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Skin Cancer Detection Using Image Processing

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Abstract: *In today's modern world, Skin cancer is the most common cause of death amongst humans. Skin cancer is abnormal growth of skin cells most often develops on body exposed to the sunlight, but can occur anywhere on the body. Most of the skin cancers are curable at early stages. So an early and fast detection of skin cancer can save the patient's life. With the new technology, early detection of skin cancer is possible at initial stage. Formal method for diagnosis skin cancer detection is Biopsy method [1]. It is done by removing skin cells and that sample goes to various laboratory testing. It is painful and time consuming process. We have proposed skin cancer detection system using svm for early detection of skin cancer disease. It is more advantageous to patients. The diagnosing methodology uses Image processing methods and Support Vector Machine (SVM) algorithm. The dermoscopy image of skin cancer is taken and it goes under various pre-processing technique for noise removal and image enhancement. Then the image is undergone to segmentation using Thresholding method. Some features of image have to be extracted using GLCM methodology. These features are given as the input to classifier. Support vector Machine (SVM) is used for classification purpose. It classifies the given image into cancerous or non-cancerous.*

Keywords: Thresholding, SVM, GLCM, Skin cancer, Classifier

Introduction

Skin cancer is a deadly disease. Skin has three (3) basic layers. Skin cancer begins in outermost layer, which is made up of first layer squamous cells, second layer basal cells, and innermost or third layer melanocytes cell. Squamous cell and basal cell are sometimes called non-melanoma cancers. Non-melanoma skin cancer always responds to treatment and rarely spreads to other skin tissues. Melanoma is more dangerous than most other types of skin cancer [3]. If it is not detected at beginning stage, it is quickly invade nearby tissues and spread to other parts of the body. Formal diagnosis method to skin cancer detection is Biopsy method. A biopsy is a method to remove a piece of tissue or a sample of cells from patient body so that it can be analysed in a laboratory. It is uncomfortable method. Biopsy Method is time consuming for patient as well as doctor because it takes lot of time for testing. Biopsy is done by removing skin tissues (skin cells) and that sample undergoes series of laboratory testing [1]. There is possibility of spreading of disease into other part of body. It is more risky. Considering all the cases mentioned above, So Skin cancer detection using svm is proposed. This methodology uses digital image processing technique and SVM for classification. This technique has inspired the early detection of skin cancers, and requires no oil to be applied to your skin to achieve clear sharp images of your moles. In this way, it's quicker and cleaner approach. But, most importantly, due to its higher magnification, Skin Cancer Detection Using SVM can prevent the unnecessary excision of perfectly harmless moles and skin lesions.

Literature Review

In this section, the works carried out by various researchers are as follows:

J Abdul Jaleel [2013]:proposed Skin detection based on Maximum Entropy Threshold, feature extracted by using Gray Level Co-occurrence Matrix(GLCM), and c1assification using Artificial Neural Network(ANN). Back-Propagation Neural (BPN) Network is used for c1assification purpose.[1]

M.Chaithanya Krishna [2016]: This paper uses segmentation as various clustering technique, features can be extracted by using ABCD (Asymmetry Index Border Colour Index Diameter) method [7].

A.A.L.C. Amarathunga [2015]: This system used rule based and forward chaining approach to detect skin disease. Proposed system enables user to identify children skin diseases via online and provide useful medical suggestions. Used different data mining classification algorithms (AdaBoost, BayesNet, MLP and NaiveBayes) to predict and diagnose the skin disease. This only works for three skin diseases (Eczema, Impetigo and Melanoma) [8].

Kawsar Ahmed [2013]: In this paper researchers have used various Data Pre-processing methods, Disease Diagnosis, Maximal Frequent Itemset Algorithm for training, K-means clustering for segmentation and significant frequent pattern for classification [6].

Mariam A.Sheha,Mai S.Mabrouk, Amr Sharawy[2012]: This paper presents an method for melanoma diagnosis applied on a set of digital images. Features extracted by using gray level Co-occurrence matrix (GLCM) and Using Multilayer perceptron classifier (MLP) to classify between cancerous and noncancerous images [9].

Proposed System

Skin cancer detection using Svm is basically defined as the process of detecting the presence of cancerous cells in image. Skin cancer detection is implemented by using GLCM and Support Vector Machine (SVM). Gray Level Co-occurrence Matrix (GLCM) is used to extract features from an image that can be used for classification. SVM is machine learning technique, mainly used for classification and regression analysis.

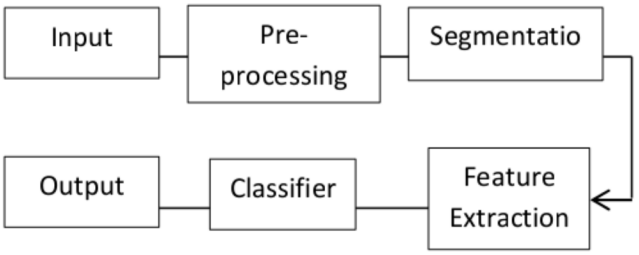

Fig 1. Block Diagram

Implementation Details

Input image

Input to proposed system is dermoscopic images, dermoscopic images are images taken by dermatoscope. It is kind of magnifier used to take pictures of skin lesions (body part). It is hand held instrument make it very easier to diagnose skin disease.

Pre processing

Goal of pre-processing is an improvement of image data that reduces unwanted distortions and enhances some image features important for further image processing. Image pre-processing involves three main things 1) Gray scale conversion 2) Noise removal 3) Image enhancement.

Grayscale conversion

Grayscale image contains only brightness information. Each pixel value in grayscale image corresponds to an amount or quantity of light. The brightness graduation can be differentiated in grayscale image. Grayscale image measures only light intensity. 8 bit image will have brightness variation from 0 to 255 where '0' represents black and '255' represents white.

In grayscale conversion colour image is converted into grayscale image shows in fig (3). Grayscale images are more easy and more faster to process than coloured images. All image processing technique are applied on grayscale image [4].

In our proposed system coloured or RBG image is converted into grayscale image by using weighted sum method by using following equations

Grayscale intensity= 0.299 R + 0.587 G + 0.114 B (1)

Noise Removal

The objective of noise removal is to detect and removed unwanted noise from digital image. The difficulty is in deciding which features of an image are real and which are caused by noise. Noise is random variations in pixel values.

In our proposed system we are using median filter to remove unwanted noise shows in fig (4). Median filter is nonlinear filter, it leaves edges invariant. Median filter is implemented by sliding window of odd length [4]. Each sample value is sorted by magnitude, the centremost value is median of sample within the window, is a filter output.

Image enhancement

The objective of image enhancement is to process an image to increase visibility of feature of interest. Here contrast enhancement is used to get better quality result shows in fig (5).

Segmentation

Segmentation is process of removing region of interest from given image. Region of interest containing each pixel similar attributes. Here we are using maximum entropy thresholding for segmentation [5]. First of all we have to take gray level of original image then calculate histogram of gray scale image then by using maximum entropy separate foreground from background. After maximum entropy we obtained binary image that is black and white image shows in fig (6).

Feature extraction

Feature extraction plays an important role in extracting information present in given image. Here we are using GLCM for texture image analysis. GLCM is used to capture spatial dependency between image pixels. GLCM works on gray level image matrix to capture most common feature such as contrast, mean, energy, homogeneity [2].

Contrast

$$\sum_i \sum_j (i-j)^2 \, C(i,j) \qquad (2)$$

Energy

$$\sum_i \sum_j C^2(i,j) \qquad (3)$$

Homogeneity

$$\sum_i \sum_j \frac{C(i,j)}{1+|i-j|} \qquad (4)$$

Mean (μ)

$$\frac{\sum_i^m \sum_j^n C(i,j)}{M*N} \qquad (5)$$

The purpose of feature extraction (glcm) is to supressed the original image data set by measuring certain values or features that helps to classify different images from one another [5].

Classifier

Classifier is used to classify cancerous image from other skin diseases. For simplicity Support Vector machine classifier is used here. Svm takes set of images and predicts for each input image belongs to which of the two categories of cancerous and non-cancerous classes. The purpose of SVM is create hyper plane that separates two classes with maximum gap between them [2]. In our proposed system output of GLCM is given as input to SVM classifier which takes training data, testing data and grouping information which classifies whether given input image is cancerous or non-cancerous shows in fig (7) [11].

Results

I have collected skin cancer images from internet. They were undergone various pre-processing techniques like gray scale conversion, median filter maximum entropy, GLCM method, all features are given to SVM to classify cancerous and non-cancerous image, output of above image would be 'cancerous' shows in fig (7).

Fig 2: Input Image

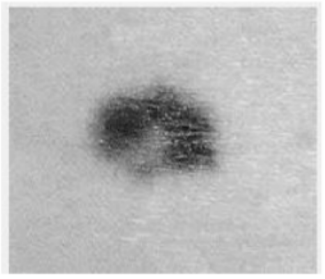

Fig 3: Gray Scale Image

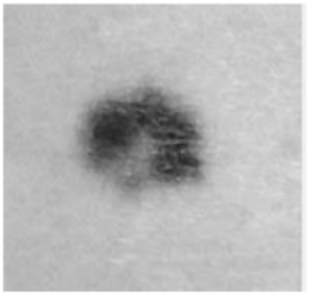

Fig 4: Image Without Noise

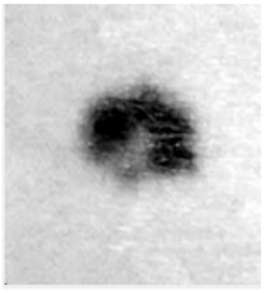

Fig 5: Enhanced image

Fig 6: Segmented Image

Fig 7: Output Image

Testing performed on 20 sample images. Accuracy is calculated by using following formula.

$$\text{Accuracy} = \frac{TP+TN}{TP+FP+FN+TN} \quad (6)$$

Parameters	SVM classifier
TP	16
TN	03
FP	0
FN	1
Accuracy	95%

Table 1: performance of SVM

Conclusion

It can be easily concluded that the proposed system of skin cancer detection can be implemented using gray level co-occurrence matrix and support vector machine to classify easily whether image is cancerous or non-cancerous. Accuracy of proposed system is 95%. It is painless and timeless process than biopsy method. It is more advantageous to patients.

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