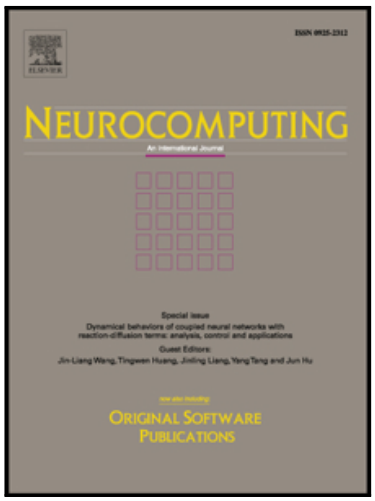

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PII: S0925-2312(17)31399-1
DOI: 10.1016/j.neucom.2017.03.093
Reference: NEUCOM 18789

To appear in: *Neurocomputing*

Received date: 30 September 2016
Revised date: 11 January 2017
Accepted date: 4 March 2017

Please cite this article as: He Huang, He Ma, Han JW van Triest, Yinghua Wei, Wei Qian, Automatic Detection of Neovascularization in Retinal Images using Extreme Learning Machine, *Neurocomputing* (2017), doi: 10.1016/j.neucom.2017.03.093

Available online at www.sciencedirect.com

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Neurocomputing 00 (2017) 1–19

Neurocomputing

Automatic Detection of Neovascularization in Retinal Images using Extreme Learning Machine

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Abstract

Diabetic Retinopathy is one complication of diabetes, which can cause blindness. Diabetic retinopathy can be divided into Non-Proliferative Diabetic Retinopathy (NPDR) and Proliferative Diabetic Retinopahy (PDR), and neovascularization is a key symbol to make diagnosis between them. An automatic detection of neovascularization in retinal images using extreme learning machine is proposed. Furthermore, we use a series of filter banks to get the features of neovascularization from retinal images. The detection framework is evaluated with images annotated by expert ophthalmologists based on the images selected from several public retinal image databases. The experimental results illustrate that the framework can mark and show the suspected neovascularization regions to ophthalmologists, and thus support for their decision making.

Keywords:
detection of neovascularization, retinal image, extreme learning machine

1. Introduction

Diabetes mellitus is a disease worldwide, which can cause serious results. The estimated prevalence of diabetes for all age groups worldwide was 2.8% in 2000 and is expected to be 4.4% in 2030, meaning that the total number of diabetes patients is forecasted to rise from 171 million in 2000 to 366 million in 2030 [1]. According to a report from World Health Organization (WHO), more than 347 million people worldwide have diabetes, and WHO proposes that diabetes will be the 7th leading cause of death in 2030 [2].

Diabetic Retinopathy (DR) is a serious complication of diabetes, and is the leading cause of blindness among people of working age in developed countries [3]. Neovascularization is a key sign for dividing diabetic retinopathy into Non-Proliferative Diabetic Retinopathy (NPDR) and Proliferative Diabetic Retinopathy (PDR), so neovascularization detection is very important for making diagnosis for diabetic retinopathy.

Because the neovascularization is very thin and it may be only 1 pixel width in retinal images, it is hard to detect neovascularization regions in retinal images. Related work includes blood vessel enhancement, retinal image classification and neovascularization detection. In work [4, 5, 6, 7, 8, 9, 10, 11], blood vessel enhancement techniques are