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Skin Cancer Detection Using FCM and SVM

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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. 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 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 segmented using FCM method. Features of segmented image are extracted by using GLCM method. 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 etc.

I. 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. 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. 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 FCM for segmentation 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.

II. LITERATURE SURVEY

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 GrayLevel Co-occurrence Matrix (GLCM), and classification using Artificial Neural Network (ANN). Back-Propagation Neural (BPN) Network is used for classification purpose.

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.

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 Naive Bayes) to predict and diagnose the skin disease. This only works for three skin diseases (Eczema, Impetigo and Melanoma).

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

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.

III. PROPOSED SYSTEM

Skin cancer detection using SVM is basically defined as the process of detecting and classification of cancerous cells in image. Skin cancer detection is implemented by using FCM.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.

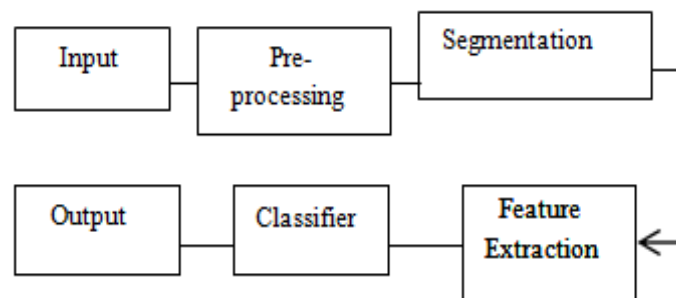


Fig1.Block Diagram

Input image

Input to proposed system is dermo scopic images, dermo scopic 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.

Gray scale 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 lightintensity.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. Grayscale images are easier and more faster to process than coloured images. All image processing technique are applied on grayscale image .

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

$$\text{Gray scale intensity} = 0.299R + 0.587G + 0.114B \quad (1)$$

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.

Filter

Here we are using a Imfilter, The imfilter function computes the value of each output pixel using double-precision, floating-point arithmetic. If the result exceeds the range of the data type, then imfilter truncates the result to the allowed range of the data type. If it is an integer data type, then imfilter rounds fractional values.

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 results.

Segmentation

Segmentation is process of removing region of interest from given image. Region of interest containing each pixel similar attributes. Here we are using FCM for segmentation. FCM is generally a data clustering model, where a data set is grouped or clustered into n clusters having each data point in the dataset associated with each cluster. The data would have a great connection with that cluster and other data points that lie away from the cluster centre might have a low degree of belonging or connection to that corresponding cluster.

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.

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

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 to create hyper plane that separates two classes with maximum gap between them. 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.

IV. SIMULATION RESULTS

The skin cancer images are collected from internet. The images were undergone various pre-processing techniques like gray scale conversion, FCM clustering, GLCM method, all features are given to SVM to classify cancerous and non-cancerous image, output of above image would be 'cancerous'



Fig 1. Input image



Fig 2. Processed Image

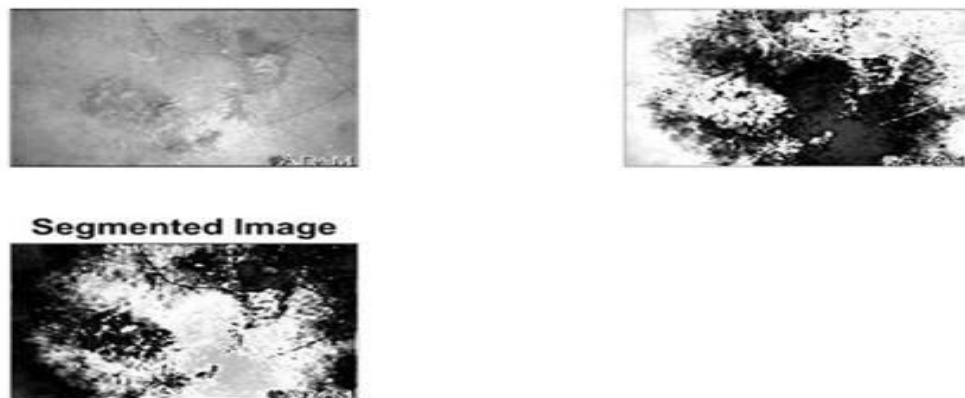


Fig 3. Segmented Image

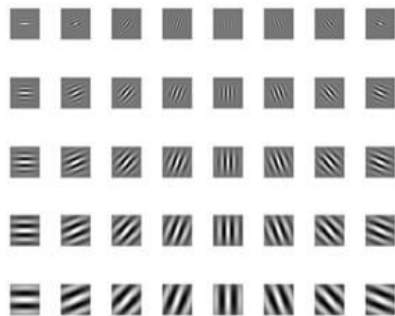


Fig 4. Real parts of Gabor filter

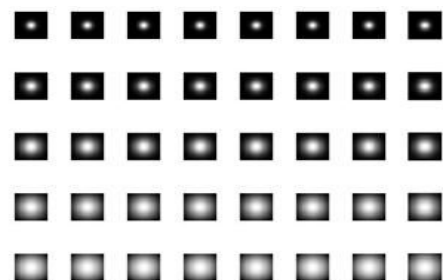


Fig 5. Magnitudes of Gabor filter

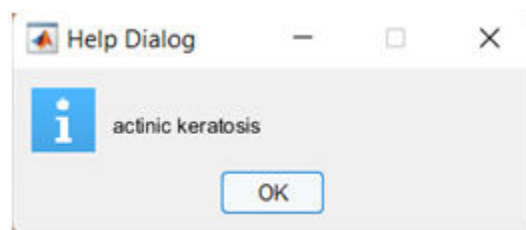


Fig 7: Output

Testing performed on 100 sample images .Accuracy is calculated by using following formula

Table I: Performance of SVM Classifier for actinic keratosis

Parameters	SVM classifier
TP	16
TN	3
FP	0
FN	1
Accuracy	95%
Sensitivity	94%
Specificity	100%
Precision	100%

Table II: Performance of SVM Classifier for Basel cell carcinoma

Parameters	SVM classifier
TP	17
TN	2
FP	0
FN	1
Accuracy	95%
Sensitivity	94.4%
Specificity	66%
Precision	100%

Table III: Performance of SVM Classifier for cherry nevus

Parameters	SVM classifier
TP	16
TN	2
FP	1
FN	1
Accuracy	96%
Sensitivity	94.1%
Specificity	66%
Precision	94%

Table IV: Performance of SVM Classifier for dermatofibroma

Parameters	SVM classifier
TP	15
TN	3
FP	0
FN	2
Accuracy	96%
Sensitivity	88.2%
Specificity	100%
Precision	100%

Table V: Performance of SVM Classifier for Melanocytic nevus

Parameters	SVM classifier
TP	15
TN	4
FP	0
FN	1
Accuracy	95%
Sensitivity	93.7%
Specificity	98%
Precision	100%

Table VI: Comparison of SVM classifier performance for various dermoscopic images

S.no	Type	Accuracy(%)	Sensitivity(%)	Specificity(%)	Precision(%)
1	Actinic Keratosis	95	94	100	100
2	Baselcell carcinoma	95	94.4	66	100
3	Cherry nevus	96	94.1	66	94
4	Dermatofibroma	96	88.2	100	100
5	Melanocytic nevus	95	93.7	98	100
6	Average(%)	95	92.88	86	98.8

V. CONCLUSION

By using gray level co-occurrence matrix and support Vector machine for classification for the given input images made easier to classify the type of diseases among the five types with the Accuracy 95%. It is painless and timeless process than biopsy method. It is more advantageous to patients.



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