A new impend for diagnose diabetic disease of the retina in fundus metaphors

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Abstract:

Reliable micro aneurysm detection in digital fundus images is still an open issue in medical image processing. Diabetic retinopathy (DR) is a serious eye disease that originates from diabetes mellitus and is the most common cause of blindness in the developed countries. Early treatment can prevent patients to become affected from this condition or at least the progression of DR can be slowed down. A key feature to recognize DR is to detect micro aneurysms (MAs) in the fundus of the eye. The detection of mass screening of patients who are suffering from diabetes is highly desired, but manual grading is slow and resource demanding. The first difficulty originates from the shape characteristics of micro aneurysms (MA). They appear as small circular dark spots on the surface of the retina which can be hard to distinguish from fragments of the vascular system or from certain eye features. we propose an neural networkbased Naive Bayes classification(NBC) to exclude spurious candidates are effectively detect using MA detector based on the combination of preprocessing methods and candidate extractors. The recognition of MAs is an essential step in the diagnosis and grading of diabetic retinopathy. MA detection through the analysis of directional cross-section profiles centeredonthe local maximum pixels of the preprocessed image. The severity of Diabetic retinopathy (DR) can be analyzed easily and performed in our detector at each threshold level. We can able to determine the image-level classification rate of the ensemble on the account the presence or absence of more diabetic retinopathy (DR) specific.

Index Terms— vessel, segmentation, local phase, infinite perimeter, active contour, fundus

1. INTRODUCTION

Blood vessels can be conceptualized anatomically as an intricate network, or tree-like structure (or vasculature), of hollow tubes of different sizes and compositions including arteries, arterioles, capillaries, venules, and veins. Their continuing integrity is vital to nurture life: any damage to them could lead to profound complications, including stroke, diabetes, arteriosclerosis, cardiovascular diseases and hypertension, to name only the most obvious. Vascular diseases are often life-critical for individuals, and present a challenging public health problem for society. The drive for better understanding and management of these conditions naturally motivates the need for improved imaging techniques. The detection and analysis of the vessels in medical images is a fundamental task in many clinical applications to support early detection, diagnosis and optimal treatment. In line with the proliferation of imaging modalities, there is an ever-increasing demand for automated vessel analysis systems for which where blood vessel segmentation is the first and most importantstep.

As blood vessels can be seen as linear structures distributed at different orientations and scales in an image, various kernels (or enhancement filters) have been proposed to enhance them in order to ease the segmentation problem . In particular, a local phase based filter recently introduced by Lathen et al. seems to be superior to intensity based filters as it is immune to intensity inhomogeneity and is capable of faithfully enhancing vessels of different widths. It is worth noting that morphological filters such as path opening in combination with multiscale Gaussian filters has also shown some interesting results. The main disadvantage of morphological methods is that they do not consider the known vessel cross-sectional shape information, and the use of an overly long structuring element may cause difficulty in detecting highly tortuous vessels.

Recent years have witnessed the rapid development of methods for vessel segmentation . Broadly speaking, all of the established segmentation techniques may be categorized as either supervised or unsupervised segmentation with respect to the overall system design and architecture. Supervised segmentation methods use training data to train a classifier (e.g. k-nearest neighbors, support vector machine (SVM), artificial neural networks (ANN) , Gaussian mixture models (GMM) , AdaBoost , or conditional random fields (CRFs) so that it can be used for the classification of image pixels as either vessel or not in a new, previously unseen image. As such this approach requires hand-labelled gold standard images for training, and discriminative features, such as Gabor features , to be extracted for each pixel of an image. In contrast, unsupervised segmentation refers to methods that achieve the segmentation of blood vessels without using training data, or explicitly using any classification techniques. The lower requirement on the data and training makes unsupervised segmentation methods more applicable to a

wider range of imaging modalities. This category encapsulates most vessel segmentation techniques in the literature, and our model as described in this paper. Christo Ananth et al. [1] proposed a system, in which a predicate is defined for measuring the evidence for a boundary between two regions using Geodesic Graph-based representation of the image. The algorithm is applied to image segmentation using two different kinds of local neighborhoods in constructing the graph. Liver and hepatic tumor segmentation can be automatically processed by the Geodesic graph-cut based method. This system has concentrated on finding a fast and interactive segmentation method for liver and tumor segmentation. In the preprocessing stage, the CT image process is carried over with mean shift filter and statistical thresholding method for reducing processing area with improving detections rate. Second stage is liver segmentation; the liver region has been segmented using the algorithm of the proposed method. The next stage tumor segmentation also followed the same steps. Finally the liver and tumor regions are separately segmented from the computer tomography image.
As such we will focus on the development of a new active contour model for improving accuracy in vessel segmentationproblems.

2. LITERATURE SURVEY:

2.1 A survey on eye-gaze tracking techniques:

Year: 2010 Author: H.R. Chennamma

Description:

Study of eye-movement is being employed in Human Computer Interaction (HCI) research. Eye - gaze tracking is one of the most challenging problems in the area of computer vision. The goal of this paper is to present a review of latest research in this continued growth of remote eye-gaze tracking. This overview includes the basic definitions and terminologies, recent advances in the field and finally the need of future development in the field.

Merits:

We are concentrating on video-based remote eye tracking systems. It is surprising to find the wide variety of gaze tracking systems which are used with the same purpose, that is, to detect the point of gaze.

Demerits:

The systems which do not have any physical contact with the user and the eye tracker apparatus are referred as non-intrusive systems or remote systems. This technique is not well-suited for everyday use, since it requires the close contact of electrodes to the user but is still frequently used by clinicians.

Technique:

- Electro-Oculography
- EyeTech Digital Systems

2.2 A study on face, eye detection and gaze estimation:

Year: 2011 Author: Zeynep Orman

Description:

Many different studies have been performed about face and eye detection. Besides having many challenging problems like, having different lighting conditions, having glasses, facial hair or mustache on face, different orientation pose or occlusion of face, face and eye detectionmethods performed great progress. In this paper we first categorize face detection models and examine the basic algorithms for face detection. Then we present methods for eye detection and gaze estimation.

Merits:

Methods use rules to describe features of a face derived from knowledge of human face. For example, a face image is consist of, two eyes that are symmetric to each other, a nose and a mouth. The relationships between features can be represented by their relative distances and positions.

Demerits:

Presence or absence of structural components: Facial features such as beards, mustaches, and glasses may or may not be present and there is a great deal of variability among these components including shape, color, and size. This method chooses to use strict rules, than it may fail while detecting faces because it may not pass all the rules defined.

Technique:

- Appearance Based Methods
- Eye feature extraction

2.3 A Survey on Methods and Models of Eye Tracking, Head Pose and Gaze Estimation:

Year: 2009 Author: Rohit P. Gaur

Description:

Eye tracking and Gaze estimation are the most challenging areas in computer vision. Even though we have achieved a significant progress in the last few decades, some domains are still facing the limitations. Be it the lack of accuracy due to the design of fovea or the tracking challenges in visible spectrum, this paper covers an in-depth research survey of the recent as well as the archaic methods and models used for eye tracking, head pose and gaze estimation.

Merits:

Eye tracking and gaze estimation opened many doors in the field of HCI because now we can use our eyes to interact with the computers. This not only helps the physically disabled people of our society but also provides a better path where one day we will be able to interact in a faster and a better sense.

Demerits:

Our brain analyses the data and responds by the means of gestures or language. As the natural tendency of a human being is to learn, eyes become our best friend. It gives us the sense of light. The importance of the eye cannot be scaled or compared

Technique:

- Video-based eye tracking
- Segmentation algorithm

2.4 A Near-infrared Image Based Face Recognition System:

Year: 2008 Author: Stan Z. Li

Description:

In this paper, we present a near infrared (NIR) image based face recognition system. Firstly, we describe a design of NIR image capture device which minimizes influence of environmental lighting on face images. Both face and facial feature localization and face recognition are performed using local features with AdaBoost learning. An evaluation in real-world user scenario shows that the system achieves excellent accuracy, speed andusability.

Merits:

Our assumptions are that the user is cooperative and that an application is in a moderate environment such as in door. These are valid for many useful applications.

Demerits:

To achieve high accuracy, the recognition should be performed based on intrinsic properties, and the algorithms should be able to deal with unfavorable influences due to extrinsic factors and mis-alignment. There are two ways to validate this assumption: by processing the face image or by minimizing extrinsic factors before the image is processed. The former is the approach that has been adopted by most of current research and has not been very successful.

Technique:

- 3D vision method
- Infrared technique

2.5 Face and Body Gesture Recognition for a Vision-Based Multimodal Analyzer:

Year: 2007 Author: Hatice Gunes

Description:

For the computer to interact intelligently with human users, computers should be able to recognize emotions, by analyzing the human's affective state, physiology and behavior. In this paper, we present a survey of research conducted on face and body gesture and recognition. In order to make human-computer interfaces truly natural, we need to develop technology that tracks human movement, body behavior and facial expression, and interprets these movements in an effective way. Accordingly in this paper, we present a framework for a vision-based multimodal analyzer that combines face and body gesture and further discuss relevant issues.

Merits:

Their system analyzes subtle changes in facial expressions based on profile contour fiducially points in a profile-view video. These parameters are used as input to classifiers based on Support Vector Machines to recognize upper facial action units and all their possible combinations.

Demerits:

The evidence for seven universal facial expressions does not imply that these emotion categories are sufficient to describe all facial expressions. There are emotions like confusion, boredom and frustration for which any prototypic expression might not exist.

Technique:

- Machine learning techniques
- Face detection techniques

3. PROPOSED SYSTEM :

Micro aneurysms (MA's) detectors tackle the following way: first, the green channel of the fundus image is extracted and preprocessed. A local maximum region (LMR), of a grayscale (intensity) image is a connected component of pixels with a given constant intensity value. Pixels of the image are processed sequentially, and compared to their N-neighbors. The proposed methods has been process the template matching, wavelet transformation, statistical approaches, baseline corrections, thresholding.Our method can differentiate easily hot to distinguish vessel bifurcations and crossings from Micro aneurysms (MAs).

4.RELATED WORK:

4.1 Color model threshold algorithm:

Color images can also be threshold. one approach is to designate a separate threshold for each of the RGB components of the image and then combine them with an AND operation . This reflects the way the camera works and how the data is stored in the computer ,but,it does not correspond to the way the people recognise color .The HSL and HSV color models are more of ten used,note that since hue is a circular quantity ,it requires circular thresholding.It is also possible to use the CMY color model.

4.2 Preprocessing:

Image analysis is the process of extracting meaningful information from images such as finding shapes, counting objects, identifying colors, or measuring object properties.Image transforms play a critical role in many image processing tasks, including image enhancement, analysis, restoration, and compression. Image Processing Toolbox provides several image transforms, including Hough, Radon, FFT, DCT, and fan-beam projections. You can reconstruct images from parallel-beam and fan-beam projection data.It enables you to accurately represent color independently from input and output devices. This is useful when analyzing the characteristics of a device, quantitatively measuring color accuracy, or developing algorithms for several different devices. With specialized functions in the toolbox, you can convert images between device-independent colorspaces.

4.3 Original histogram:

A histogram is the probability distribution of pixel values in an image. (For RGB images, the histogram is usually broken into three histograms of the three component channels.) Like any other distribution, histograms have simple mathematical rules. Two operations that affect the pixel values, and thus the histograms, will be used extensively through these posts: Adding a value to all the pixels adds that amount to the histogram; visually, this shifts the histogram. Multiplying all the pixel values by a certain amount scales where the histogram data appears; visually, this stretches the histogram.

4.4 Contrast limited Adaptive Histogram Equalization (CLAHE):

This is the second part of a three-part post on understanding and using histograms to modify the appearance of images. The first part covered introductory material on histograms and a method known as histogram stretching for improving contrast and color. This post will cover histogram equalization and an advanced technique called contrast-limited adaptive histogram equalization, both intended for increasing the contrast of an image. The final post will extend the concepts of histogram equalization to arbitrary distributions of pixel values.

The next stop on our tour of histogram-processing techniques is histogram equalization. If you plotted the CDF of some of your image histograms, you may have noticed that the CDF does not form a straight line—meaning that the pixel values are not equally likely to occur (since the CDF is the integral of the PDF). The good news is that most natural images do not have flat CDFs. That said, some industrial applications can benefit from having a flat CDF. The process of flattening the CDF is called histogram equalization.

Fig 1. Illustrative enhancement results using different enhancement methods and their subsequent IPACHI-based segmentation results.

4.5 Equal area dualistic sub-image histogram equalization (DSIHE):

Various enhancement schemes are used for enhancing an image which includes gray scale manipulation, filtering and Histogram Equalization (HE). Histogram equalization is one of the well known imaget enhancement technique. It became a popular technique for contrast enhancement because this method is simple and effective. In the latter case, preserving the input brightness of the image is required to avoid the generation of non-existing artifacts in the output image. Although these methods preserve the input brightness on the output image with a significant contrast enhancement, they may produce images with do not look as natural as the input ones. The basic idea of HE method is to re-map the gray levels of animage.

4.6 Dynamic Histogram equalization (DHE) :

Preserving dynamic histogram equalization technique to improve its brightness preserving and contrast enhancement abilities while reducing its computational complexity. The modified technique, called Brightness Preserving Dynamic Fuzzy Histogram Equalization (BPDFHE), uses fuzzy statistics of digital images for their representation and processing. Representation and processing of images in the fuzzy domain enables the technique to handle the inexactness of gray level values in a better way, resulting in improved performance. Execution time is dependent on image size and nature of the histogram, however experimental results show it to be faster as compared to the techniques compared here. The performance analysis of the BPDFHE along with that for BPDHE has been given for comparative evaluation.

4.7 Feature extraction:

Feature extraction a type of dimensionality reduction that efficiently represents interesting parts of an image as a compact feature vector. This approach is useful when image sizes are large and a reduced feature representation is required to quickly complete tasks such as image matching and retrieval.Feature detection, feature extraction, and matching are often combined to solve common computer vision problems such as object detection and recognition, content-based image retrieval, face detection andrecognition, and texture classification. Computer Vision System Toolbox provides a suite of feature detectors and descriptors. Additionally Computer Vision System Toolbox offers capabilities for feature detection and extraction that include:

Corner detection, including Shi & Tomasi, Harris, and FAST methods

- BRISK, MSER, and SURF detection for blobs and regions
- Extraction of BRISK, FREAK, SURF, and simple pixel neighborhood descriptors
- Histogram of Oriented Gradients (HOG) feature extraction
- Visualization of feature location, scale, and orientation

4.8 Green Plane:

An RGB image, sometimes referred to as a "truecolor" image, is stored in JAVA as an m-by-n-by-3 data array that defines red, green, and blue color components for each individual pixel. RGB images do not use a palette. The color of each pixel is determined by the combination of the red, green, and blue intensities stored in each color plane at the pixel's location. Graphics file formats store RGB images as 24-bit images, where the red, green, and blue components are 8 bits each. This yields a potential of 16 million colors. The precision with which a real-life image can be replicated has led to the commonly used term "truecolor image."

An RGB JAVA array can be of class double, uint8, or uint16. In an RGB array of class double, each color component is a value between 0 and 1. A pixel whose color components are (0,0,0) displays as black, and a pixel whose color components are (1,1,1) displays as white. The three color components for each pixel are stored along the third dimension of the data array. For example, the red, green, and blue color components of the pixel (10,5) are stored in RGB(10,5,1), RGB(10,5,2), and RGB(10,5,3), respectively.

4.9 Background image:

The background illumination is brighter in the center of the image than at the bottom. In this step, the example uses a morphological opening operation to estimate the background illumination. Morphological opening is an erosion followed by a dilation, using the same structuring element for both operations. The opening operation has the effect of removing objects that cannot completely contain the structuring element. For more information about morphological image processing, see Morphological Operations. Use the surf command to create a surface display of the background (the background approximation created in Step .The surf command creates colored parametric surfaces that enable you to view mathematical functions over a rectangular region. However, the surf function requires data of class double, so you first need to convertbackground using the double command: n the surface display, [0, 0] represents the origin, or upper-left corner of the image. The highestpart of the curve indicates that the highest pixel values of background (and consequently rice.png) occur near the middle rows of the image. The lowest pixel values occur at the bottom of the image and are represented in the surface plot by the lowest part of the curve. After subtraction, the image has a uniform background but is now a bit too dark. Use imadjust to adjust the contrast of the image. imadjust increases the contrast of the image by saturating 1% of the data at both low and high intensities of I2 and by stretching the intensity values to fill the uint8 dynamic range. See the imadjustreference page for moreinformation.

4.10 Shade-correction image:

The method by which images are produced--the interaction between objects in real space, the illumination, and the camera--frequently leads to situations where the image exhibits significant shading across the field-of-view. In some cases the image might be bright in the center and decrease in brightness as one goes to the edge of the field-of-view. In other cases the image might be darker on the left side and lighter on the right side. The shading might be caused by non-uniform illumination, non-uniform camera sensitivity, or even dirt and dust on glass (lens) surfaces. In general this shading effect is undesirable. Eliminating it is frequently necessary for subsequent processing and especially when image analysis or image understanding is the final goal. The function bwconncomp finds all the connected components (objects) in the binary image. The accuracy of your results depend on the size of the objects, the connectivity parameter (4,8,or arbitrary), and whether or not any objects are touching (in which case they may be labeled as one object). Some of the rice grains in bw are touching. One way to visualize connected components is to create a label matrix and then display it as a pseudo-color indexed image.Use labelmatrix to create a label matrix from the output of bwconncomp. Note that labelmatrix stores the label matrix in the smallest numeric class necessary for the number of objects.

4.11 Matched Filter:

In signal processing, a matched filter (originally known as a North filter) is obtained by correlating a known signal, or template, with an unknown signal to detect the presence of the template in the unknown signal. This is equivalent to convolving the unknown signal with a conjugated time-reversed version of the template. The matched filter is the optimal linear filter for maximizing thesignal to noise ratio (SNR) in the presence of additive stochastic noise. Matched filters are commonly used in radar, in which a known signal is sent out, and the reflected signal is examined for common elements of the out-going signal. Pulse compression is an example of matched filtering. It is so called because impulse response is matched to input pulse signals. Two-dimensional matched filters are commonly used in image processing.

5.CONCLUSION:

In this project we have presented a method for the detection of MAs on retinal images, based on the principle of analyzing directional cross-section profiles centered on the candidate pixels of the preprocessed image. The number of pixels to be processed is significantly reduced by only considering the local maxima of the preprocessed image. We apply peak detection on each profile, and calculate a set of values that describe the size, height, and shape of the central peak. The statistical measures of these values as the orientation of the cross-section changes constitute thefeature set used in a classification step to eliminate false candidates. We proposed a formula to calculate the final score of the remaining candidates based on the obtained featurevalues.

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