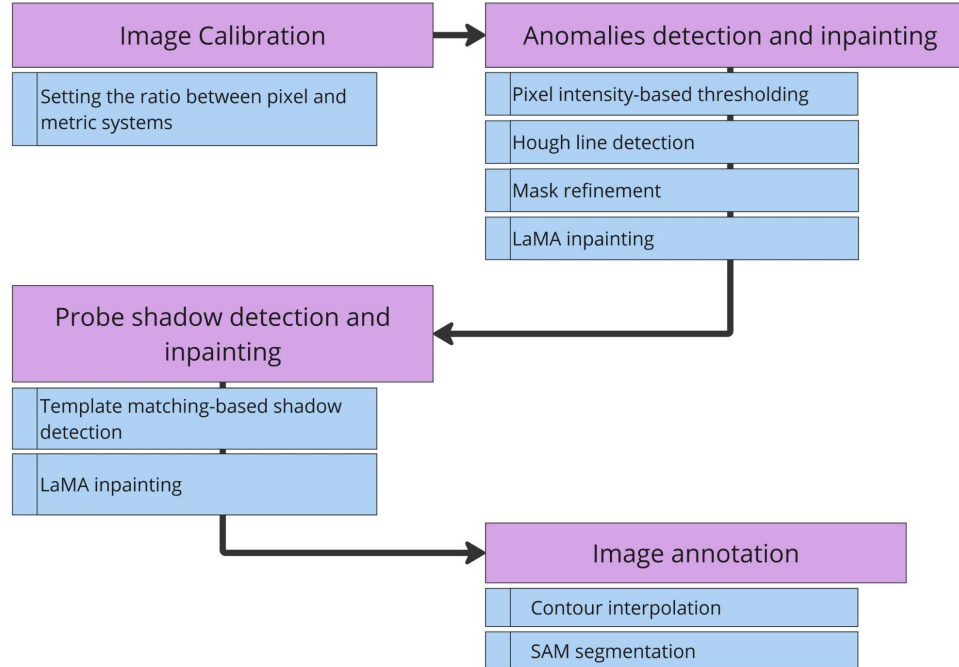
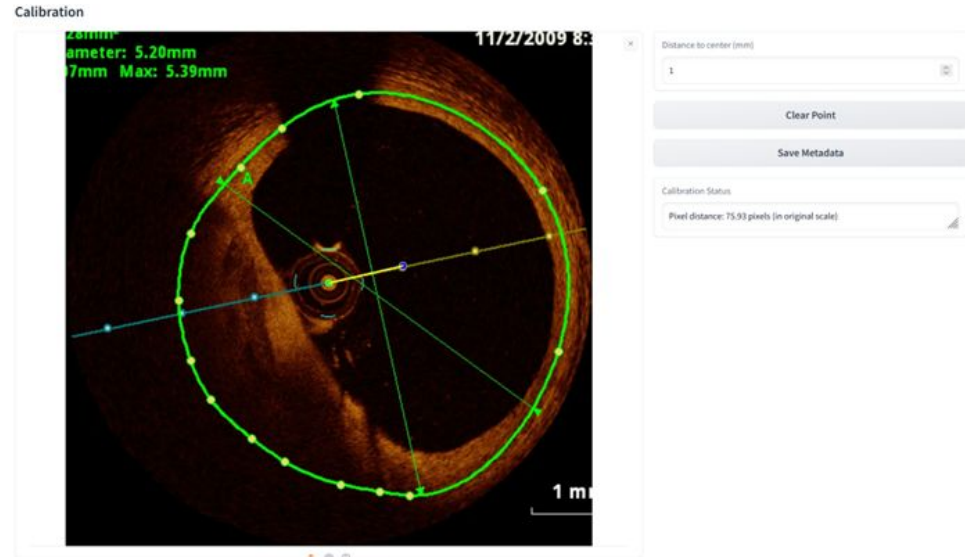


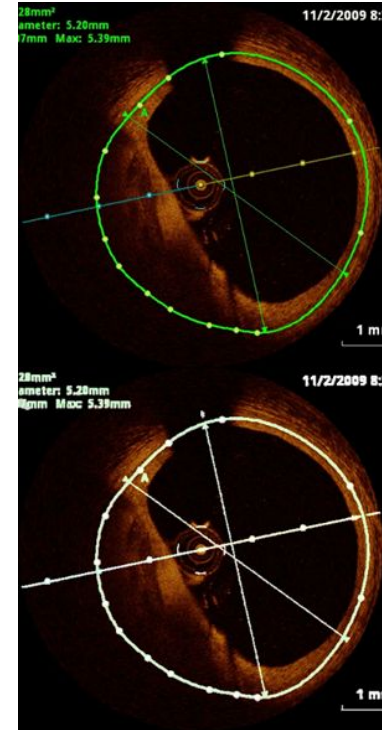
Image Calibration

- Critical first step for accurate reconstruction and analysis;
- Sets pixel-to-metric ratio using ruler division by manual selection of reference points.



Anomaly Detection

- Challenge: Technical marks and doctor's notations;
- Solution:
 - Intensity-based thresholding;
 - Hough line detection;
 - Mask refinement using CascadePSP;
 - LaMa inpainting for final cleanup.



Probe Shadow Handling

- Challenge: Moving shadow through OCT frames;
- Solution:
 - Template matching with bright arc detection;
 - ROI limitation for efficiency;
 - Rotation and scaling invariance;
 - LaMa inpainting for final cleanup.

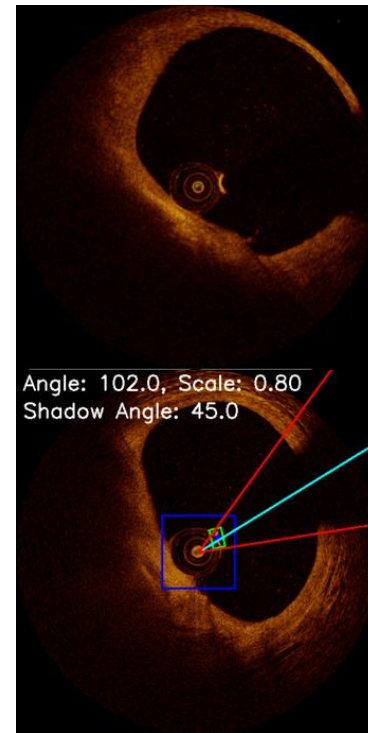


Image Annotation Methods

Manual Annotation using spline interpolation with adjustable smoothness and point extrapolation

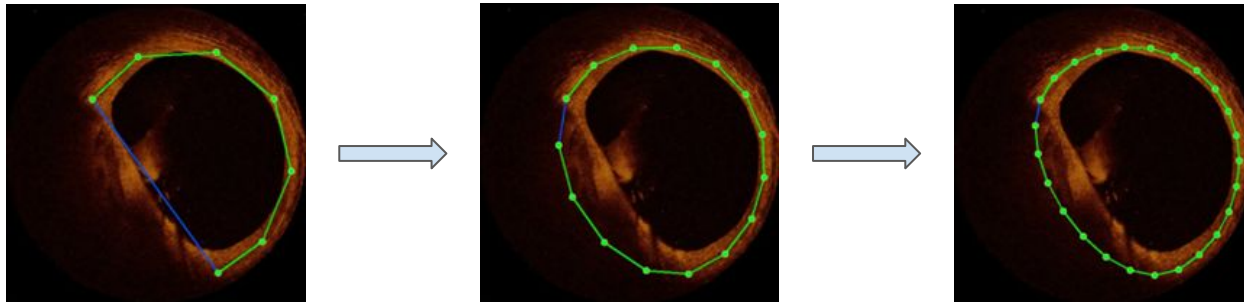
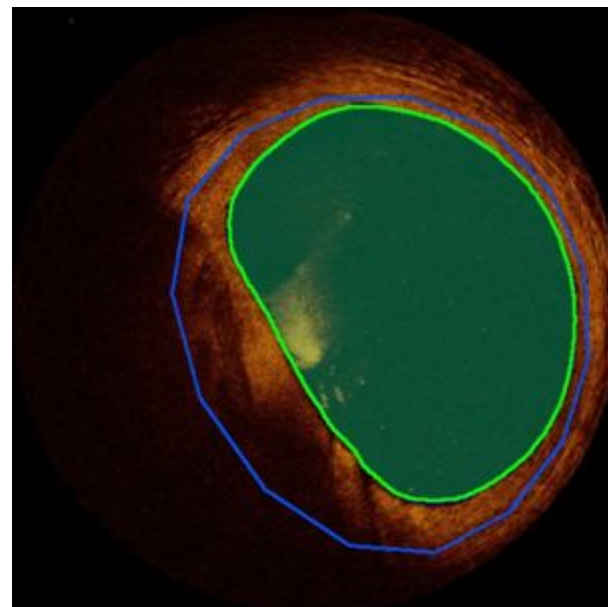


Image Annotation Methods

Automatic Annotation using SAM2:

- Single-click operation;
- Effective for hole segmentation;
- Limited to general segmentation.



Conclusions

We successfully implemented partial automation of OCT image processing by combining classical and modern computer vision approaches. Using our application we can analyze vessel condition faster and also start preparing the dataset for future segmentation model training.

Future Improvements

- Calibration automation;
- Fine-tune diffusion-based models for inpainting;
- Train our own segmentation model.

Thank you for your attention!



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