Diagnosis of Diabetic Retinopathy Using Deep Neural Network

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Abstract- *The condition of the vascular network of human eye is an important diagnostic factor in ophthalmology. Its segmentation in fundus imaging is a nontrivial task due to variable size of vessels, relatively low contrast, and potential presence of pathologies like micro aneurysms and haemorrhages. The Project proposes the Retinal image analysis through efficient detection of vessels and exudates for retinal vasculature disorder analysis. It plays important roles in detection of some diseases in early stages, such as diabetes, which can be performed by comparison of the states of retinal blood vessels. Intrinsic characteristics of retinal images make the blood vessel detection process difficult. Here, we proposed a new algorithm to detect the retinal blood vessels effectively. The green channel will be selected for image analysis to extract vessels accurately. The duabachies wavelet transform is used to enhance the image contrast for effective vessels detection.The directionality feature of the multi structure elements method makes it an effective tool in edge detection. Hence, morphology operators using multi structure elements are applied to the enhanced image in order to find the retinal image ridges. Afterward, morphological operators by reconstruction eliminate the ridges not belonging to the vessel tree while trying to preserve the thin vessels unchanged. In order to increase the efficiency of the morphological operators by reconstruction, they were applied using multi structure elements. A simple thresholding method along opening and closing indicates the remained ridges belonging to vessels. Experimental result proves that the blood vessels and exudates can be effectively detected by applying this method on the retinal images.*

Keywords- Image processing, Image segmentation, Discrete wavelet transformation, GLCM, Neuralnetwork

I. INTRODUCTION

Diabetic retinopathy, also known as diabetic eye disease (DED) is a medical condition in which damage occurs to the retina due to diabetes mellitus. It is a leading cause of blindness in developed countries. Diabetic retinopathy affects up to 80 percent of those who have had diabetes for 20 years or more. At least 90% of new cases could be reduced with proper treatment and monitoring of the eyes. The longer a person has diabetes, the higher his or her chances of developing diabetic retinopathy. Each year in the United States, diabetic retinopathy accounts for 12% of all new cases of blindness. It is also the leading cause of blindness in people aged 20 to 64.DR is one of the most chronic diseases which make the key cause of vision loss in middle-aged people in the developed world. DR emerges as small changes in the retinal capillaries. The first differentiable deviations are microaneurysms which are local disruptions of the retinal capillary. The distorted microaneurysms cause the creation of intraregional hemorrhage. This leads to the first stage of DR which is commonly termed as mild nonproliferative diabetic retinopathy. Due to the sensitivity of eye fundus to some vascular diseases, fundus imaging technique is more suitable for noninvasive kind of screening. The result of the screening approach is directly related to the quality and accuracy of the fundus image extraction technique coupled with efficient image processing methodologies.

In Introduction you can mention the introduction about your research

Identify the constructs of a Journal – Essentially a journal consists of five major sections. The number of pages may vary depending upon the topic of research work but generally comprises up to 5 to 7 pages. These are: multi-label learning, more than one class can be assigned to an instance. With the increase in the number of data

II. IDENTIFY, RESEARCH ANDCOLLECT IDEA

Methodology used is digital image processing, the manipulation of images by computers. The test image selected from the data set undegoes image enhancement, segmentation, discrete wavelet transformation, NN training and comparision . The processed image shows normal or ubnormal bloodvessels.

IMAGE PROCESSING

Image Acquisition is to acquire a digital image. To do so requires an image sensor and the capability to digitize the signal produced by the sensor.

The sensor could be monochrome or color TV camera that produces an entire image of the problem domain every 1/30 sec. Image enhancement is among the simplest and most appealing areas of digital image processing. Basically, the idea behind enhancement techniques is to bring out detail that is obscured, or simply to highlight certain features of interesting an image. A familiar example of enhancement is when we increase the contrast of an image because "it looks better." It is important to keep in mind that enhancement is a very subjective area of image processing.

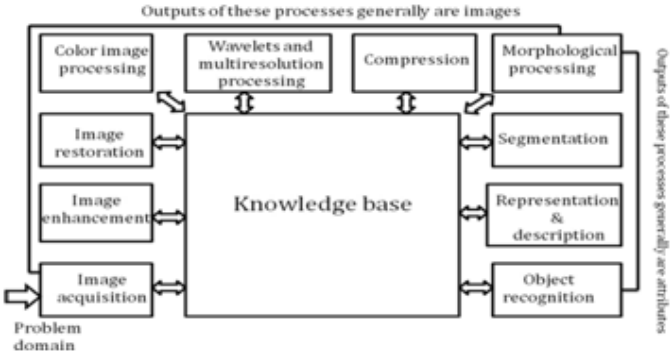


Image restoration is an area that also deals with improving the appearance of an image. However, unlike enhancement, which is subjective, image restoration is objective, in the sense that restoration techniques tend to be based on mathematical or probabilistic models of image degradation.

Segmentation procedures partition an image into its constituent parts or objects. In general, autonomous segmentation is one of the most difficult tasks in digital image processing. A rugged segmentation procedure brings the process a long way toward successful solution of imaging problems that require objects to be identified individually. Digital image is defined as a two dimensional function f(x, y), where x and y are spatial (plane) coordinates, and the amplitude off at any pair of coordinates (x, y is called intensity or grey level of the image at that point. The field of digital image processing refers to processing digital images by means of a digital computer. The digital image is composed of a finite number of elements, each of which has a particular location and value. The elements are referred to as picture elements, image elements, pels, and pixels. Pixel is the term most widely used.

Digital Image compression addresses the problem of reducing the amount of data required to represent a digital image. The underlying basis of the reduction process is removal of redundant data. From the mathematical viewpoint, this amounts to transforming a 2D pixel array into a statically uncorrelated data set. The data redundancy is not an abstract concept but a mathematically quantifiable entity. If n1 and n2 denote the number of information-carrying units in two data sets that represent the same information, the relative data redundancy *RD* of the first data set can be defined as,

$$R_D = 1 - \frac{1}{C_R}$$

Where C_R called as compression ratio. It is defined as

$$C_R = \frac{n1}{n2}$$

In image compression, three basic data redundancies can be identified and exploited: Coding redundancy, interpixel redundancy, and phychovisal redundancy. Image compression is achieved when one or more of these redundancies are reduced or eliminated. The image compression is mainly used for image transmission and storage.

Image transmission applications are in broadcast television; remote sensing via satellite , air-craft, radar, or sonar; teleconferencing; computer communications; and facsimile transmission. Image storage is required most commonly for educational and business documents, medical images that arise in computer tomography ,magnetic resonance imaging and digital radiology, motion pictures, satellite images, weather maps, geological surveys, and soon.

DISCRETE WAVELET TRANSFORM ALGORITHM

There are several types of implementation of the DWT algorithm. The oldest and most known one is the Malaat (pyramidal) algoritm. In this algorithm two filters - smoothing and non-smoothing one are constructed from the wavelet coefficients and those filters are recurrently used to obtain data for all the scales. If the total number of data D=2^N is used and signal length is L, first D/2 data at scale L/2^(N-1) are computed, than (D/2)/2 data at scale L/2^(N- 2),...etc up to finally obtaining 2 data at scale L/2. The result of this algorithm is an array of the same length as the input one, where the data are usually sorted from the largest scales to the smallest ones. Similarly the inverse DWT can reconstruct the original signal from the wavelet spectrum. Note that the wavelet that is used as a base for decomposition cannot be changed if we want to reconstruct the original signal, e. g. by using Haar wavelet we obtain a wavelet spectrum; it can be used for signal reconstruction using the same (Haar)wavelet.

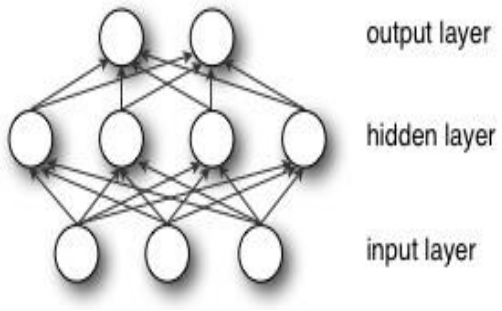
GLCM FEATURE EXTRACTION

To create a GLCM, use the graycomatrix function. The function creates a gray-level co-occurrence matrix by calculating how often a pixel with the intensity value i occurs

in a specific spatial relationship to a pixel with the value j. By default, the spatial relationship is defined as the pixel of interest and the pixel to its immediate right , but you can specify other spatial relationships between the two pixels. Each element (i,j) in the resultant GLCM is simply the sum of the number of times that the pixel with value i occurred in the specified spatial relationship to a pixel with value j in the input image.

NN ALGORITHM

Deep learning is the name we use for "stacked neural networks"; that is, networks composed of several layers. The layers are made of nodes. A node is just a place where the computations happen.A node combines input from the data with a set of coefficients, or weights, that either amplify or dampen that input, thereby assigning significance to inputs with regard to the task the algorithm is trying to learn; e.g. which input is most helpful is classifying data without error? These input-weight products are summed and then the sum passed through a node's so-called a ctivation function, to Determine whether and to what extent that signal should progress further through the network to affect the ultimate outcome, say, an act of classification. If the signals passes through, the neuron has been "activated.".



Pairing the model's adjustable weights with input features is how we assign significance to those features with regard to how the neural network classifies and clusters input.A collection of weights, whether they are in their start or end state, is also called a model, because it is an attempt to model data's relationship to ground-truth labels, to grasp the data's structure. Models normally start out bad and end up less bad, changing over time as the neural network updates its parameters.This is because a neural network is born in ignorance. It does not know which weights and biases will translate the input best to make the correct guesses. It has to start out with a guess, and then try to make better guesses sequentially as it learns from its mistakes.Here is a simple explanation of what happens during learning with a feedforward neural network, the simplest architecture to explain. Input enters the network. The coefficients, or weights, map that input to a set of guesses the network makes at the end.

III. GUI USERINTERFACE

A graphical user interface (GUI) is a user interface built with graphical objects, such as buttons, text fields, sliders, and menus. In general, these objects already have meanings to most computer users. For example, when you move a slider, a value changes; when you press an OK button, your settings are applied and the dialog box is dismissed. Of course, to leverage this built-in familiarity, you must be consistent in how you use the various GUI-building components. Applications that provide GUIs are generally easier to learn and use since the person using the application does not need to know what commands are available or how they work. The action that results from a particular user action can be made clear by the design of the interface.

GUI DEVELOPMENT ENVIRONMENT

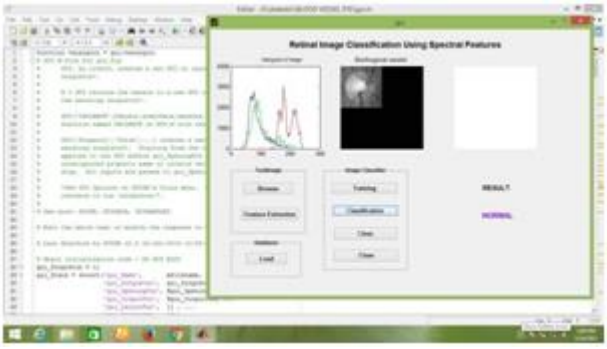
The process of implementing a GUI involves two basic tasks:

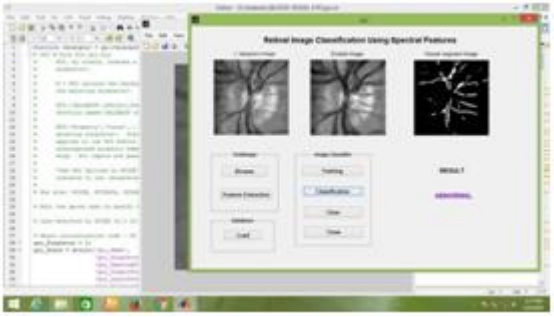
- Laying out the GUI components
- Programming the GUI components

primarily is a set of layout tools. However, GUIDE also generates an M-file that contains code to handle the initialization and launching of the GUI. This M-file provides a framework for the implementation of the callbacks - the functions that execute when users activate components inthe GUI.

IV. RESULT ANDDISCUSSION

Our idea and proposed method are programmed in MATLAB and combined into a single window of GUI titled "Retinal Image Classification Using Spectral Features". If the test image has DR it shows abnormal, ohterwise it shows normal





V. CONCLUSION

In this, pre-processing and feature extraction of the diabetic retinal fundus image is done for thedetectionof diabetic retinopathy using machine learning techniques. The pre- processing techniques such as greenchannel extraction, Histogram equalization and resizing were performed using DIP toolbox of MATLAB. The images were divided into two different datasets, the one was a normal stimulus, and the other was diabetic affected retinal images. The biologically significant features are extracted from normal and diabetic retinal fundus image data sets. Out of the total extracted features, most significant features are used for comparison and ranking these features is very simple and fundamental in the process of identifying a normal and a diabetic fundus image. From the results obtained, it is observed that exudate area is the best feature out of all the features which can primarily be used for diabetic detection, followed by blood vessels and other features, which suggests us that exudate is one of the major feature responsible for diabetic retinopathy. The features used in this study are specific due to their biological relevance and previously reported results. In future, many more features can be extracted from attributes such as red lesions, Kapoor entropy, edema, etc. The Learners canbe used for classification of diabetic retinopathy images in multiple classes based on the features values and performance may be evaluated on different measures.

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