Automated "disease/no disease" grading of age-related macular degeneration by an image mining approach

Abstract

Purpose:

To describe and evaluate an automated grading system for age-related macular degeneration (AMD) by color fundus photography.

Methods:

An automated "disease/no disease" grading system for AMD was developed based on image-mining techniques. First, image preprocessing was performed to normalize color and nonuniform illumination of the fundus images to define a region of interest and to identify and remove pixels belonging to retinal vessels. To represent images for the prediction task, a graph-based image representation using quadtrees was then adopted. Next, a graph-mining technique was applied to the generated graphs to extract relevant features (in the form of frequent subgraphs) from images of both AMD and healthy volunteers. Features of the training data were then fed into a classifier generator for training purposes before employing the trained classifiers to classify new "unseen" images.

Results:

The algorithm was evaluated on two publically available fundus-image datasets comprising 258 images (160 AMD and 98 normal). Ten-fold cross validation was used. The experiments produced a best specificity of 100% and a best sensitivity of 99.4% with an overall accuracy of 99.6%. Our approach outperformed previous approaches reported in the literature.

Conclusions:

This study has demonstrated a proof-of-concept, image-mining technique for automated AMD grading. This technique has the potential to be further developed as an automated grading tool for future whole-scale AMD screening programs.