Classification of Skin Lesion Based on Medical Image Processing Techniques using Machine Learning

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Human Cancer is one of the most dangerous disease which is mainly caused by genetic instability of multiple molecular alterations. Among many forms of human cancer, skin cancer is the most common one. To identify skin cancer at an early stage we will study and analyze them through various techniques named as segmentation and feature extraction. Here, we focus malignant melanoma skin cancer, (due to the high concentration of Melanoma- Hier we offer our skin, in the dermis layer of the skin) detection. In this, We used our ABCD rule dermoscopy technology for malignant melanoma skin cancer detection. In this system different step for melanoma skin lesion characterization i.e, first the Image Acquisition Technique, pre-processing, segmentation, define feature for skin Feature Selection determines lesion characterization, classification methods. In the Feature extraction by digital image processing method includes, symmetry detection, Border Detection, color, and diameter detection and also we used LBP for extract the texture based features. Here we proposed the Back Propagation Neural Network to classify the benign or malignant stage.

Keywords:

Preprocessing, Skin cancerDetection, Segmentation, Back propagation neural network.

(I) Introduction:

countries. With this type of cancer, the patient can be survived if it is detected in early stages . So, early detection is the promising strategy to cut the mortality rate of skin cancer . As skin cancer diagnosis can be faced to different human faults and involves some expense and morbidity, researchers are trying to automate this assessment to verify if it is inoffensive or dangerous, and estimate it with a small margin of error less that the human achievements . In such systems, the accuracy of diagnostics is not always acceptable and involves some errors. Therefore, high performance computer aided diagnostic systems help the physicians to avoid misdiagnosis. The common approaches to skin lesion early detection include different steps of Preprocessing, Segmentation, Feature extraction and Classification.

(II) Methodology:

(A)Preprocessing:

Image pre-processing is an essential step of detection in order to remove noise such as hair clothing and other artifacts and enhance the quality of original image. The main purpose of this step is to improve the quality of skin image by removing unrelated and surplus parts in the back ground of image for further processing. Good selection of preprocessing techniques can greatly improve the accuracy of the system. The objective of the preprocessing stage can be achieved through three process stages of image enhancement, image restoration and hair removal.

(B)Contour Detection:

Contour detection includes a variety of mathematical methods that aim at identifying points in a digital image at which the image brightness changes sharply or, more formally, has discontinuities. The points at which image brightness changes sharply are typically organized into a set of curved line segments termed edges. The same problem of finding discontinuities in 1D signals is known as step detection and the problem of finding signal discontinuities over time is known as change detection. Edge detection is a fundamental tool in image processing, machine vision and computer vision, particularly in the areas of feature detection andfeature extraction.

The purpose of detecting sharp changes in image brightness is to capture important events and changes in properties of the world. It can be shown that under rather general assumptions for an image formation model, discontinuities in image brightness are likely to correspond to: (1)discontinuities in depth,(2)discontinuities in surface orientation,(3)changes in material properties and(4)variations in scene illumination.

In the ideal case, the result of applying an edge detector to an image may lead to a set of connected curves that indicate the boundaries of objects, the boundaries of surface markings as well as curves that correspond to discontinuities in surface orientation. Thus, applying an edge detection algorithm to an image may significantly reduce the amount of data to be processed and may therefore filter out information that may be regarded as less relevant, while preserving the important structural properties of an image. If the edge detection step is successful, the subsequent task of interpreting the information contents in the original image may therefore be substantially simplified. However, it is not always possible to obtain such ideal edges from real life images of moderate complexity.

Edges extracted from non-trivial images are often hampered by fragmentation, meaning that the edge curves are not connected, missing edge segments as well as false edgesnot corresponding to interesting phenomena in the image – thus complicating the subsequent task of interpreting the image data.

Edge detection is one of the fundamental steps in image processing, image analysis, image pattern recognition, and computer vision techniques.

The edges extracted from a two-dimensional image of a three-dimensional scene can be classified as either viewpoint dependent or viewpoint independent. A viewpoint independent edge typically reflects inherent properties of the three-dimensional objects, such as surface markings and surface shape. A viewpoint dependent edge may change as the viewpoint changes, and typically reflects the geometry of the scene, such as objects occluding one another.

A typical edge might for instance be the border between a block of red color and a block of yellow. In contrast a line (as can be extracted by a ridge detector) can be a small number of pixels of a different color on an otherwise unchanging background. For a line, there may therefore usually be one edge on each side of the line.

(C)Threshold Segmentation:

Thresholding is the simplest method of image segmentation. From a grayscale image, thresholding can be used to create binary images.

Colour images can also be thresholded. One approach is to designate a separate threshold for each of the RGB components of the image and then combine them with an ANDoperation. This reflects the way the camera works and how the data is stored in the computer, but it does not correspond to the way that people recognize colour. Therefore, theHSL and HSV colour models are more often used; note that since hue is a circular quantity it requires circular thresholding.

Segmentation involves separating an image into regions (or their contours) corresponding to objects. We usually try to segment regions by identifying common properties. Or, similarly, we identify contours by identifying differences between regions (edges). The simplest property that pixels in a region can share is intensity. So, a natural way to segment such regions is through thresholding, the separation of light and dark regions. Thresholding creates binary images from grey-level ones by turning all pixels below some threshold to zero and all pixels about that threshold to one. (What you want to do with pixels at the threshold doesn't matter, as long as you're consistent.) If g(x, y) is a thresholded version of f (x, y) at some global threshold T. g is equal to 1 if f x(, y) ≥ T and zero otherwise.

Threshold technique is one of the important techniques in image segmentation. This technique can be expressed as

$$T=T[x, y, p(x, y), f(x, y]$$

Where T is the threshold value.x, y are the coordinates of the threshold value point.p(x,y) ,f(x,y) are points the gray level image pixels.Threshold image g(x,y) can be define:

Thresholding techniques are classified as bellow:

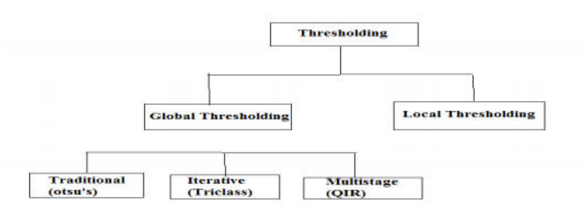


Figure 1. Thresholding Techniques

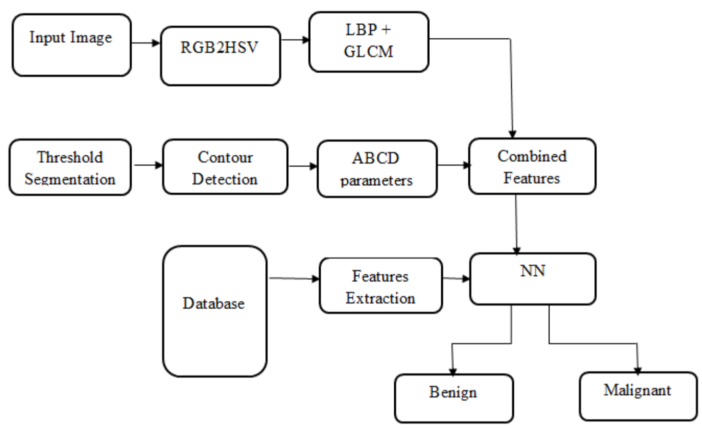
Global Thresholding Global (single) thresholding method is used when there the intensity distribution between the objects of foreground and background are very distinct. When the differences between foreground and background objects are very distinct, a single value of threshold can simply be used to differentiate both objects apart. Thus, in this type of thresholding, the value of threshold T depends solely on the property of the pixel and the grey level value of the image. Some most common used global thresholding methods are Otsu method, entropy based thresholding, etc. Otsu'salgorithm is a popular global thresholding technique.Traditional Thresholding (Otsu's Method) In image processing, segmentation is often the first step to pre-process images to extract objects of interest for further analysis. Segmentation techniques can be generally categorized into two frameworks, edge-based and region based approaches. As a segmentation technique, Otsu's method is widely used in pattern recognition, document binarization, and computer vision. In many cases Otsu's method is used as a pre-processing technique to segment an image for further processing such as feature analysis and quantification. Otsu's method searches for a threshold that minimizes the intra-class variances of the segmented image and can achieve good results when the histogram of the original image has two distinct peaks, one belongs to the background, and the other belongs to the foreground or the signal. The Otsu's threshold is found by searching across the whole range of the pixel values of the image until the intra-class variances reach their minimum. As it is defined, the threshold determined by Otsu's method is more profoundly determined by the class that has the larger variance, be it the background or the foreground. As such, Otsu's method may create suboptimal results when the histogram of the image has more than two peaks or if one of the classes has a large variance.Iterative Thresholding(A New Iterative TriclassThresholding Technique) A new iterative method that is based on Otsu's method but differs from the standard application of the method in an important way. At the first iteration, we apply Otsu's method on an image to obtain the Otsu's threshold and the means of two classes separated by the threshold as the standard application does. Then, instead of classifying the image into two classes separated by the Otsu's threshold, our method separates the image into three classes based on the two class means derived. The three classes are defined as the foreground with pixel values are greater than the larger mean, the background with pixel values are less than the smaller mean, and more importantly, a third class we call the "to-be-determined" (TBD) region with pixel values fall between the two class means. Then at the next iteration, the method keeps the previous foreground and background regions unchanged and re-applies Otsu's method on the TBD region only to, again, separate it into three classes in the similar manner. When the iteration stops after meeting a preset criterion, the last TBD region is then separated into two classes, foreground and background, instead of three regions. The final foreground is the logical union of all the previously determined foreground regions and the final background is determined similarly. The new method is almost parameter free except for the stopping rule for the iterative process and has minimal added computational load. Multistage Thresholding(Quadratic Ratio Technique For Handwritten Character) The QIR technique was found superior in thresholding handwriting images where the following tight requirements need to be met: 1. All the details of the handwriting are to be retained 2. The papers used may contain strong coloured or patterned background 3. The handwriting may be written by a wide variety of writing media such as a fountain pen, ballpoint pen, or pencil.QIR is a global two stage thresholding technique. The first stage of the algorithm divides an image into three sub images: foreground, background, and a fuzzy sub image where it is hard to determine whether a pixel actually belongs to the foreground or the background. Two important parameters that separate the sub images are A, which separates the foreground and the fuzzy sub image, and C, which separate the fuzzy and the background sub image. If a pixel's intensity is less than or equal to A, the pixel belongs to the foreground. If a pixel's intensity is greater than or equal to C, the pixel belongs to the background. If a pixel has an intensity value between A and C, it belongs to the fuzzy sub image and more information is needed from the image to decide whether it actually belongs to the foreground or the background.

(D)Neural Networks:

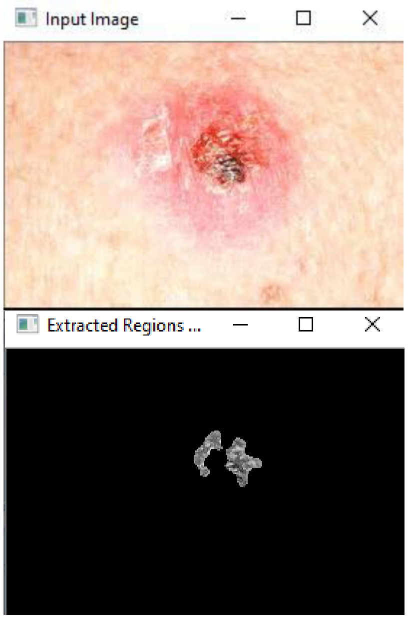
Neural networks are predictive models loosely based on the action of biological neurons.

The selection of the name "neural network" was one of the great PR successes of the Twentieth Century. It certainly sounds more exciting than a technical description such as "A network of weighted, additive values with nonlinear transfer functions". However, despite the name, neural networks are far from "thinking machines" or "artificial Brains". A typical artifical neural network might have a hundred neurons. In comparison, the human nervous system is believed to have about $3x10^{10}$ neurons. We are still light years from "Data". In this system, Back propagation Neural Network is used.

(III)System Architecture:



(IV)Results:



(V)Conclusion:

To overcome the difficulties of proper diagnosis of diseases based on visual evaluation, the proposed integrated system plays an important role by quantifying the effective features and identifying the diseases with higher degree of accuracy. This combined approach of quantitative and qualitative analysis not only increases the diagnostic accuracy, but also provides some important information not obtainable from qualitative assessment alone.

(VI)References:

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