CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Medical imaging is a method of creating visual representation of the interior part of human body for medical analysis. Medical imaging creates database of normal anatomy and physiology to enable abnormalities identification so that it can be used for diagnosing and treating diseases. Computer Aided Diagnosis (CAD) is being developed to translate a medical image into an outcome that are able to help physicians understand more about a disease with a more accurate findings. Besides, this application can run in shorter time and less human effort can be used. The most established CAD applications in medical fields are the automated systems in mammography, chest computed tomography and radiography.

This thesis describes the algorithm that can aid in the detection of diabetic retinopathy. Diabetic Retinopathy (DR) is an eye disease that happens due to complication of diabetes. DR can causes vision loss if left untreated at the early stage. To properly and correctly detecting the disease, an automated detection system is needed. Therefore, the aid of a computer is needed to interpret and analyse the digital images of the retina.

The Fundus Image Analysis (FIA) system described in this thesis is developed to assist the ophthalmologists by providing reference to their diagnosis. To study diabetic retinopathy, doctors use Colour fundus image to begin with. From here, extraction of anatomical features and abnormal features can be done according to desired outcome.
1.2 DIABETIC RETINOPATHY

Diabetic Retinopathy (DR) is a complication of diabetes on retina that occurs because of the microangiopathy which in turn affects the retinal precapillary arterioles, capillaries and venules. It is mainly caused by leakage of the microvascular. Progressive damage of the microvascular can cause permanent vision loss can happen.

Microaneurysms are the first clinically noticeable signs of diabetic retinopathy. High sugar levels in the blood causes the walls of small blood vessels to swell thus creating this microaneurysms. As the disease progresses, microaneurysms will be ruptured. This will then cause the formation of hemorrhage. Retinal hemorrhage look either as small red dots or spots identical to microaneurysms. Exudates formed through vessels leakage of lipids and proteins. They are seen on the retina as typical bright, reflective white or yellowish coloured lesions.

![Figure 1.1: Illustration of retinal microaneurysm, hemorrhage and exudates.](image)

In Malaysia, 3.3 million cases of diabetes is recorded in the year of 2015. With the rising prevalence of diabetes mellitus worldwide, diabetic retinopathy is now a leaking cause of blindness among working age individuals. Early detection and treatment is of vital importance as it may prevent vision loss and blindness (Vashist, Singh et al. 2011).
1.3 CONVENTIONAL SCREENING METHOD FOR DIABETIC RETINOPATHY

Early detection and treatment of diabetic retinopathy can prevent visual impairment and most of the patients can be saved from vision loss. Screening is an effective way for early detection of diabetic retinopathy. Studies have revealed that people who suffer from diabetes benefit from regularly attending a screening session (Bresnick, Mukamel et al. 2000). In this screening session retinas of both eyes are examined by an ophthalmologist. If diabetic retinopathy is detected, patient can continue with follow up.

Traditionally the screening session requires the ophthalmologist to observed the retina either directly using an ophthalmoscope or indirectly through digital photographs taken from a fundus camera. Ophthalmoscope is an instrument containing a light source and lenses. Whereas s digital fundus camera is a low power microscope with a camera attached and designed to take picture of the interior parts of the eye. For large scale screening, fundus images are more reliable than ophthalmoscope in detecting diabetic