Image mining approaches for the screening of age-related macular degeneration

Abstract

Age-related Macular Degeneration (AMD) is the most common cause of irreversible vision loss in those aged over 50. In this chapter we investigating two techniques to support automated AMD screening. First of all we conceptualise AMD screening in terms of a binary classification problem (disease v. no-disease). We then propose and compare two very different techniques whereby the desired classification can be undertaken. The first is founded on a histogram based retinal image representation and the second on a graph based representation. In the histogram based approach each image is defined in terms of a histograms that in turn is presented as "time series curves". Given a training set (a collection of labelled positive and negative examples) we create a Case Base (CB) of labelled curves to which a Case Based Reasoning (CBR) mechanism is applied so as to classify "unseen" images according to whether they feature AMD or not. Curve comparison is conducted using a time series comparison technique. For the graph mining based approach a hierarchical decomposition technique is proposed, whereby pre-labelled retinal images contained in a training set, are successively decomposed into smaller and smaller segments until each segment describes a uniform set of features. The resulting decomposition is stored in a tree structure, one per image, to which a frequent sub-graph (sub-tree) mining technique is applied so as to identify the frequently occurring sub-trees that exist within the overall tree data set. The identified sub-trees then form the global attribute set from which a collection of feature vectors (one per image) is derived so as to describe the training set. A standard classifier generator is then applied to this feature vector representation to produce the desired classifier. The two approaches are compared and evaluated using two publicly available data sets, ARIA and STARE, respectively comprising 161 and 97 pre-labelled retinal images. The paper details both approaches and reports on their evaluation.