Open-source toolbox for harmonised analysis of clinical angiography images to support discovery of novel biomarkers

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I Introduction

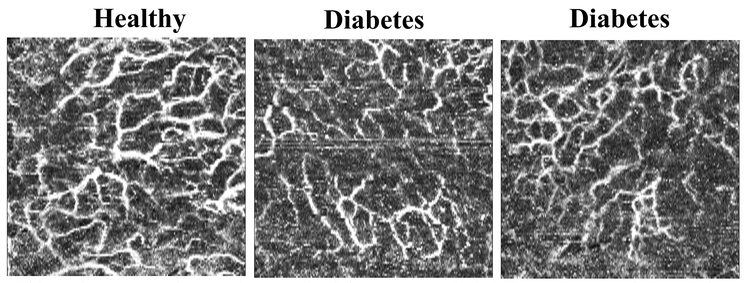
Accurate assessment of the microvasculature (the smallest vessels in the human body) could identify biomarkers that lead to a decline in vascular disease mortality. Optical coherence tomography angiography (OCTA) is a non-invasive modality capable of imaging microvasculature, but inconsistencies in data processing protocols across institutions and devices represent a major barrier to progress in applying OCTA to reduce the burden of disease. Our project aims to remove this barrier.

II Methods

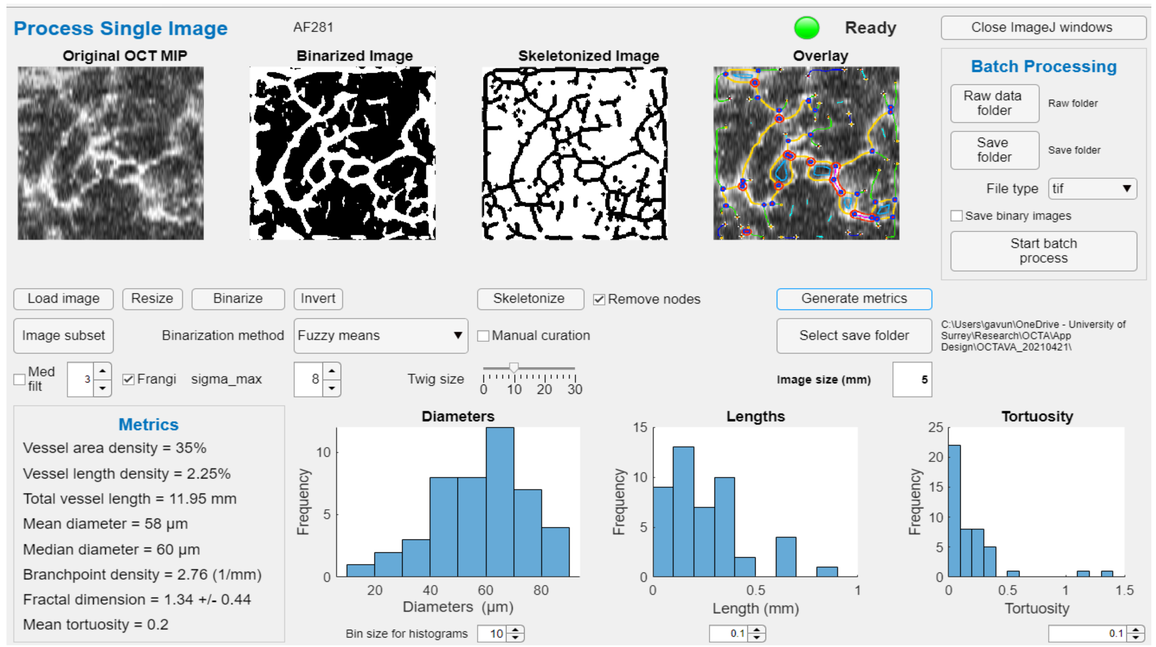
We have acquired and used OCTA images to develop and optimize a toolbox for OCTA image analysis. We validated the optimized software using OCTA images from different commercial and non-commercial instruments and samples.

III Results

We have created an integrated MATLAB – ImageJ toolkit (OCTAVA – OCTA Vascular Analyser) with a user-friendly interface for processing and analysis of OCTA images. Quantitative assessment of various OCTA images showed that OCTAVA can accurately and reproducibly determine metrics for characterization of the microvasculature.



Skin microvasculature imaged with commercial OCTA system; image size 5×5-mm; fewer vessels visible in diabetes.



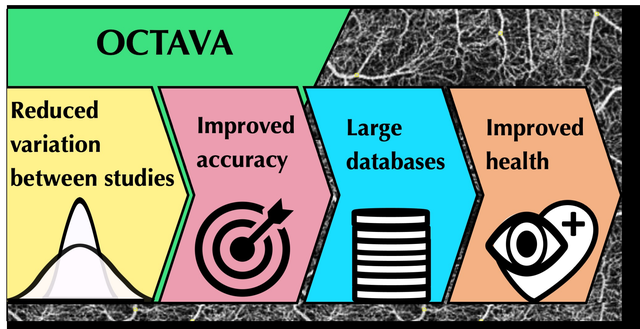
OCTAVA graphical user interface.

IV Conclusions

Wide adoption of OCTAVA is possible and could enable studies and aggregation of data on a scale sufficient to develop reliable microvascular biomarkers for early detection and to guide treatment of and thereby reduce the burden of microvascular disease.

V Open research win

There are no large-scale OCTA data sets yet widely available. Making OCTAVA open access means that it can be further validated via international laboratory and clinical research communities and eventually become standardized software for OCTA data analysis. This would enable building large cross-institution normative databases of the microvascular system in health and disease. Such large data sets will enable defining the most sensitive biomarkers to distinguish between health and disease. Working on OCTAVA we have learnt about various repositories to host data and software for the public, how to prepare documentation for users, and when to consider IP protection in software research.



Source code is available at:
https://github.com/GUntracht/OCTAVA

Compiled, standalone version is available at:
https://sourceforge.net/projects/octava/files/

1. Untracht G.R. et al. OCTAVA: An open-source toolbox for quantitative analysis of optical coherence tomography angiography images Plos One (2021); open access
2. Sampson D.M. et al. Towards standardizing retinal optical coherence tomography angiography: a review; Light Science and Applications (2022); open access