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STUDY OF TECHNIQUES USED FOR SEGMENTATION AND CLASSIFICATION OF SKIN LESION

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ABSTRACT

The most dangerous and common type of cancer is skin cancer and the deadliest form of it is melanoma. To monitor the patient by using a computerised system that utilizes the images of skin lesion which is captured using dermatoscope are required. The segmentation is used to detect skin lesions from these images. There are different method for segmentation that are used to detect skin lesion from dermoscopic images and also it detect the pigmented lesions that are presented. By using the segmentation the various images can be classified into skin and non skin pixels based images. In this paper the review of various segmentation techniques used for detecting different types of skin lesions are to be done. The main goal of using segmentation technique is accuracy, speed and computational speed. The proposed literature studies various techniques used to perform segmentation and classification of MRI dataset. existing techniques are discussed mathematically hence it is possible to extract best technique for future enhancement.

Keywords- ***Skin Cancer, melanoma, dermatoscope, segmentation and classification, pixel, pigmented***

1. INTRODUCTION

Skin Cancer is most common type of disease present within humans. Early detection of this disease is compulsory in order to recover from the disease. Early detection if fail, may even cause death. Skin lesion is categorised as:

a. Melanoma
b. Mole

Melanoma is less common type of skin cancer occur within humans but it impact is dangerous. Death rate caused

by Melanoma is 75% of all cancerous diseases. Melanoma at its own sometimes known as skin cancer.

Mole (nevus) is a benign skin lesion present on uppermost layer of skin. Skin region affected with mole becomes brown. Detection of this disease at early stage can cure a person but at later stage it could result in dangerous impactful problems.

Image processing is the need of the hour in detecting commonly occurring diseases. Detecting regions from the skin appearing different than usual is fascinating task and play critical role in human computer interaction suggested by (1). Skin cancer is increasing by leaps and bounds and hence early detection of the same is necessary. One of the deadly skin cancer is melanoma which if detected at stage 4, survival rate is only 9-15% but if detected early at stage 2, survival rate is increased to 85-99% as proposed by (2). Thus early detection of such cancers is essential for well being of living entities.

Various classification mechanisms for detection of skin lesions is proposed through this literature. Skin artifacts removal scheme proposed by (3). Two steps involving distortion removal from radar signals and then performance is analysed by the use of artificial neural network strategies. Ad-hoc skin classifier is proposed by (4). The proposed model is less dependent on changes in the skin colour, illumination conditions etc. (5) proposes skin lesion detection from CMYK images. CMYK is not used most often but turned out be good choice in the detection of skin lesion as proved through experimental results. Melanoma early detection is proposed by (6). This work suggests two major components of a non-invasive skin lesion detection and prevention system which is fully automatic and used for the early detection and prevention of melanoma. The first component uses the equations to generate alerts preventing skin burn due to sunlight. The equation also calculates the time it takes to completely burn the image due to sun burn. The second component is fully automatic skin analysis module used to perform classification, feature extraction etc. (7)proposes pixel wise skin colour detection based on neural network technique. The worth of the research is proved through experimental research. (8) Proposes multicenter wave waveguide for early detection of skin cancer. The device used is easy to fabricate and produces better result as compared to existing literature.

2. LITERATURE SURVEY

This section conducts the survey of existing techniques already being employed to check the skin lesion.

2.1 SUPPORT VECTOR MACHINE AND ANN (ARTIFICIAL NEURAL NETWORK)

Skin lesion detection is compulsory at early stage to avoid deadly effects within human body. Death rate is

enhanced considerably if detection is at 4th stage. Recovery rate is greatly enhanced if it is detected at 2nd or early stage of lesion. Support vector machine is one of the effective images processing segmentation mechanism used to detect distinguished part from the original part. (9) proposed precise segmentation strategy. Precise segmentation of the infected area along with surrounding area is critical for accurate analysis and diagnosis of lesion. Improved ALDS based on probabilistic approach is followed. Neural network decision theory is used to detect the melanoma. The member ship function decide melanoma if obtain value is within the range specified for particular member function. To minimize the energy consumption active contour is used. The energy function used is listed as under

$$E_{Total} = \int_0^1 E_{int}(V(s) + E_{img}(V(s)) + E_{con}(V(s))$$

Equation 1: Total Energy Consumed

E_{total} is the total of energy consumed during segmentation. E_{int} , E_{img} and E_{con} are the energy consumed during image initialization, image processing and conversion. V indicates the vector initialization during support vector machine operation. As proposed by [9], In the initial observation results were not consistent, hence similarity index was observed, using the following equation

$$SSIM = \frac{(2u_x u_y + c_1)(\sigma_{xy} + c_2)}{(u_x^2 + u_y^2 + c_1)(\sigma_x^2 + \sigma_y^2 + c_2)}$$

Equation 2: Similarity Index

U_x and U_y indicates the membership functions whose value lies between 0 and 1. After this step feature extraction and comparison is performed using SVM and ANN techniques. Obtained results suggest optimality of this technique.

2.2 SVM AND DEEP BELEIF NETWORK

Skin Lesion image detection process begins by first feature extraction and then feature selection process. For this purpose segmentation is required and classifiers are required to be trained. (10) proposed SVM and Deep belief network for detection of skin lesion. A test vector x is considered for training purpose. Final classification through classification model is given through the following function

$$F_{final} = sign(w.(f_i(x)_{k*i)}$$

Equation 3: Final Classification

The classifier includes deep learning architecture and exponential loss function used to enhance seperability. Deep

belief network is constructed using greedy layer wise unsupervised learning algorithm and parameter space of W is constructed by the use of unsupervised learning approach along with exponential loss function for fine tuning the classifier. Accuracy of the classifier is up to 95% hence is efficient.

a. SVM AND TEXTURE CLASSIFICATION

(11)propose mechanism to classify demography image into melanoma and non melanoma images. Texture and colour features are extracted for analysing the same. GLCM is used to extract the texture features of an image. Colour histograms are effective mechanism proposed to extract the colour features in three colour spaces with primary colour collaboration including RGB, HSV and OPP. Classification is generated by the use of SVM(Support Vector Machine).(12) proposes ship detection by the use of texture and SVM classification. Image is characterized into sub block to reduce the complexity of the image. Each block is processed separately and then collaborated together to form complete image. Supervised learning technique SVM is used for classification. From the mathematical point of view, feature extraction mechanism utilized following equation

$$for\ label\ pair(i,j)\ x = 1 - - - l$$

$$\min(y) = \frac{1}{2} w^t w + C \sum \delta$$

Equation 4: Feature Extraction function

W is known as weight factor, δ known as misclassification, C is known as regularization parameter.

Classification and accuracy can further be improved by the use of neural network techniques along with SVM (Support vector machine.

3. PARAMETER TO BE OPTIMIZED.

Using segmentation and feature extraction, critical features associated with the diseases can be extracted and used to detect disease accurately. Parameters to be optimized includes

- Accuracy

The accuracy of extracted attribute should be high in case of correct classification

- F-Score

F-Score is overall score of various parameters obtained from image segmentation. The parameters may include slandered deviation, moments, kurtosis, mean, geometrical mean etc

- Precision

This gives the absolute result rather than approximate result. Precision in case of successful segmentation should be high.

- Recall

Recall indicates the feedback parameter obtained after comparison of segmented image with the original image.

4. CONCLUSION

Analysis of existing techniques associated with skin lesion detection indicates that support vector machine gives better results as compared to other strategies in terms of segmentation. The rate at which segmentation is performed however could be an issue. The image can be compressed and then presented to SVM for segmentation. The clarity of image can be further enhanced using various filtering mechanism including median filter along with Gaussian filter.

Compression, filtering and segmentation can be merged along with classification to accurately detect skin lesion in future.

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