STOCHASTIC GRADIENT DESCENT ALGORITHM FOR GLAUCOMA DETECTION USING FREQUENCY DOMAIN FEATURES OF RETINAL IMAGES

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Abstract:
Glaucoma is a category of eye disorders that are important for good vision and damage the optic nervous. The abnormally high pressure in your eye is often responsible for its damage. Glaucoma is one of the major blindness causes for people aged 60 or over. The glaucoma detection using Stochastic Gradient Descent (SGD) algorithm is described in this study. The input retinal images are given to frequency domain for feature extraction and SGD algorithm is used for detection. Experimental results show the performance of proposed system.
Keywords: Glaucoma detection, Frequency domain, Stochastic gradient descent algorithm, retinal images

Introduction:

Diagnosis of glaucoma by digital fundus image was assisted by computer [1].CDR is determined to diagnose glaucoma after segmentation of OC and OD. Classification of the image of glaucoma using discreet orthogonal inventory transform [2].The coefficients of DOST are distributed by sample distances where low frequencies have a lower sampling speed and high frequencies are sampled more frequently.

Detection of progression with the algorithm of maximization of variational expectation [3]. In comparison, we suggest using the Markov Random Field to deal with such dependence, compared to previous research that does not integrate a priori information on images and particularly the dependency on space pixels in the detection map. Detection of development by structural assessment of retinal nerve fibre and functional visual field points [4]. The longitudinal features from the eye of each patient were then applied to the learning classification system to identify each eye as stable or advanced over time.

ISSN 2515-8260 Volume 07, Issue 09, 2020

Fundus images of the eye detect glaucoma [5]. Fundus imaging is the most commonly used tool for detecting glaucoma to combine portability, size and expense. The grey level concurrence matrix features a foundation classification of glaucoma from the fundus image [6-7].It then causes vision loss and damages the optic nerve. Glaucoma must be correctly treated at low cost.

An efficient method for stochastic gradient descent algorithm for glaucoma detection using frequency domain features of retinal images is described in this study. The organization of the paper is as follows: Section 2 describes about the methods and materials described about the glaucoma classification. The section 3 describes about experimental results and discussion. The final section concludes about the glaucoma classification.

Methods and Materials

Stochastic gradient descent is a common and frequent algorithm used in numerous algorithms for machine learning. Primarily it forms the backbone of Neural Networks. We have to look closely at how much calculation we generate with each algorithm iteration.
Say 10,000 data points and 10 functionality are available. There are as many terms as there are data points and hence 10000 terms for the number of squared residuals. In relation to each of the features we have to determine the derivative of this equation such that we do 10000 * 10 = 100,000 calculations per iteration. 1000 iterations are common, in fact 100,000*1000=1000000 calculations are available to complete the algorithm. It's quite an overhead and therefore the downward gradient on enormous data is sluggish. With a stochastic gradient descent, learning can be much easier for very large data sets and only a few passes through the data set are always required to obtain a good or good set of coefficients

Initially, the input images are given to frequency domain features and Stochastic gradient descent algorithm is used for prediction.

Frequency domain features

The frequency field refers to the research of mechanics, electronics, control system engineering and statistics of the math or signals in reference to frequency rather than time. Simply put, a diagram shows how a signal changes with the time, while a diagram of the frequency domain shows that there is a large component over a variety of frequencies in the signal frequency band. The phase shift information needed for each sinusoid can also be used in an image of the frequency domain to recover the original time signals from recombinant frequency components [8-10]. A certain function or signal may be transformed between time and frequency domains by a pair of mathematical operators known as transforms. Fourier returns the frequency-domain function to the time function with the reverse transformation. A spectrum analyzer is an optical signal frequency domain unit.

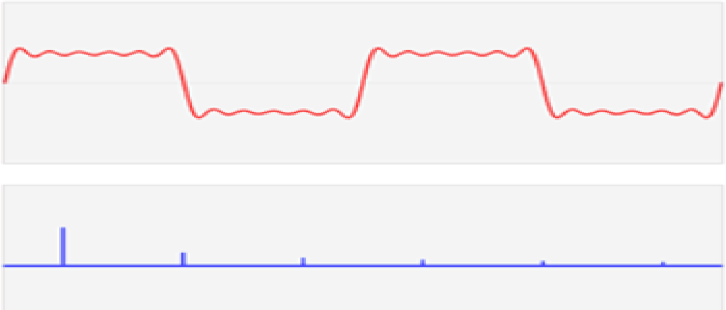

Figure 1 Frequency domain features

The simple mathematical analysis is one of the key reasons to use the frequency-domain representation of a problem. Moreover a frequency system can usually give an intuitive understanding of the system's qualitative behaviour; a scientific nomenclature that reveals the behavior of physical systems, which characterizes inputs from time to time by different terms like bandwidth, frequency response, gain, phase shift, resonant frequencies, was created to describe them.

Stochastic gradient descent algorithm

Gradient descent is a easy method of optimization you can use with several computer algorithms. The gradient optimization can be viewed as a stochastic strategy, since it substitutes the real gradient by an approximation. For traditional statistics, for lesser squares and in maximum-like independent observations, sum-minimization difficulties are noticed. M-estimators are called the general class of estimators that emerge as a sum minimizer. A compromise between the real gradient and the gradient is to calculate the gradient against more than one sample of training at a single point. That can function much better than the originally defined stochastic gradients, as the code can use vector libraries instead of computing individual steps.

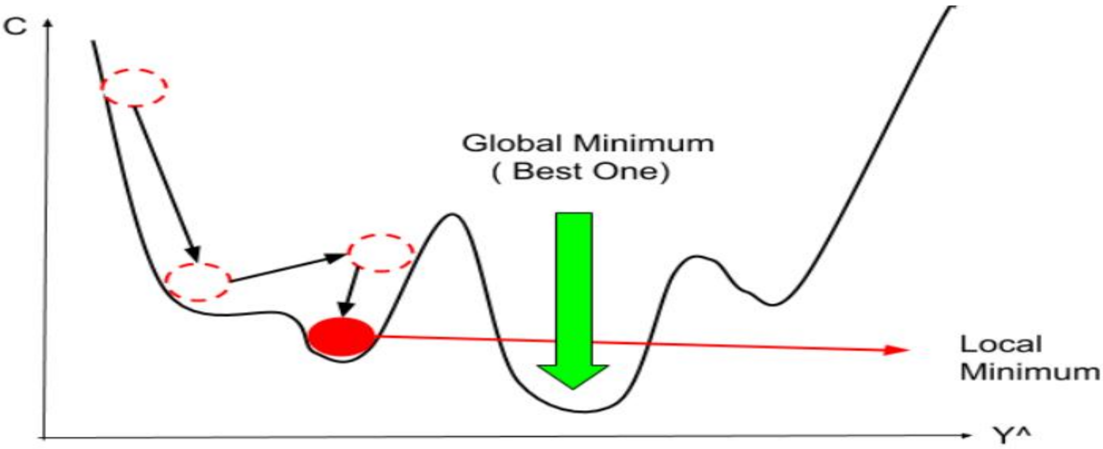

Figure 2 Stochastic gradient descent algorithm

Results and Discussion:

The performance is evaluated by using retinal images. The sample retinal images are shown below in figure 3.

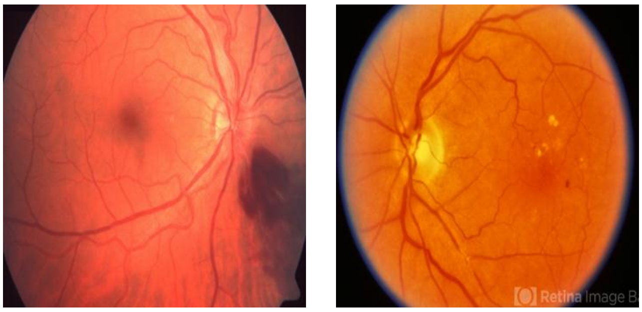

Figure 2 Retinal images

The performance of stochastic gradient descent algorithm for glaucoma detection using frequency domain features of retinal images is measured by classification accuracy. Table 1 shows the classification accuracy of retinal images for glaucoma detection.

Frequency domain feature levels	Performance (%)		
	Accuracy	Sensitivity	Specificity
1	90	89	91
2	88	87	89
3	86	85	87

From table 1 it is observed that classification accuracy is 90% and its sensitivity and specificity are 89% and 91%.

Conclusion:

An efficient method for stochastic gradient descent algorithm for glaucoma detection using frequency domain features of retinal images is described in this study. The input retinal images are given to frequency domain features for feature extraction. Then stochastic gradient descent algorithm is used for classification. The overall classification accuracy is 90% by using frequency domain features and stochastic gradient descent algorithm.

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ISSN 2515-8260 Volume 07, Issue 09, 2020

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