Title: Gradient boosted segmentation of retinal fundus images

Author: Matúš Goliaš

Department: Department of Software and Computer Science Education

Supervisor: Doc. RNDr. Elena Šikudová PhD., Department of Software and Computer Science Education

Abstract: Over the recent years, there has been an increase in the use of automatic methods in medical diagnosis. A significant number of publications have analysed eye disorders and diseases. One of the most severe eye conditions is glaucoma. It damages optic nerves and causes gradual loss of vision. An essential step towards a faster diagnosis of this disease is accurate segmentation of the optic disc and cup. This task is difficult due to many retinal defects, different image acquisition techniques, and artefacts caused by imaging devices. This thesis describes an iterative threshold-based algorithm for extraction of the optic disc. An objective function quantifying object similarity to the optic disc is defined to direct the iteration. Following that, we introduce a superpixel-based classification algorithm for extraction of the optic cup. We propose the use of gradient boosted decision trees which outperform random forest and support vector machine. In addition, we evaluate the proposed algorithms and their alternatives on a publicly available retinal fundus image dataset. Finally, we discuss the reason for performance differences and implement our algorithms in the programming language Python.

Keywords: segmentation, thresholding, superpixels, optic disc, optic cup