Quantitative Description of Vessel Features in Hypertensive Retinopathy Fundus Images

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Aim. This paper presents a computerized system for the extraction and quantitative description of the main vascular diagnostic signs from fundus images in hypertensive retinopathy. The features taken into account are vessel tortuosity, generalized and focal vessel narrowing, presence of Gunn or Salus signs.

Methods. High resolution digital images of fundus are directly acquired from fundus cameras or scanned from slides. At first the vessel network is extracted by a tracking algorithm, which starts from a high number of seed points inside the vessels. The numerous vessel segments identified are then linked to reconstruct a connected vessel network, where bifurcations and crossings are properly recognized. A new tortuosity measure, able to reproduce the grading of this features as perceived by clinical experts, has been proposed and is computed for each recognized vessel and for the entire network. Vessel caliber is also recorded and its variations (general and local) are recognized to provide the vessel narrowing indexes. Finally, Gunn and Salus signs are detected by looking at changes in vessel caliber or vessel direction at crossings.

Results and conclusion. A prototype Matlab program was implemented and evaluated on a set of 22 images of hypertensive retinopathy of different severity. The program provided tortuosity indexes in accordance with the qualitative ordering of 3 clinical experts and achieved a XX% correct detection of the other signs.