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AUTOMATIC BOUNDARY TRACE SEGMENTATION OF SKIN CANCER USING GLCM BASED ON FEATURE EXTRACTION IN SUPPORT VECTOR MACHINE

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ABSTRACT: Diagnosis Of skin disease requires patients history, physical examination, and proper laboratory diagnostic tests. The diagnosis is very long-term process because it requires large number of features clinical as well as histopathological for analysis and to provide further treatment. Many times the laboratory test such as skin biopsy, scrapings are painful to patients. Today, millions of people are living with cancer or have had cancer or any other skin diseases. The risk of developing many types of cancer can be reduced by changes in a person's lifestyle, for example, by staying away from tobacco, limiting time in the sun, being physically active and healthy eating. Our aim is to find the types of skin diseases by various techniques of image processing. The disease diagnosis becomes difficult as the complexity and number of features of the disease increases. Hence computer aided diagnosis system is introduced. The implementation of computer algorithm consists of certain steps that involves image processing, image feature extraction and data classification with the help of classifier such as Support Vector Machine(SVM).This paper presents a new approach for skin disease detection and analysis from given photograph of patient's cancer affected area, which can be used to automate the diagnosis of skin diseases .These methods are compared for their effectiveness.

Keywords: Skin diseases- cancer, Psoriasis, rashes, Malignant, Wound , Boundary traced Segmentation, GLCM, Classifier SVM.

INTRODUCTION

Human skin is one of the most difficult surface to analyze due to its complexity of uneven edge, tone, presence of hair and other mitigating features. Skin is the surface of the body having some texture; diseased skin has variation in the texture from healthy skin. Human skin contains hemoglobin and Melanin pigments in the structure. The colour of skin changes due to Slight variation of pigment structure. Therefore by analyzing the skin texture and colour a lot of observations can be made regarding the nature of the skin. Skin diseases, if not treated earlier leads to spreading of the infection from one part of the body to other, therefore it is necessary to be cautious regarding skin care. In designing system for the detection of skin disease the difficult task is to identify them because of huge similarities between different classes .These similarities creates confusion because patients have multiple and vague symptoms. The diagnosis of disease from cancer class is very difficult because, at first sight, all these diseases look in the same way. Conventional skin disease diagnosis involves test such as biopsy and scrapings which are painful to patients. In biopsy tubular punch usually 4 mm is inserted into deep dermal or subcutaneous tissue to obtain a specimen .In scrapings scale is taken from the border of the lesion and placed onto a microscope slide. Due to these problems skin disease identification becomes more challenging. To overcome this, A computer aided diagnosis system would be developed. There are many papers that describe the applications of artificial neural networks in medical decision-making. Lots of research has been made .The SVM have the ability to work with medical images for correct disease diagnosis.

A. Skin cancer

It is a disease where cancerous cells form in the skin layer, and affects the cell growth. Image processing is a commonly used method for skin cancer detection from the appearance of affected area on the skin. Skin cancer is a major public health problem in the light skinned population. Skin cancer is divided into non melanoma skin cancer (NMSC) and melanoma skin cancer (MSC).Non melanoma skin cancer (MMSC) is the Types of skin cancer most prevalent cancer among light-skinned population. The critical factor in assessment of patient prognosis in skin cancer is early diagnosis.

B. Psoriasis

It is a common, chronic, relapsing, inflammatory skin disorder with a strong genetic basis (Giardina et al., 2004). One to 2% of the American population has plaque psoriasis. The plaque type is the most common, although several other distinctive clinical variants of psoriasis are recognized (e.g., Psoriasis, Guttate; Psoriasis,Nails; Psoriasis, Pustular) (Naldi, 2004).. The diagnosis of psoriasis is usually apparent clinically but sometimes it may resembles other skin disorders in atypical cases, such as lichen simplex chronicus, nummular eczema, seborrheic dermatitis and melanoma.

C. Malignant

The treatment includes surgical removal of the tumor. If melanoma is found early, while it is still small and thin, then the chance of cure is high. The main design issues for the proper characterization of skin lesions of malignant tumor is the image acquisition, the image pre-processing and analysis, the image segmentation , the feature extraction, and the detection. It is the medium Risk of the skin cancer.

D. Rashes

It is a change of the skin which affects its color, appearance, or texture. A rash may be localized in one part of the body, or affect all the skin. Rashes may cause the skin to change color, itch, become warm, bumpy, chapped, dry, cracked or blistered, swell, and may be painful. Diagnosis must take into account such things as the appearance of the rash, other symptoms, what the patient may have been exposed to, occupation, and occurrence in family members. Rash can last 5 to 20 days, the diagnosis may confirm any number of conditions. The presence of a rash may aid diagnosis; associated signs and symptoms are diagnostic of certain diseases.

E. Wound

Skin types are epidermis, dermis, cutis and sub cutis. The top most layer of skin is represented as epidermis, the next layer followed by the epidermis called as dermis, and the layer in vascular are represented as cutis and sub cutis. Wound is an injury that affect an living tissue or breaking of a membrane and damage the tissue. From the lesion the affected area is extracted by using various filtering, and image segmentation thereby it helps to treat the disease with proper medication.

II RELATED WORKS

An automated system for detection and classification of one of the skin four types of skin cancers are proposed here: Melanoma, Basal cell carcinoma, actinic Keratosis, Squamous cell carcinoma .There are a certain features of these types of skin cancers, which can be extracted using proper feature extraction algorithm [1]. Different algorithms (segmentation and characterization) are used for classification of pigmented skin lesion from a macroscopic image. a new system for characterizing digital images of skin lesions has been presented.. [2]. A scheme for automated detection of skin diseases by analysing the texture recognition techniques based on gray level co-occurrence matrix (GLCM) is discussed here and wavelet decomposition matrix(WDM) and various types of classifiers are used [3].The characteristic features of the test and the reference images and analysed the skin diseases using texture analysis are extracted. Texture analysis is one of the fundamental aspects of human vision by which we differentiate between surfaces and objects. [4]. Segmentation of skin lesion from the surrounding skin in the dermoscopic images by using Neural Network segmentation algorithm. Different segmentation techniques were applied to the dermoscopic images to segment the skin lesions and evaluated with 3 different metrics, namely sensitivity, accuracy and border error. Segmentation performance shows that Neural Network based lesion segmentation has high sensitivity, accuracy and less border error [5]. A study on the past and present technologies for skin cancer detections along with their relevant tools is carried out in details. Then it goes on discussing briefly about features, advantages or drawbacks of each of them. discussed the mathematics preliminary required to process the image of skin cancer lesion using proposed scheme. [6]. A technique for early detection skin cancer problem is proposed. The diagnosing methodology uses Digital Image Processing Techniques and Artificial Neural Networks for the classification of Malignant Melanoma from other skin diseases. Dermoscopic images were collected and they are processed by various Image processing techniques. The cancerous region is separated from healthy skin by the method of segmentation. [7].

III DESIGN CONSIDERATION

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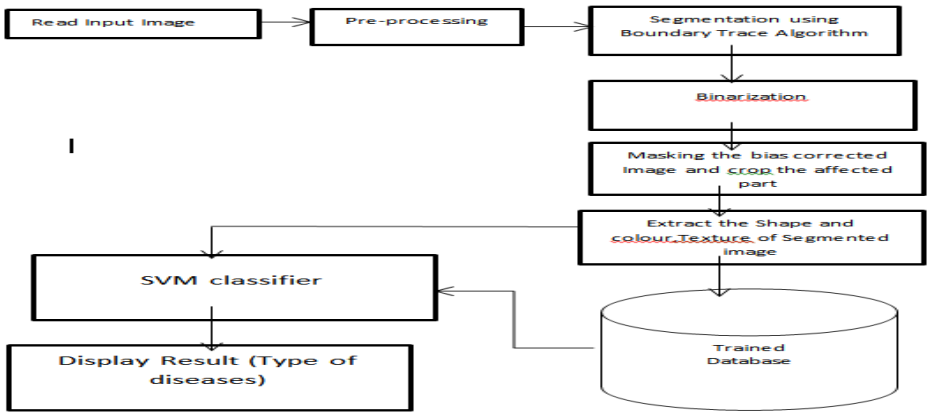

Figure.1.Block Diagram

At first an image is acquired with a digital camera under consistent lighting. The proper interpretation of these dermoscopic images leads to increased clinical diagnostic accuracy. Most Automated Skin Lesion Diagnosis methods adopt the standard computer-aided diagnosis (CAD) pipeline which is illustrated in Fig.1 and it consists of five general stages. After the image is acquired, it contains many artifacts such as hair and oil bubbles which could bias downstream processes are identified. Next, the lesion is segmented from the surrounding healthy skin. After segmentation, discriminative features are extracted from the lesion. Features which are usually extracted are border, colour, entropy, compactness, radial variance of the mask, coarseness. Finally; by extracting these features the detection is done which finally shows the risk probability of the lesion which is present in the image.

IV MATERIALS AND METHODS

A. IMAGE ACQUISITION

In this paper, online database of skin diseases images is used for testing the method. Skin images for cancers, rashes, malignant, wound of different types are obtained from [3], of these images for skin cancer, malignant and normal or harmless skin lesions are collected and database is created for testing purpose.

(a)Skin Rashes image (b)Skin Cancer image (c)Skin Psoriosis image

(d)Skin Maligant image (e)Normal Skin wound image

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B. PREPROCESSING

To remove low frequency or background noise from image, filtering is used remove some hair like material from skin image, if present. Wiener filter removes noise by inverts blurring. wiener filter is optimal which can be used to execute inverse filtering and noise smoothing. The major aim of this filter is to minimize the mean square error between original image and filtered image. The goal of the wiener filter is to filter out noise that has corrupted signal.

C. SEGMENTATION

It partitions an image containing each pixel into distinct regions. It analysis the image and extract the area of interest of defected area. Segmentation accuracy determines the success or failure of computerised analysis procedures. In segmentation isolation of parts of the image that constitute objects or areas of interest is done. Thresholding is done to separate out the regions of the image corresponding to objects in which we are interested, from the regions of the image that corresponds to the background [1].

D. BOUNDARY TRACING ALGORITHM

The boundary tracing algorithm is used to extract the contours of the objects (regions) from an image. When applying this algorithm it is used to find edges, this function looks for places in the image where the intensity changes rapidly, using one of these two criteria: Places where the first derivative of the intensity is larger in magnitude than some threshold. Places where the second derivative of the intensity has a zero crossing. Boundary tracing and image enhancement have been proposed based on combination of Morphology, Weiner filters and thresholding techniques. Image Processing basically includes analysis, manipulations, storage and display of graphical images from sources such as photographs, drawings and so on. Image processing spans a sequence of 3 phases, which are the image acquire, processing and display phase Operation sensitive area could also be defined in edge detection such that it includes places like detection across horizontal edges, vertical edges, or both. Edges are sharpen based on skin lesion segmentation. It is an automatic segmentation.

It is to extract the objects contours using a border tracing algorithm

It is to represent efficiently each extracted contour using chain codes

It is to take advantage of using chain codes in representing the objects' contours (border reconstruction, matching, merging etc.

F. FEATURE EXTRACTION

In pattern recognition and in image processing, feature extraction is a special form of dimensionality reduction.When the input data to an algorithm is too large to be processed and it is suspected to be notoriously redundant then the input data will be transformed into a reduced representation set of features (features vector). Feature Extraction is helpful in identifying Skin cancer. Transforming the input data into the set of features is called feature extraction [4]. In this project we're extracting some features by using GLCM [6].Gray level co-occurrence matrix is a statistical method of examining the texture and the following features can be extracted using this method.

(I)CONTRAST

Contrast is defined as the separation between the darkest and brightest area. Contrast sensitivity is a measure of the ability to discern between luminance of different levels in a static image. Contrast sensitivity is a measure of the ability to discern between luminance of different levels in a static image

$$Contrast = \sum_{i,j=0}^{n-1} P_{i,j} \ (i-j)^2$$

(II)CORRELATION

Digital image correlation is a measure of gray level linear dependence between neighboring pixel and it is used for the measurements of changes in images**.** Correlation is computed into what is known as the correlation coefficient, which ranges between -1 and +1. The autocorrelation function is used as a measure of periodicity of texture as well as a measure of the scale of the texture primitives.

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$$Correlation = \sum_{i,j=0}^{n-1} P_{ij} \frac{(i-\mu)(j-\mu)}{\sigma^2}$$

(III)HOMOGENITY

Homogeneity is defined as the quality or state of being homogeneous. It measures the local homogeneity of a pixel pair. The values are expected to be large if the grey levels of each pixel pair is similar.

$$Homogenity = \sum_{i,j=0}^{n-1} \frac{P_{ij}}{1+(i-j)^2}$$

(IV) SHAPE AND COLOUR

The term shape is commonly used to refer to the geometric properties of an object or its external boundary, as opposed to other properties such as color, texture, material composition. Colour is a component of light which is separated when it is reflected off of an object. Colour can be identified numerically by their coordinates.

(v)TEXTURE

It is the visual characteristic of a surface. For example, a surface can be rough, smooth, hard, and coarse .skin lesion may be differ from size, shape, density and elementary parts.

(VI)INERTIA

It also known as the angular second moment, measures the texture uniformity. High values of energy are expected when the texture presents a grey level distribution that is either constant or periodic .

$$INERTIA = \sum_{i=0}^{G-1} \sum_{j=0}^{G-1} \{i-j\}^2 \times P(i,j)$$

(VII)MEAN AND VARIANCE

Mean value gives the contribution of individual pixel intensity for the entire image & variance is normally used to find how each pixel varies from the neighboring pixel (or centre pixel) and is used in classify into different regions.

$$VARIANCE = \sum_{i=0}^{G-1} \sum_{j=0}^{G-1} (i-\mu)^2 P(i,j)$$

(VIII) ENERGY

It provides the sum of squared elements in the GLCM .Also known as the uniformity or the angular second moment.

$$Energy = \sum_{i,j=0}^{N-1} (P_{ij})^2$$

(IX)CLUSTER SHADE AND CLUSTER PROMINENCE:

Cluster shade and cluster prominence are the measure of the skewness or asymmetry. It emulate human perceptual behavior, they give a measure of the degree to which the outliers in the histogram favor one side or another of the statistical mean.

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$$SHADE = \sum_{i=0}^{G-1}\sum_{j=0}^{G-1}\{i+j-\mu_x-\mu_y\}^3 \times P(i,j)$$

$$PROM = \sum_{i=0}^{G-1}\sum_{j=0}^{G-1}\{i+j-\mu_x-\mu_y\}^4 \times P(i,j)$$

(X)ENTROPY

Entropy is a measure of the uncertainty in a random variable. It measures the randomness of a grey level distribution. It is expected to be high if the grey levels are distributed randomly throughout the image. The energy and the entropy are inversely correlated.

$$Entropy = \sum_{i,j=0}^{N-1} -ln(P_{ij})P_{ij}$$

$$SENT = -\sum_{i=0}^{2G-2} P_{x+y}(i)log(P_{x+y}(i))$$

$$DENT = -\sum_{i=0}^{G-1} P_{x+y}(i)log(P_{x+y}(i))$$

Similarity and dissimilarity of the skin lesion can be identified through different set of features. Finally the extracted features can be given into the classifier and the classifier classifies the skin disease for early prevention of skin cancer.

E. SUPPORT VECTOR MACHINE (SVM) CLASSIFIER

Support vector machines are supervised learning models with associated learning algorithms that analyze data and recognize patterns, used for classification and regression analysis. Given a set of training examples, each marked as belonging to one of two categories, an SVM training algorithm builds a model that assigns new examples into one category or the other, making it a non-probabilistic binary linear classifier. An SVM model is a representation of the examples as points in space, mapped so that the examples of the separate categories are divided by a clear gap that is as wide as possible.

It requires less input of knowledge about the problem than other approaches.
It is skilled of implementing more complex separating of feature space.
It is amenable to high-performance parallel processing implementation of image.
It works for both linear and non-linear data.
It works with high accuracy.

V RESULTS AND DISCUSSION

The experimental results are obtained using Matlab tool. Different skin lesion images are used to identify the skin cancer at early stage.

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Fig(I):Input Image

Fig(II):Preprocessed Image

An Input Image is converted into grey Scale. Then, after displaying the input image the pre-processing stage is being carried. Preprocessing commonly involved in removing of low frequency background noise and normalizing the intensity of the individual particles images, removing reflection, and masking portions. Here, by weiner filtering the noise reduction is done and the noise which is present is removed. Such noise reduction in pre-processing step is done to improve the results of later processing. And also it preserves edges while removing noise By applying Boundary trace Segmentation Method it measure the spreading of the pixel levels each side of the threshold, the pixels that either falls in foreground or background. The aim is to find the threshold value where the sum of foreground and background spreads is at its minimum.

Fig(III):Boundary Traced Lesion

FIG(IV): Binarized ,cropped skin lesion and Enhanced lesion

Fig (v) refers the GLCM based feature extraction. Different features are extracted and it is given to the classifier for further classification of the skin disease.Here all the relative features are extracted from the image. Fig (vi) is referred for Detection and identification using Support Vector Machine(SVM).

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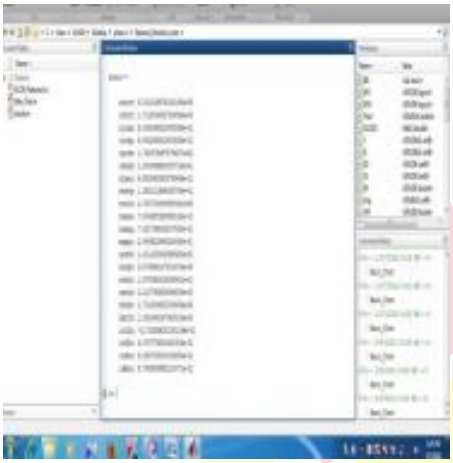
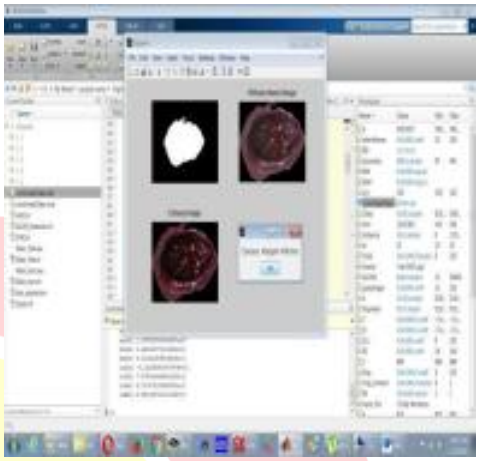


Fig(v):GLCM feature Extraction



Fig(vi):Classifier Result

VI **CONCLUSION**

Thus we have extracted some color and texture features of diseased skin for cancer, Psoriasis, rashes, Malignant, Wound. The results obtained are as shown, which clearly shows the difference between them. Thus we can classify cancer, Psoriasis, rashes, Malignant, Wound based on GLCM features. Early skin cancer diagnostic system using computer based techniques is more efficient than the conventional Biopsy methods. The cost involved as well as the time taken for detection is less in this proposed methodology. The methodology incorporates Artificial Intelligence and Digital Image Processing for skin cancer detection. SVM based classifier proved to be very efficient in decision making as well as pattern recognition applications. The proposed method has an accuracy of 94%, which is much higher than that of conventional methods.

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