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TEXTURE FEATURE EXTRACTION FOR CLASSIFICATION OF MELANOMA

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Abstract - *The skin properties like skin dryness, fungus and allergic symptoms of skin layer may lead to starting symptoms of malignant melanoma skin cancer. The correct identification of skin spots based on certain features is the key steps in detecting the skin cancer disease in advance. The affected skin texture profile correlation with malignant melanoma skin cancer is discussed in the proposed work. In the existing scenario, the skin images are analyzed in frequency domain. The skin color in texture images does not vary over a wide range. Therefore, the histogram profile of the skin texture remains almost flat. We have shifted the skin texture analysis towards the gray level profile analysis. The gray color profile of the skin texture may give fair idea about the skin sensitivity and is a new emerging skin texture analysis tool. In the proposed work, skin gray color profile has been taken as the input parameter in order to ascertain the skin profile. A support vector machine (SVM) classifier is trained to classify the different skin images based on GLCM features. The SVM classifier very well classifies the different skin images into their respective classes using GLCM features.*

Key words— Gray level Co-occurrence matrix (GLCM), Support Vector Machine (SVM), Texture Feature Extraction.

1. INTRODUCTION

Skin Cancer is a disease affecting the skin. Skin cancer may appear as malignant or benign form. Malignant melanoma is the appearance of sores that cause bleeding. Malignant Melanoma is the deadliest form of all skin cancers. It arises from cancerous growth in pigmented skin lesion. It is named after the cell from which it presumably arises, the melanocyte. If diagnosed at the right time, this disease is curable. Melanoma diagnosis is difficult and needs sampling and laboratory tests. Melanoma can spread out to all parts of the body through lymphatic system or blood. Laboratory sampling often causes the inflammation or even spread of lesion. So, there has always been lack of less dangerous and time-consuming methods. Computer based diagnosis can improve the speed of skin cancer diagnosis which works according to the disease symptoms. The similarities among skin lesions make the diagnosis of malignant cells a difficult task.

There are some unique symptoms of skin cancer, such as: Asymmetry, Border irregularity, Color variation and Diameter. Those are popularly known as ABCD parameters. ABCD parameters. Asymmetry, Border irregularity, Color, Diameter. Asymmetry is one half of the tumor does not match the other half. Border Irregularity is the unevenness of images. Color intensity change in the lesioned region is irregular. Malignant melanoma is having a diameter greater than 6 mm. The single most promising strategy to cut acutely the mortality rate from melanoma is early detection. Attempts to improve the diagnostic accuracy of melanoma have spurred the development of innovative in-vivo imaging modalities, including total body photography, dermoscopy, automated diagnostic system and reflectance confocal microscopy.

There are many traditional methods available to detect skin cancer. But early detection of skin cancer is always better. Usually doctors use Biopsy method for the diagnosis of skin cancer. It is the removal of the skin and those skin samples are undergone many laboratory testing for diagnosis. It is painful and time consuming technique. So aim is to develop Computer Aided Detection system for skin cancer. It is always less dangerous and time-consuming method.

1.1 Background

Skin cancer is the most dangerous types of skin diseases and lesions from which people suffer in the case of late diagnosis; it can threat the patient's life. The goal of any imaging technique used in dermatology is to diagnose melanoma in early stages, because it depends on effectiveness of treatment. Investigations shows, that early diagnosis is more than 90% curable and late is less than 50%. The diagnosis and successful treatment is often supplemented with permanent monitoring of suspicious skin lesions .Skin cancer is a major public health problem [1]. We analyzed Different type of skin cancer. It is divided into non melanoma skin cancer (NMSC) and melanoma skin cancer (MM). Non melanoma skin cancer (MMSC) is the most prevalent cancer among light-skinned population. It is divided into basal cell carcinoma (BCC) (75%), squamous cell carcinoma (SCC) (24%), and other rare types (1%) such as sebaceous carcinoma. The age-standardized incidence rates per year of basal cell carcinoma is 175 per 100,000 in men and 124 per 100,000 in women.1 Rates of squamous cell cancer are 63.1 per 100,000 in men and 22.5 per 100,000 women. Non melanoma skin cancer is seldom lethal, but if advanced can cause severe disfigurement and morbidity. The critical factor in assessment of patient prognosis in skin cancer is early diagnosis .More than 60,000 people in the United States were diagnosed with invasive melanoma in recent years, and more than 8000 Americans died of the disease [2].

Malignant melanoma is the deadliest form of all skin cancers. The authors present a novel neural network approach for the automated separation of melanoma from three benign

categories of tumors which exhibit melanoma-like characteristics. Our approach uses discriminant features, based on tumor shape and relative tumor color that are supplied to an artificial neural network for classification of tumor images as malignant or benign. With this approach, for reasonably balanced training/testing sets, we are able to obtain above 80% correct classification of the malignant and benign tumors on real skin tumor images [3]. In paper [4], an automatically skin cancer classification system is developed and the relationship of skin cancer image across different type of neural network are studied with different types of preprocessing.. The collected images are fed into the system, and across different image processing procedure to enhance the image properties. A preliminary study of a proposed statistical model is present using the multispectral images of experimental models in paper [5].

Paper [6] presents an automated method for melanoma diagnosis applied on a set of dermoscopy images. Features extracted are based on gray level Co-occurrence matrix (GLCM) and Using Multilayer perceptron classifier (MLP) to classify between Melanocytic Nevi and Malignant melanoma. MLP classifier was proposed for detection of skin cancer. This paper summarizes the some of the most important developments in neural network classification research. Specifically, the issues of posterior probability estimation, the link between neural and conventional classifiers, learning and generalization tradeoff in classification, the feature variable selection, as well as the effect of misclassification costs are examined [7]. We analyzed reports of an investigation into the application of a multilayer perceptron to the diagnosis of skin melanoma. The lesions are classified as either benign or malignant based on information relating to the shape of their outline.

Color image segmentation methods can be seen as an extension of the gray image segmentation method in the color images, but many of the original gray image segmentation methods cannot be directly applied to color images. We analyzed proposed a color image segmentation method of automatic seed region growing on basis of the region with the combination of the watershed algorithm with seed region growing algorithm which based on the traditional seed region growing algorithm.

At present the diagnosis of melanoma is mainly performed based on the experience of each doctor. The doctors need some objective measure for diagnosis of melanoma and nevus. But there are few researches on objective index for the diagnosis. We analyzed that this work deals with features of melanoma and nevus for computer diagnosis. First, we extracted the contour of lesions with image processing. One hundred five values of features were computed based on ABCD-rule. Discriminant analysis showed the accuracy of 96.0% (specificity of 98.3 % and the sensitivity of 90.0%). The results obviously showed the difference between melanoma and nevus [11]. In paper [12], there was a new approach to extract global image features for the purpose of texture classification. The proposed texture features are obtained by generating an estimated global map representing the measured intensity similarity between any given image pixel and its surrounding neighbors within a certain window. The intensity similarity map is an average representation of the texture-image dominant neighborhood similarity.

1.2 Motivation

Skin cancer is mostly found in the light-skinned population. Darker skin has more pigment-making cells, which provide some inherent protection against UV rays, but not enough. This unique biological difference means harmful effects of UV exposure occur more slowly in people of color, but UV rays are still damaging and can cause cosmetic problems and serious conditions like skin cancer. If your doctor determines you have skin cancer, you may have additional tests to determine the extent (stage) of the skin cancer. But if you have a large squamous cell carcinoma, Merkel cell carcinoma or melanoma, your doctor may recommend further tests to determine the extent of the cancer. Aim of this report to produce computer aided classification system which distinguishes malignant melanoma from benign melanoma using imaging techniques and software. It uses digital image processing technique and artificial intelligence for the classification.

2. PROPOSED APPROACH

Skin cancers are the most common form of cancers in humans. It is a deadly type of cancer. Most of the skin cancers are curable at initial stages. So an early detection of skin cancer can save the patient's life. With the advancement of technology, early detection of skin cancer is possible. One such technology is the early detection of skin cancer using Artificial Neural Network. The diagnosing methodology uses image processing techniques and artificial intelligence. The dermoscopy image of skin cancer is taken and it is subjected to various pre-processing for noise removal and image enhancement. Then the image is undergone image segmentation using Thresholding. There are certain features unique for skin cancer regions. Such features are extracted using feature extraction technique – Gray level co-occurrence matrix, ABCD rule, ROI etc. These features are given as the input nodes to SVM. SVM act as classifier and can be used for classification purpose. It classifies the given data set into cancerous or non-cancerous.

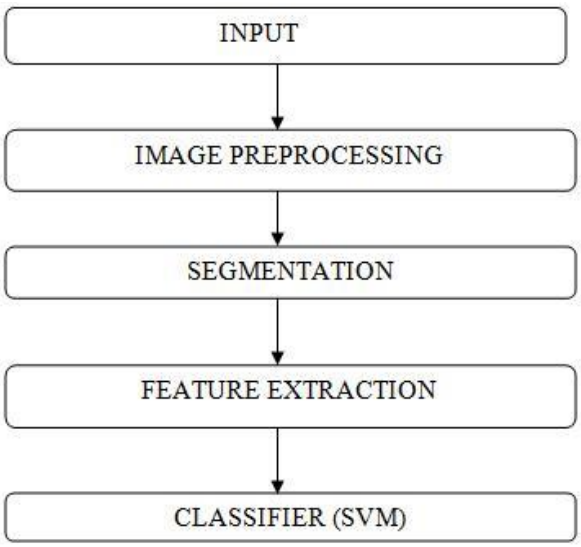

Fig -1: Block diagram of proposed methodology

2.1 Texture feature extraction

A. GRAY LEVEL CO-OCCURRENCE MATRIX (GLCM)

In statistical texture analysis, from the distribution of intensities the texture features are obtained at specified position relative to one another in an image. The statistics of texture are classified into first order, second order and higher order statistics. The method of extracting second order statistical texture features is done using Gray Level Co -occurrence Matrix (GLCM). First order texture measure is not related to pixel neighbor relationships and it is calculated from the original image. GLCM considers the relation between two pixels at a time, called reference pixel and a neighbor pixel. A GLCM is defined by a matrix in which the number of rows and columns are equal to the number of gray levels G in an image. The matrix element P (i, j | Δx, Δy) is the relative frequency where i and j represents the intensity and both are separated by a pixel distance Δx, Δy. The different textural features such as energy, entropy, contrast, homogeneity, correlation, dissimilarity, inverse difference moment and maximum probability can be computed using GLCM matrix.

B. COLOR FEATURE EXTRACTION

Color is considered as another important feature descriptor for the classification of melanoma. If the particular region is affected the skin lesions region changes the color effectively. Relative color histograms in different color spaces are constructed to identify the melanoma. The 3-D histogram is constructed for the color spaces such as RGB, LAB, HSV, HUE and OPP [12]. RGB color space represents a mixture of Red, Green and Blue. The color component is represented by the mixture coefficients of these three colors. The drawbacks of the color spaces are not perceptually uniform, and it depends on the acquisition setup. It provides a high correlation among these three color channels. Different color representations have been proposed to overcome these drawbacks. e.g: the edges are strengthened in biologically inspired color spaces such as the opponent color space (OPP), hue saturation and brightness (HSV and HIS) are the color spaces related to human description of color, CIE La*b* and L*uv are perceptually uniform color spaces. These two color spaces are device independent. For these histograms 8x8x8 = 512 color bins are generated and it is considered as a single feature vector. This feature vector is given as an input to the SVM classifier to calculate the sensitivity and specificity.

2.2 Support vector machine (SVM) classifier

Support vector machine is considered as the supervised learning models. It is a kind of learning algorithm which is used to analyze the data and recognize the data patterns. This algorithm is used for the purpose of classification. It is mainly applicable for solving the binary problems. SVMs have several advantages over the more classical classifiers such as decision trees and neural networks. The support vector training mainly involves optimization of a convex cost function. Therefore, there is no risk of getting stuck at local minima as in the case of back propagation neural networks. The principle of structural risk minimization is used in SVM which minimizes the upper bound on the generalization error. Therefore, SVMs are less prone to over fitting when compared to algorithms such as back propagation neural networks that implement the ERM (empirical risk minimization principle). Another advantage of SVMs is that they provide a unified framework in which different learning machine architectures (e.g., RBF networks and feed forward neural networks) can be generated through an appropriate choice of kernel .The disadvantage of support vector machines is that the classification result is purely contradiction.

3. CONCLUSIONS

A Computer aided skin cancer detection system is proposed. It can be better diagnosis method than the conventional biopsy method. Computer based skin cancer detection is more advantageous to patients, by which patients can identify the skin cancer without going to hospital or without the help of a doctor. It saves a lot of time for patients.

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