AB025. Machine learning applied to the oxygen induced retinopathy model

Javier Mazzaferri[1,2], Bruno Larrivée[1,2], Przemyslaw Sapieha[1,2,3], Santiago Costantino[2]

[1]Department of Biochemistry, [2]Department of Ophthalmology, Maisonneuve-Rosemont Hospital Research Centre, University of Montreal, Montreal, Quebec, Canada; [3]Departement of Neuroscience, McGill University, Montreal, Quebec, Canada

Background: The oxygen induced retinopathy rodent model is widely used, notably for the assessment of developmental dystrophies in preclinical studies of vascular retinal diseases. Typically, the quantification of vessel tufts and avascular regions is computed manually from flat mounted retinas imaged using fluorescent probes that highlight the vascular network. However, such manual measurements are time-consuming and hampered by user variability and bias, thus a rapid and objective alternative is required.

Methods: We employ a machine learning approach to segment and characterize vascular tufts. The proposed quantitative retinal vascular assessment (QuRVA) technique uses quadratic discrimination analysis and morphological techniques to provide reliable measurements of vascular density and pathological vascular tuft regions, devoid of user intervention within seconds. Our algorithms allow also delineating the whole vasculature network, and identifying and analyzing avascular regions.

Results: Our first experiment shows the high degree of error and variability of manual segmentations. In consequence, we developed a set of algorithms to perform this task automatically. We benchmark and validate the results of our analysis pipeline using the consensus of several manually curated segmentations using commonly used computer tools. We describe the method, provide details for reproducing the algorithm, and validate all aspects of the analysis.

Conclusions: Manual and semi-automated procedures for tuft detection present strong fluctuations among users, demonstrating the need for fast and unbiased tools in this highly active research field with tremendous implications for basic research and industry.

Keywords: Oxygen induced retinopathy (OIR); machine learning; image segmentation

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