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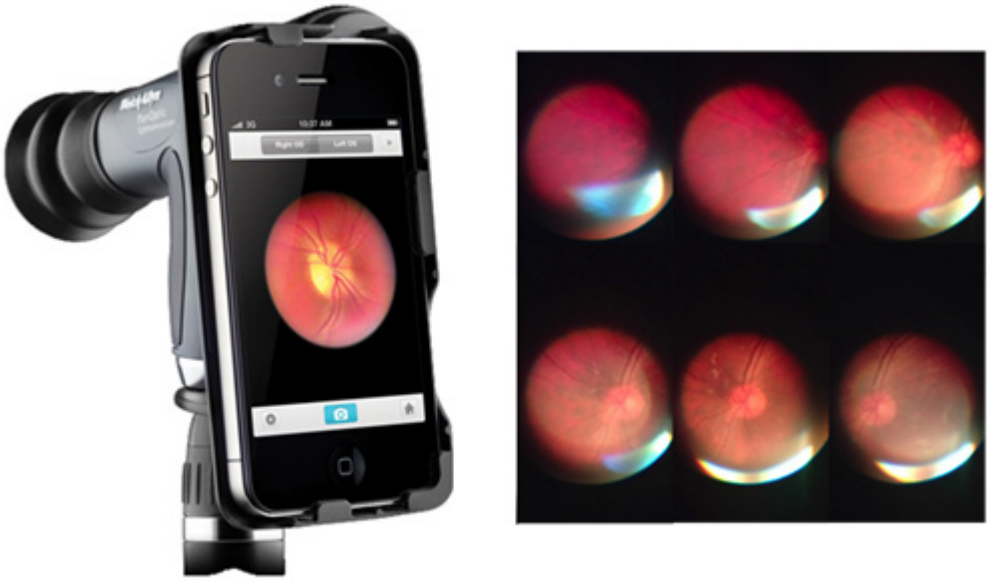

Fig1. Mobile-based retinal image acquisition.

EyeFundusScope

MOBILE-BASED RISK ASSESSMENT OF DIABETIC RETINOPATHY BY IMAGE PROCESSING

Project

The aim of this project is to develop a self-contained mobile-based system capable of detecting early signs of sight threatening diabetic retinopathy on retinal images acquired through an ophthalmoscopic adapter, on a non-expert monitoring context.

Purpose

Diabetic Retinopathy (DR) is a pathology which ultimately may lead to complete vision loss, and is related to the systemic nature of diabetes, particularly the problematic glycemic control and hypertension.

It is estimated that 50% of diabetic patients for more than ten years suffer from diabetic retinopathy. Despite wide success in halting disease progression in case of early diagnosis, late detection may lead to irreversible effects on vision.

Current screening practices recommend a yearly retinal assessment of the diabetic population, but this recommendation is often not followed.

Depending on the stage of the disease, cumulative changes are verified at the retina microvascularity, in chronological order:

- Microaneurysms formation;
- Excessive vessel permeability;
- Vessel occlusion;
- Neo vascularization;

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Features

- Mobile retinal image acquisition
- Management of acquired data
- Stitching for Field Of View (FOV) improvement
- Microaneurysm detection

Advantages

- Non-expert end-user
- Smartphone fundography with an adapter
- Avoiding the use of expensive, desktop equipment

Challenges

- Computer-aided alignment of the eye fundus
- Lighting
- Sharpness and contrast of the images
- Computational performance
- Pre-diagnosis of Diabetic Retinopathy

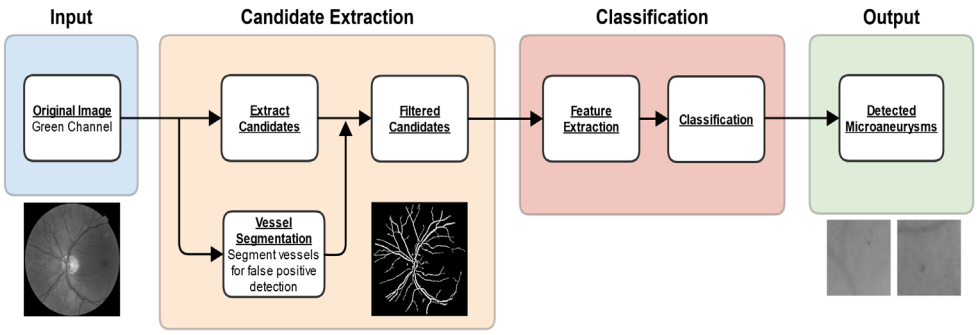

Fig2. Overview of the microaneurysm detection algorithm.

- Formation of fibrous tissue;
- Contraction of fibrous tissue.

EyeFundusScope purpose is to allow a non-expert assessment of diabetic retinopathy by automatically detecting microaneurysms. These are the first visible signs of DR, which will be used as an indicator of the severity/risk of the pathology.

Approach

The solution includes an Android application which will perform the acquisition, data management and microaneurysm detection in the retinal images.

An acquisition protocol was also devised, with the goal of ensuring the quality of the acquired images.

The innovation on this project is in the detection algorithm that aims to overcome the challenges of imaging with a lower cost equipment than a specialized examiner. The algorithm follows a standard approach for state of the art methods (detailed in Figure 2), which include a candidate extraction step, removal of false positives by vessel segmentation and finally classification of the candidates into microaneurysm/ not microaneurysm.

Validation was initially performed in public retinal image datasets – Digital Retinal Images for Vessel Extraction (DRIVE) and Retinopathy Online Challenge (ROC).

The constraints of image processing on mobile devices (memory, processor, battery) are considered, and the use of computationally heavy approaches was avoided.

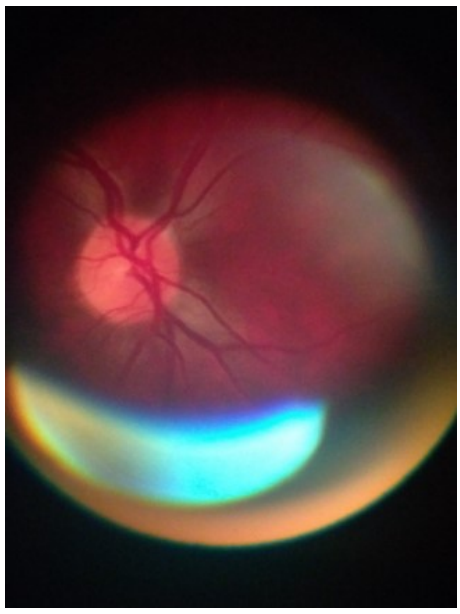

Fig3. Example of acquired image (with corneal reflection).