FEATURE EXTRACTION ALGORITHMS OF RETINAL MICROVASCULATURE FOR COST-EFFECTIVE MEDICAL DEVICE

Researchers: *Kuryati Kipli[1], Mohammed Enamul Hoque[1], Lim Lik Thai[2] and M.M.Hamdi[3]*

[1]Department of Electrical and Electronics Engineering,
[2]Department of Ophthalmology, Faculty of Medicine and Health Sciences (FMHS),
[3]Department of Para-Clinical Sciences, Faculty of Medicine and Health Sciences (FMHS),
University Malaysia Sarawak

At present, chronic diseases such as stroke and diabetes mellitus continues to increase. In such medical conditions, if inappropriately treated, complications will easily occur such as visual morbidity, including blindness. According to the World Health Organization, as of 2010 worldwide, there are 39 million (13.6%) blind people due to visual morbidity related to chronic diseases. Therefore, this represent the magnitude of urgency needed to come up with technologies capable of preventing the unwanted complication (Mariotti, 2010). Digital image processing is one of the most remarkable advancing disciplines of computer visual image technology which is being widely employed in the modern biomedical imaging systems with increasing accuracy. This includes growing contributions of digital image processing in modern ophthalmic diagnostic systems. The human retina is the only location where blood vessels can be directly visualized non-invasively in vivo. Fundus retinal image processing has become one of the most interesting technologies in diagnosing the severe cardiovascular diseases such as diabetes, hypertension and stroke as the retinal microvasculature shares some physiological and anatomic landmarks. These includes the hard exudates, microaneurysm, cotton wool spot (CWS), and changes in the vessel diameter and bifurcation angle that are associative to the above-mentioned diseases. Widely usage of this modality, is due to its non-invasive nature, practicality and low cost of their acquisition process (Abramoff et al. 2010). Despite that, manual analysis of those retinal images is prohibitive for big scale mass screening campaigns. There are risks of bias, arise from inter-rater variability between clinicians, depending on their professional experiences, human limitation such as work fatigue and quality of the acquired images (Abramoff et al. 2010). This study aimed at developing robust and consistent retinal image analysis algorithms for the extraction of respective features of retinal microvasculature that can be integrated into the cost-effective ophthalmic diagnostic device. Additionally, an automated retinal image segmentation algorithm for the extraction of

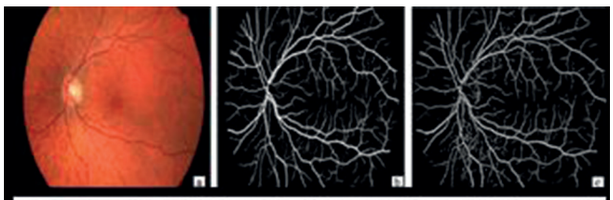

Figure 1: (a) Original image from HRFID, (b) manual segmented image and (c) resultant image of the developed segmentation algorithm.

Figure 2: (a) Region of Interest (ROI), (b) Skeleton of ROI, and (c) Diameter Measurement. (d) Graphical User Interface of the Entire System.