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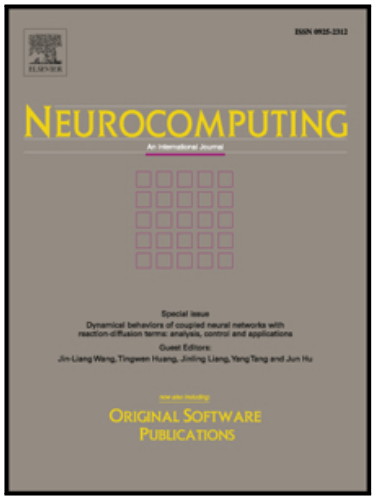

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Fast and Effective Optic disk localization based on Convolutional Neural Network

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Abstract

As a benchmark structure in the retina, the precise localization of the Optic Disc (OD) has received considerable attention from researchers owning to its importance for ophthalmic image analysis and retinopathy screening. In most literature works, although OD localization has achieved fairly good performance, rather less attention has been paid to supervised techniques. As the ODs are common in characteristics and form a fixed pattern, we propose in this paper an OD localization method based on Convolutional Neural Networks (CNNs). In data preparation, the blue channel in the fundus image, which is always empty or noisy and tends to be uninformative, is replaced by coarsely segmented vasculature maps (Red channel, Green channel and Vasculatures are denoted as RGV). In addition, the input of the CNN structures is rectangular instead of square in order to involve more context information of the vasculatures. For training, a two-stage process is designed to alleviate the class-imbalance problem by choosing large number of positive samples at the first stage and choosing samples at the center of OD to fine-tune the fist-stage model at the second stage. Then a probability guided search algorithm is developed to improve the efficiency of OD localization by selectively searching patches with large chances to be an OD and their neighbors. Finally, the precise OD position is located as center of the highest probability regions after weighted voting. Extensive experiments on four publicly available databases demonstrate the effectiveness and efficiency of the proposed method, with an average detection rate of 99.11% and detection time less than 15 seconds per image.