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Melanoma Skin Cancer Analysis

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***Abstract*—**Nowadays, there are various highly accurate, complex systems which are used for diagnosis of different skin cancers. However, such treatments cause a heavy load on the human body which might lead to negative side effects on the body parts. Since, Early Stage Detection of Skin Cancer is necessary and a basic step, we present a Computer Aided System for detection of Melanoma Skin Cancer using Image Processing and Machine Learning. This process will be carried out without any penetration of radiations through the body. This system is going to be as an early warning tool to avoid the future consequences during further treatments.

Keywords: *Lesion, Melanoma, Benign, MelaFind, Wavelet, Fourier, Clustering, Classification, Pre-processing, Morphological, Contrast Enhancement, Dilation, Erosion, Histogram, Thresh- olding, Binarization, Contour, Random Forest.*

I. INTRODUCTION

As per the statistics from the American Cancer Society, Melanoma is the deadliest form of Skin Cancer. Melanoma is a cancer that begins in the melanocytes. These are the cells that can become melanoma. They make a brown pigment called melanin, which gives the skin its tan or brown color. Melanin protects the deeper layers of the skin from some of the harmful effects of the sun. For most people, when skin is exposed to the sun, melanocytes make more of the pigment, causing the skin to tan or darken.The major reason the occurence of Melanoma is high Exposure to Ultra Violet Rays. Due to the depletion in the Ozone layer, the will be increase in the U.V rays exposure which will give rise to Melanoma. Dermatoscopy is a non evasive examination for diagnosis of Melanoma Skin Cancer based on use of Incident Light and Oil Immersion for the Visual Analysis of the sub-surface structures of the skin. Even though, Dermatoscopy is much efficient than any other unaided observation based detection, its diagnostic accuracy depends on the training of the Dermatologist. There should be availability of an expert doctor with proper facilities and equipments. Thus an automated diagnostic system which should be efficient as well as cost-effective is needed for doctors. Computer is not as intelligent as a human but will be able to extract information from a structure which is difficult to be perceived by a human. This system will be able to detect cancer with a higher accuracy than a Dermatologist.

II. LITERATURE SURVEY

Science and Technology has been gradually enhanced and used to facilitate many pioneering and extraordinary inventions in the field of medicine. Many systems for detection of symptoms and their treatment have been made in order to make medical conditions much better than the previous generations.

A. Techniques

There have been various researches done on this Domain and many new methods have been carried out. [8] Stanford has built a Super Computer named MelaFind. It provides your dermatologist with critical information when deciding to biopsy irregular moles. However, cost is a major factor for this system. Being a super computer, it cannot be afforded by all the hospitals which automatically reduces the scope of this system. Melanoma being about the mole, has specific properties to identify it in the mole. There are 4 basic features of melanoma.

1. Asymmetry - One half of the mole is different from the other half.
2. Border - An irregular, scalloped or poorly-defined border.
3. Color - The color of this mole varies from one area to another. It can have shades of tan, brown, or black; or is sometimes white, red, or blue.
4. Diameter - Melanomas are usually greater than 6 mm (the size of a pencil eraser) when diagnosed, but the size can vary. Based on these features which can be extracted from an image are been carried out in various techniques among which,

[1] a multi level wavelet-based texture analysis method for classification of melanoma which represents a approach for distinguishing benign and melanoma skin lesions from digital images. The features were collected from coefficients cre- ated by multi-level Discrete Wavelet decompositions. Wavelet analysis, like Fourier transformation, which are used for a number of operations in signal analysis. The mean and variance of wavelet coefficients for a two level decomposition were calculated and used in a neural network to make a classification.

[2] Another technique was proposed in which to improve the accuracy level, a k-means clustering is proposed followed by local binary pattern which not only clearly detects the melanoma but also segment the cancerous part from the back ground. Further, the image is confirmed by using the local binary pattern in order to do the dimensional analysis of the skin cancer. The algorithm is tested on different skin image data base covering different stages of skin cancer and normal images. [3] A fast and fully automatic algorithm for skin lesion segmentation in dermoscopic images was presented using Delaunay Triangulation is used to extract a binary mask of the lesion region, without the need of any training stage. A quantitative evaluation was conducted on a publicly available database. [4] A Blind Image Deconvolution (BID) procedure was implemented to restore mammographic images from Gaussian blur and then enhancement process is done using real dual tree wavelet transform. The result of these methods is also compared with the hybrid combination of BID, conventional wavelet Transform and median filter approach to remove Gaussian noise, Salt Pepper and Speckle Noise with Gaussian blur. Mini-MIAS database is considered to evaluate the performance of these techniques.

B. Tools and Libraries

[5] OpenCV (Open Source Computer Vision Library) is released under a BSD license and hence it's free for both academic and commercial use. It has C++, Python and Java

interfaces and supports Windows, Linux, Mac OS, iOS and Android. OpenCV was designed for computational efficiency and with a strong focus on real-time applications. Written in optimized C/C++, the library can take advantage of multi- core processing. Enabled with OpenCL, it can take advantage of the hardware acceleration of the underlying heterogeneous compute platform [6] Random Forest Decision trees involve the greedy selection of the best split point from the dataset at each step. This Algorithm is used to create each tree, meaning that it is likely that the same or very similar split points will be chosen in each tree making the different trees very similar (trees will be correlated). This, in turn, makes their predictions similar, mitigating the variance originally sought.

III. PROPOSED METHODOLOGY

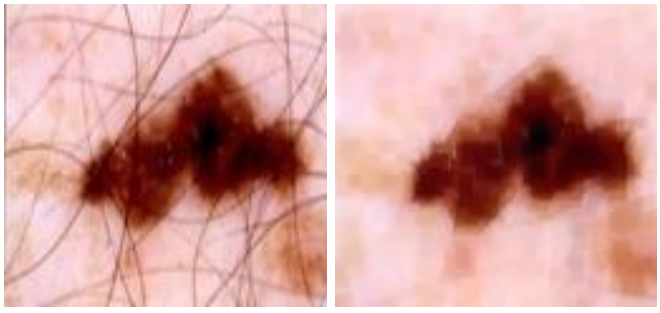
The first phase consists of three modules namely Preprocessing of the Skin Lesion, Segmentation of the Skin Lesion and Feature Extraction from the segmented lesion.

A. Preprocessing of the Skin Lesion

The image obtained as input might be a noisy image containing many artifacts like hair, bubbles, etc. Hence, in order to remove these artifacts, The image obtained needs to be enhanced to refine the further processing. The skin lesion image taken as an input will be preprocessed in following steps

a) Applying Morphological Transformations: In order to remove the artifacts like hairs, Bubbles from the input image. Combination of Dilation and Erosion transformations are used. These operations are mapped on the image using a kernel which sums up the small areas with the larger background areas in terms of intensity values.

b) Applying Contrast Enhancement on the lesion image: The image after applying morphing turns out to be blur. Hence, it needs to be enhanced by intensity. This can be achieved using Histogram Equalization, where all the intensity values in the image are computed along with their frequencies and a cumulative histogram intensity is applied over the image. This contrasted image is converted into a gray scale image.



(a) Input Lesion Image with arti- artifacts facts (b) Lesion image after removal

Fig. 1: Preprocessing of the Lesion image

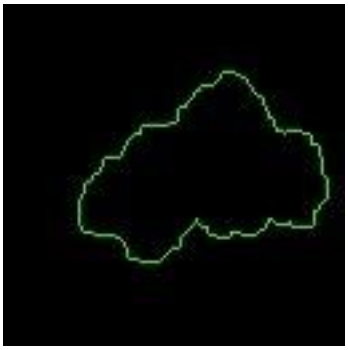


Fig. 2: Contour Detected Lesion for Feature Extraction

c) Binarization of the lesion image using maximum en- tropy thresholding: The grayscale image is binarized using a threshold value which is computed as the maximum entropy value considering the intensity variation in the entire lesion image.

B. Segmentation of the Skin Lesion

The image obtained is a binarized image which is further processed for segmenting the skin lesion. This stage will be accomplished by Blob detection using Contours. The Contours are used to detect boundaries in an image using the logic of instant change in the intensity. Contour points are obtained in vector and then these points are mapped onto a black image. All the contours obtained are compared to find the largest contour for the lesion.

C. Feature Extraction from Segmented Lesion

There are various features which can be considered for recognizing the melanoma skin cancer but we will be considering only those features which are most certain for the analysis of the cancer. The features of melanoma are divided into three categories:

a) SHAPE: : This category consists of features such as Asymmetry of the lesion image which is computed using Major axis and Minor axis of symmetry, Border Irregularity which depends on the uniformity of the area of the lesion over its boundary (perimeter) and Diameter of the lesion using the Center of Mass of the lesion.

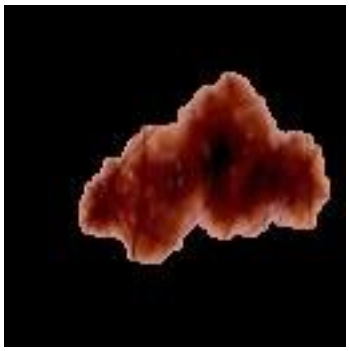


Figure 3: Segmented lesion image

b) COLOUR: The color feature is computed in terms of three values which are Hue, Saturation and Value. Hue is more specifically described by the dominant wavelength and is the first item when adding in the three components of a color. Value refers to the lightness or darkness of the colour. Saturation defines the brilliance and intensity of a color.

c) TEXTURE: : There are 3 texture features which defines the lesion image. Coarseness aims to identify the largest size at which a texture exists, even where a smaller micro texture exists. Contrast aims to capture the dynamic range of gray levels in an image, together with the polarization of the distribution of black and white. Directionality refers to a global texture property which is measured on a scale of 0 to 10.

D. Training the System using Random Forest Classification

Decision tree concept is more to the rule based system. Given the training dataset with targets and features, the decision tree algorithm will come up with some set of rules. The same set rules can be used to perform the prediction on the test dataset. In random forest algorithm, Instead of using information gain for calculating the root node, the process of finding the root node and splitting the feature nodes will happen randomly

In order to train the system for classification using the feartures extracted, Random Forest Algorithm is considered which works efficiently for Classfication of Finite Features. In order to train the system for classification using the feartures extracted, Random Forest Algorithm is considered which works efficiently for Classfication of Finite Features.

References

[1] Murtagi Natiq Faris Alsaeed, E.Sreenivasa Reddy "Skin Lesions Detection By Using Multilevel Wavelet Transform" International Journal Of Inventions In Computer Science And Engineering ,Volume2 Issue 5 May 2015

[2] Ramandeep Kaur, Gurmeen Kaur "Skin Cancer – Melanoma Detection In Skin Images Using Local Binary Pattern (Lbp) And Glcm" Doi: 10.1063/1.4968145 Conference: 4th International Conference On Fundamental And Applied Sciences (Icfas2016)

[3] Shehzad Khalid, Uzma Jamil, Kashif Saleem, M. Usman Akram, Waleed Manzoor, Waqas Ahmed And Amina Sohail "Segmentation Of Skin Lesion Using Cohen–Daubechies–Feauveau Biorthogonal Wavelet" Khalid Et Al. Springerplus (2016) 5:1603doi 10.1186/S40064-016- 3211-4

[4] Andrea Pennisi, Domenico D Bloisi And Daniele Nardi, Skin Lesion Image Segmentation Using Delaunay Triangulation For Melanoma Detection.

[5] OReilly OpenCV Learning Book by Gary Bradski and Adrian Kaedlar

[6] Decision Trees and Random Forests: A Visual Introduction For Beginners: A Simple Guide to Machine Learning with Decision Trees

[7] www.cancer.org/cancer/melanoma-skin-cancer/detection

[8] R.M. Nishikawa, M.L. Giger, K. Doi, C.J. Vyborny and R.A. Schmidt. 1995. "Computer aided detection of clustered micro calcifications in digital mammograms," Med. Biol. Eng. Comp. Vol. 33, pp. 174-178.