International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 03 Issue: 05 | May-2016 www.irjet.net p-ISSN: 2395-0072

SEGMENTATION OF SKIN LESION FROM DIGITAL IMAGES USING MORPHOLOGICAL FILTER

M.Yuvaraju[1], D.Divya[2], A.Poornima[3]

[1]Assistant Professor, Department of EEE, Anna University Regional Campus, Coimbatore, Tamil Nadu, India
rajaucbe@gmail.com

[2]Assistant Professor, Department of EEE, Anna University Regional Campus, Coimbatore, Tamil Nadu, India
divyadevarajan@gmail.com

[3]PG Scholar, Department of EEE, Anna University Regional Campus, Coimbatore, Tamilnadu, India
a.poorni69@gmail.com

---***---

Abstract - *Skin cancer is the deadliest form of skin disease. Its incidence has been rising at a rate of 3% per year. In order to reduce the cost of screening, there is a need for an automated melanoma screening system. Segmentation is significant to detect skin lesion from images. In the proposed method, a novel texture based skin lesion segmentation algorithm is used and probabilistic neural network is used to classify the stages of skin cancer. The feature of the image is extracted by using GLCM algorithm and its features gives better classification with probabilistic neural network. The five different skin lesion is commonly grouped into Basal Cell Carcinoma (BCC), Actinic Keratosis (AK), Squamous Cell Carcinoma (SCC), Melanocytic nevus/mole (MC), Seborrhoeic Keratosis (SK).The system will be used to classify the queried images automatically to choose the stages of abnormality. The morphological filter segmentation is used to detect the skin cancer. The proposed system has higher accuracy, sensitivity, specificity, segmentation compared to other systems.*

Key Words: *Skin cancer, Grey level co-occurrence matrix, Probabilistic Neural Network, Segmentation.*

1. INTRODUCTION

Skin is commonly used primal in image processing and the applications range from face tracking to signal analysis for different human interactions. Generally skin cancers are the most common prevalent form of cancers in human beings. Surprisingly it is also a deadly type of cancer. Many of the skin cancers are curable at early stages. Also with the technology advancements, early detection is possible [1]. The American cancer society estimates that more than 70,000 new skin cancers are diagnosed every year in the United States alone. The skin cancers can be classified into melanoma and non-melanoma. Melanoma is the most deadly form and are predictable 76,690 people being diagnosed with melanoma and 9480 people quiet of melanoma in the United States. In the United States the life time hazard of receiving melanoma is 1 in 49 [2].

Melanoma reasons for approximately 75% of deaths related with skin cancer. It is a malignant tumor of the melanocytic and generally happens on the trunk or lower extremities. Recent trends have stated that melanoma can be less dangerous if detected at a premature stage. I.e. if detected at stage I the survival rate of the effected person increase to 96% [3]. Due to the increase in the incidence rate of melanoma, researchers are more concerned about proposing such automated systems that diagnose skin lesion correctly. Also it has been found that in order it detect Melanoma at an early stage screening is very much valuable [4] but the cost of screening melanoma is too high. So to reduce the screening cost the automated algorithms have been proposed to automatically screen melanoma.

A digital dermoscope acquires images that contribute to early screening of melanoma [5] and all automated systems use dermoscopic images. Dermoscope is a device that is used to capture images of lesion by the dermatologists. It also magnifies the image and acts as a filter. With dermoscopy it becomes difficult to differeniate malignant and benign lesion and in such case a detailed analysis is needed to be done [6]. Recent work with automated melanoma screening algorithms tries adapting the algorithms to analyze image directly taken by a standard digital camera. The common approach includes, image segmentation, feature extraction, lesion classification [7]. Segmentation is the one of the most important steps in accurately determining a skin lesion.

Segmentation sub-divides a digital image into several segments which simplifies the illustration of an image making it more significant to analyze. Segmentation is a process in which each pixel in a digital image is assigned with a label to distinguish among pixels sharing same label and features. Before classifying the lesion as malignant or benign and extracting features from it, a segmentation algorithm must be used to place and identify the skin lesion. Many segmentation algorithms for digital images use color information in a single channel or in three color channels i.e. red, green and blue.

The proposed method comprises first step is preprocessing the image to convert the RGB images into HSV image. After that the features like contrast, correlation, energy, homogeneity, entropy, and correlation are extracted while the segmented image using Grey Level Co-occurrence Matrix (GLCM).The classification of the lesion as cancerous or normal is done using Probabilistic Neural Network. After classification the segmentation is done by morphological filter. The performance of the system is figured out with accuracy, specificity and sensitivity.

2. RELATED WORKS

In recent advances, various computer vision based melanoma detection systems have been implemented and used in many hospitals. As melanoma is a most growing cancer, the systems are aiming at detecting the skin lesions at the early stages so that the chance of cure is high [8]. Many computer vision-based diagnosis systems have been commonly used in various hospitals and by Dermatologist in their clinics to extract and detect the melanoma at the early stage and mainly the recognition of malignant tumor. This dissertation presents new approach to classify and diagnose the cancerous tumor.

A new method is developed for evaluating and detecting the textures that visible in the abnormal skin test image. In the skin images that acquired through the dermatoscope, these texture features are used to identify and place the nature of the skin lesion whether it is cancerous or not. The proposed method uses the adaptive filter to find the threshold that enthused by swarm intelligence (SI) optimization algorithms. In medical image processing, segmentation of skin images is a significant problem, also plays an important role in computer vision applications. Skin segmentation subdivides an input image into necessary regions that segregate the skin regions. This paper proposes a skin color segmentation method i.e. K-means clustering and texture feature extraction. Existing skin segmentation classifiers are improved by combining the extracted feature of color and texture for segmentation purpose [9].

Detection is a very effective method and it was used by the doctors to diagnose the sensitive images or can say to detect the tumor or cancer regions. In this study, the methodology consist three color spaces HSV, RGB and YCbCr; these are used to do experimental comparison of skin color recognition. HSV color space based skin color detection has a very essential characteristic [10].

Melanoma is not common like other type of cancers. It is dangerous if not treated during its early stages. Someone can get melanoma. However this is particularly common between the non-Hispanic males and females. When melanoma found early and well treated then the cure rate is almost 100% [11].

The Multistage illumination algorithm reduces the illumination difference in images containing skin lesions. The first step includes a monto Carlo nonparametric modelling approach that gives an approximation of the illumination map. In the second step parametric modelling approach is used to draw a final assessment of the illumination map. Improved segmentation, classification and visual results are shown by the final illumination map approximation [12].

The proposed system contains a decision support component that uses perspective knowledge i. e age, gender, skin type, etc. and combines it with image classification to estimate risk of melanoma. In proposed method defines a statistical textural distinctiveness approach that uses sparse texture model that represents the textural distinctiveness. The probability of occurrence of all representative textures computes the saliency of the pixels [13].

3. METHODOLOGY

This algorithm for detecting melanoma lesion involves three main steps: pre-processing, feature extraction classification and morphological segmentation. Fig.1 illustrates the overall architecture of the system.

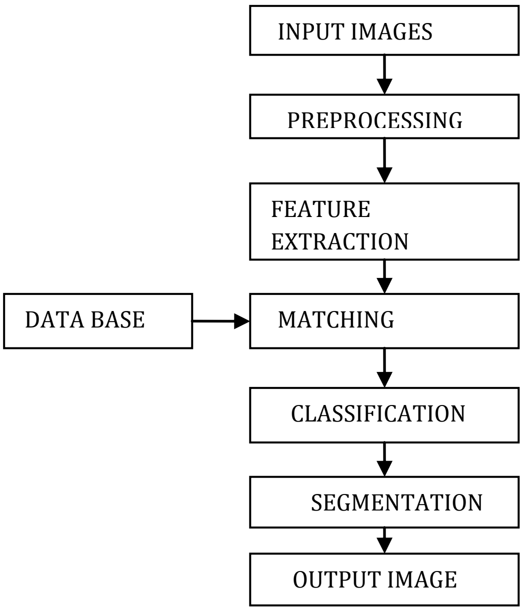

Fig-1: Flow diagram for proposed system.

3.1. Pre-processing

Before extracting significant information from the images, it becomes necessary to apply some pre-processing procedures. The first step in the computerized analysis of skin lesion images is the pre-processing of an image.

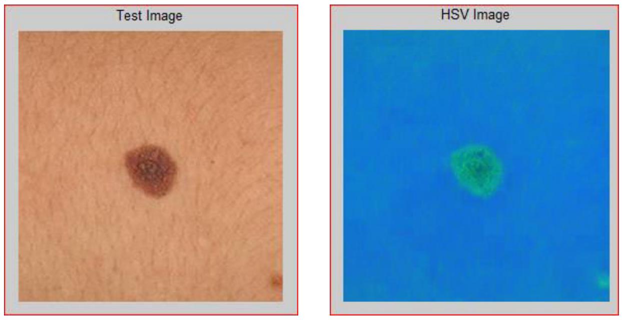

Fig-2: Pre-processing applied in the given input image

The main aim of pre-processing techniques is image resizing and conversion from RGB illustration into HSV illustration. H is hue; it is a circle plate of color is changed in gradient into green and blue respectively. S is saturation; it is the value of color strength. V is brightness; it is value of illumination which is light or dark. This model is important to deal with disclosure problem in picture brightness (v) image from HSV model is only taken out to utilize which has a range of 0 to 1.

3.2 Feature Extraction

There is some unique feature that distinguishes malignant melanoma from benign melanoma. These descriptions are certain for classification purpose. The final result of feature extraction assignment is a vector of features. Three types of feature extracted color, shape, and texture. One of the early signs of melanoma is the skin color variations. The descriptors of color are essentially statistical parameters calculated from dissimilar color space channels, like variance, mean and standard deviation of RGB or HSV. In this paper, color variance of RGB image feature has been calculated using HSV channel. Feature extraction is done by using grey level co-occurrence matrix. The grey level co-occurrence matrices place for the spatial distribution and the hope of the grey levels within local area. The important information is taken out from the matrix as the texture illustration. The texture features are

- Energy
- Contrast
- Correlation
- Homogneity

- Entropy

Energy: A feature which measures the overall probability of having distinctive grey scale patterns in the image, defined as

$$\sum_{i=1}^{m}\sum_{j=1}^{n}\left(GLCM(i,j)\right)^2 \quad (1)$$

Contrast: A feature which measures the variance in grey scale levels across the image, defined as

$$\sum_{i=1}^{m}\sum_{j=1}^{n}\left((i-j)^2\, GLCM(i,j)\right) \quad (2)$$

Correlation: Correlation that brings away how correlated a reference pixel to its neighbour over an image, defined as

$$\sum_{i=1}^{m}\sum_{j=1}^{n}\frac{\{i\times j\}\times GLCM(i,j)-(\mu_x\times\mu_y)}{\sigma_x\times\sigma_y} \quad (3)$$

Homogeneity: A feature which measures the closeness of grey levels across the image, defined as

$$\sum_{i=1}^{m}\sum_{j=1}^{n}\frac{GLCM(i,j)}{1+|i-j|} \quad (4)$$

Entropy: A feature which measures the randomness of grey level distribution is the entropy, defined as

$$-\sum_{i=1}^{m}\sum_{j=1}^{n}\left(GLCM(i,j)\right)\log\left(GLCM(i,j)\right) \quad (5)$$

3.3 Classification

The probabilistic neural network is well suited for an optimal binary classifier, which classifies the skin lesions as cancerous or normal. PNN is a feed forward neural network, which was copied from the Bayesian network and a statistical algorithm called kernel fisher Discriminant study. The cancerous region is separated from the healthy skin by the method of feature extraction. From the feature extraction neural network learns skin and lesion pixel values. The features, the pre-processing images are extracted and based on the features the images are classified as cancerous or non-cancerous using neural network classifier. The proposed system defines an effective way to detect the skin lesion more accurately and faster by segmenting the lesions images or different scales. Moreover, it has got good accuracy and higher levels of quality. As the proposed system involves neural network, it achieves higher accuracy.

3.4 Segmentation

Segmentation refers to the partitioning of an image into displace regions that are homogeneous with respect to a select property such as luminance, color, texture. After the classification, the segmentation is done by using morphological filter. Morphological filters were used to decrease the number of objects in the input image.

Morphological dilation operator is practical to fill up holes and smooth the border. It is a progression of expands binary, mask image is prolonged is controlled by a structuring component which is a disc with a radius of 5 pixels in the morphological dilation. For each adjacent region in the first segmentation, count the amount of pixels in the region. The contiguous region with large number of pixels is assumed to correspond to lesion class and all the other regions are transformed into normal class. This gives the final lesion segmentation.

4. EXPERIMENTAL RESULTS

The aim of this experiment is to measure specificity, sensitivity and accuracy of morphological filter after the algorithms classify all pixels as belonging to the normal skin class or lesion class. A sample test image is given as input to the proposed system and the features are extracted by GLCM. The skin lesion affected region is segmented by morphological filter and finally the type of skin lesion is displayed and is shown in Fig. 3.

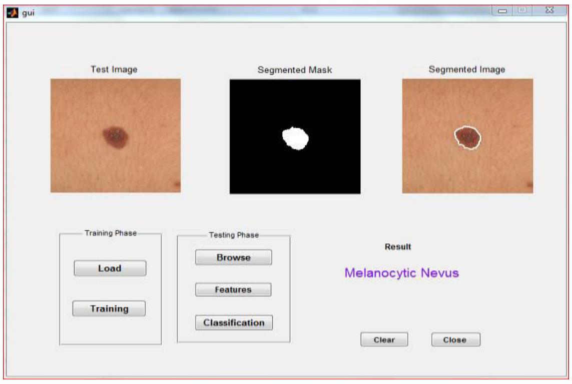

Fig-3: Skin Lesion Detection

If a normal skin is given as the input to the proposed system, the extracted feature doesn't match with the skin cancer Image. So the result is displayed normal and it is shown in Fig. 4.

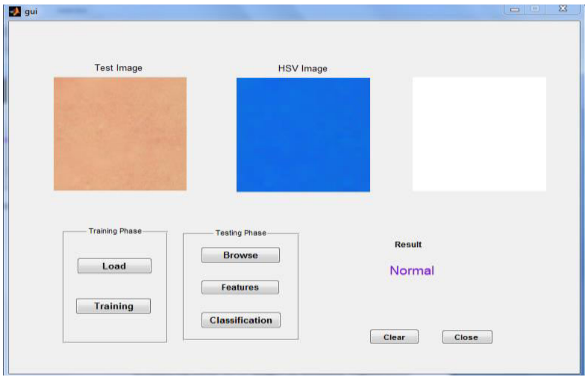

Fig-4: Skin Lesion under normal condition

The proposed work compares the detected skin lesion using morphological filter with other segmentation algorithms. The three steps involved in the process are to generate a segmented result. The first step is feature extraction to extract the features and the second step is to classify the images as skin or lesion. Finally the segmentation results are achieved in third step. The morphological filter is implemented in MATLAB version 2013a on a computer. The images used for this algorithm have been taken from the DermQuest database.

4.1 DermQuest Database

A set of 50 images are taken from the DermQuest database. The goal of DermQuest is to provide reputable and reliable information and resource for dermatologists and residents in dermatology. The digital images are collected from by the doctors working in a hospital and some of the bench mark images are together from the internet. The images are classified into normal and lesion by neural network.

4.2 Performance Metrics

There are several conditions that are commonly used along with the explanation of Specificity, Sensitivity and Accuracy. They are True Negative (TN), True Positive (TP), False Positive (FP) and False Negative (FN). Sensitivity, Specificity and Accuracy are described in conditions of TN, TP, FN and FP.

$$\text{Sensitivity} = \frac{TP}{TP + FN} \quad (6)$$

$$\text{Specificity} = \frac{TN}{TN + FP} \quad (7)$$

$$\text{Accuracy} = \frac{TP + TN}{TP + FN + TN + FP} \quad (8)$$

Here

TP = True positive i.e. the number of true positive pixel

TN = True Negative i.e. the number of true negative pixels

FN = False Negative i.e. the number of false negative pixels

FP = False Positive i.e. the number of false positive pixels.

Table-1: Segmentation Sensitivity, Specificity and Accuracy Results for all Lesion Photographs

Segmentation algorithm	Sensitivity	Specificity	Accuracy
L-SRM[15]	89.4%	92.7%	92.3%
Otsu-R[16]	87.3%	85.4%	84.9%
Otsu-RGB[17]	93.6%	80.3%	80.2%
Otsu-PCA[18]	79.6%	99.6%	98.1%
TDLS[19]	91.2%	99.0%	98.3%
Morphological filter	**100%**	66.6%	90%

Table 1 shows the standard sensitivity, specificity and accuracy for whole set of images on dissimilar segmentation algorithm. The first algorithm (L-SRM) is considered for dermatological images, on the other hand can be applied to lesion photographs as well. Otsu-R finds the Otsu-RGB uses all three RGB color channels and finds Otsu threshold with the red color channel. The next method Otsu-RGB uses all three RGB color channels and finds Otsu thresholds for all channels. Otsu-RGB algorithm has better sensitivity. The Otsu-PCA results in high specificity. The TDLS algorithm has better Accuracy.

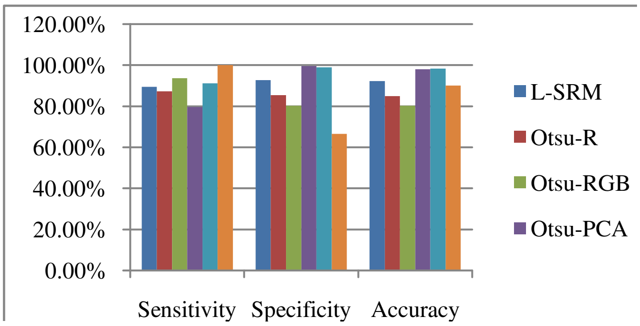

Chart-1: Comparison of different segmentation algorithms.

Table 1 infer that morphological filter is capable to achieve well in all five metrics. The above Fig.5 shows the graph that compares various segmentation algorithms on the basis of result of sensitivity. Morphological filter shows the highest result.

5. CONCLUSION

This paper presented various skin classifiers for detecting the skin cancer. Methods for the early detection of melanoma have been proposed. Morphological filter along with neural network is used for the segmentation and classification of skin lesions. Detection skin cancer precisely by texture based segmentation is worn. In the proposed system, segmentation and categorization of skin lesion as cancerous or normal based on the texture features. This method provides an idea about how much the disease have been infected in the pre-screening time. So it helps the dermatologists to start the suitable checkups and treatments at the first. It will develop the efficiency of early detection of skin cancer. This method can be used between general populations as it uses images of skin lesion captured by digital camera.

ACKNOWLEDGEMENT

The author would like to thank the Department of Electrical and Electronics Engineering in Anna University Regional Campus, Coimbatore for their valuable suggestions and worthy reviews for improving the paper quality.

REFERENCES

[1] J. Abdul Jaleel, Sibi Salim, R. B. Aswin, "Artificial neural network based detection of skin cancer," International Journal of Advanced Research in Electrical, Electronics and Inst. Eng..,vol. 1,pp. 200-205, Sep. 2012.

[2] N. Howlader, A. M. Noone, M. Krapcho, J. Garshell, N. Neyman, S.F. Altekruse, C. L. Kosary, M. Yu, J. Ruhl, Z. Tatalovich, H. Cho, A. Mariotto, D. R. Lewis, H. S. Chen, E. J. Feuer, and K. A. Cronin, ―SEER cancer statistics review, 1975-2010,‖ Nat. Cancer Inst., Bethesda, MD, USA, Tech. Rep., 2013.

[3] K. A. Freedberg, A. C. Geller, D. R. Miller, R. A. Lew, and H. K.Koh,"Screening for malignant melanoma: A cost effectiveness analysis," Journal of the American Academy of Dermatology, vol.41, no. 5, pt. 1,pp. 738–745, Nov 1999.

[4] Jeffrey Glaister, Alexander Wong and David A. Clausi "Segmentation of skin lesions from digital images using joint statistical texture distinctiveness"0018- 9294 (c) 2013 IEEE Transactions on Biomedical Engineering.

[5] M. E. Celebi, H. A. Kingravi, B. Uddin, H. Iyatomi, Y. A.Aslandogan, W. V. Stoecker, and R. H. Moss, "A methodological approach to the classication of dermoscopy images," Computerized Medical Imaging and Graphics, vol. 31, no. 6, pp. 362–373, Sept 2007.

[6] Hina Sood1, Manshi Shukla2 "An Approach for Detection of Skin Lesions from Digital Images using Genetic Algorithm" Global Journal of Advanced Engineering Technologies, Vol3, Issue3-2014.

[7] Margarida Silveira, Member, IEEE, Jacinto C. Nascimento, Member, IEEE, Jorge S. Marques, André R. S. Marçal, Member, IEEE, Teresa Mendonça, Member, IEEE, Syogo Yamauchi, Junji Maeda, Member, IEEE, and Jorge Rozeira "Comparison of Segmentation Methods for Melanoma Diagnosis in Dermoscopy Images" IEEE Journal of selected topics in Signal Processing, vol. 3, no. 1, February 2009.

[8] Ilias Maglogiannis, Charalampos N. Doukas, "Overview of Advanced Computer Vision Systems for Skin Lesions Characterization", pg no. 721-733, 2009 IEEE.

[9] Zhiwei Jiang, Min Yao, Wei Jiang, "Skin Detection Using Color, Texture and Space Information", 2007 IEEE.

[10]LeiYang, et al., "An algorithm of skin detection based on texture", pg no. 1822-1825, 2011 IEEE.

[11]J.Junitha Persi Rajam, A.A.Haseena Thasneem, "Detection of Skin Lesions in Dermoscopic Images", pg no. 193-198, February 2014.

[12]Pablo G. Cavalcanti, Jacob Scharcanski, Leandro E.Di Persia and Diego H. Milone "An ICA-Based Method for the Segmentation of Pigmented Skin Lesions in Macroscopic Images" IEEE EMBS 2011.

[13]Jeffrey Glaister, Robert Amelard, Alexander Wong and David A. Clausi "MSIM: Multistage Illumination Modeling of Dermatological Photographs for Illumination- Corrected Skin Lesion Analysis" IEEE Transactions on Biomedical Engineering, Vol. 60, No. 7, July 2013.

[14]P. G. Cavalcanti and J. Scharcanski, "Automated Pre-screening of Pigmented Skin Lesions using Standard Cameras, Comput.Med.Imag.Graph" vol.35, no.6,pp.481–491, Sep.2011.

[15]M.E.Celebi, H.A.Kingravi, H.Iyatomi, Y.A.Aslandogan, W.V.Stoecker, R.H. Moss, J. M. Malters, J. M. Grichnik, A. A. Marghoob, H. S. Rabinovitz, and S. W. Menzies, "Border detection in dermoscopy images using statistical region merging," Skin Res.Technol., vol. 14, no. 3, pp. 347–353, 2008.

[16]P. G. Cavalcanti, J. Scharcanski, and C. B. O. Lopes, "Shading attenuation in human skin color images," in Advances in Visual Computing, G. Bebis, R.Boyle, B. Parvin, D. Koracin, R. Chung, R. Hammoud, M. Hussain, T. Kar-Han, R. Crawfis, D. Thalmann, D. Kao, and L. Avila, Eds., (ser.Lecture Notes in Computer Science), vol. 6453 Heidelberg, Germany: Springer, pp. 190-198, 2010.

[17]Jeffreyglaister, alexander Wong, "segmentation of skin lesions from digital images using joint statistical texture distinctiveness," IEEE Trans.bio.med, vol.61, no. 4, April 2014.

[18]S.Jeniva1, Dr.c.Santhi2, "An efficient skin lesion segmentation analysis using statistical texture distinctiveness," International journal of advanced research trends in engineering and technology, 7th Feb, 2015.

[19]Navya p v1, shiny p k 2, "A new topology for the detection and classification of melanoma," International journal of infinite innovations in engineering and technology, volume 2, issue 2, June, 2015.

[20]B.GohilaVani, A.Selvaraj, "Automated Diagnosis of Pigmented Skin Lesions Based on Texture Characteristics," International Journal of Computer Science and Engineering Communications. Vol.3, Issue 2, Page.938-945, ISSN: 2347–8586, 2015.