Abstract

The World Health Organization estimates that in 2010 there were 285 million people visually impaired in the world. It is calculated that the 80% of these cases are preventable or treatable. In addition, aging population and chronic disease increase are two factors that predict a higher number of blindness cases in the future. Hypertension, diabetic retinopathy (DR), age-related macular degeneration (AMD) and glaucoma are the most common pathologies in the current society that provoke retinal damage and can be directly related to blindness and vision loss. The early diagnosis of these diseases allows, through appropriate treatment, to reduce costs generated when they are in advanced states and may become chronic. This fact justifies screening campaigns. However, a screening campaign requires a heavy workload for trained experts in the analysis of anomalous patterns of each disease, which in addition to the increase of population at risk, makes these campaigns economically unfeasible. Therefore, the need of automatic screening system developments is highlighted.

The final goal of this thesis is the implementation of novel methods that allow the analysis and processing of fundus images to implement an automatic screening of four of the most important diseases that affect world population. In particular, the main objective of the thesis is to build up algorithms for the characterization of the retinal structures and the retina background in order to assist in the discrimination between a "normal" and pathological retina.

Mathematical morphology along with other operators are used for the detection of the retinal vessels and the optic disk. The proposed methods work properly on databases with a large degree of variability. Not only have the main structures been segmented, but significant features have also been extracted from them to be used in a computer aided diagnosis software for hypertensive risk determination. The texture of the retina background is also analyzed in this work by means of local binary patterns with the aim of identifying DR and AMD and

avoiding the need of segmentation of the characteristic retinal lesions of each disease. The results are promising above all for AMD diagnosis.