International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-9 Issue-2, December 2019

Skin Lesion Detection using Texture Based Segmentation and Classification by Convolutional Neural Networks (CNN)

Agilandeeswari L, Mahajan Tanuja Sagar, Keerthana N

Abstract: ***Skin cancer is one of the dangerous cancers like breast cancer, brain tumour, and lung cancer. The detection of a skin lesion is melanoma or nonmelanoma is a very crucial issue. The earlier detection of melanoma is one of the best solutions for this issue. There is a various technique for detecting the skin lesion. Because of the technology advancement earlier detection of the skin lesion is possible. Malignant melanoma is a very harmful melanoma it is the cancerous cell that will lead to growth and that can be a mole in different colours red, black and brown. Skin lesion segmentation from dermoscopic images is a very challenging task nowadays because of the contrast of those images. there are various techniques for detecting the skin cancer base on the characteristics of the images shape, colour, textures. We proposed a system for skin cancer detection using texture-based segmentation and classification using Convolutional Neural Network. GLCM (Gray Level Co-occurrence Matrix) matrix is exacting the features from an image. And used Neural network tool for checking the accuracy of training network. Nowadays Deep Learning technique is very popular for classification of images. CNN is one of the techniques of Deep Learning. The proposed work will help in classification of skin lesion. Model will helpful for dermatologists for classifying melanomas.***

Keywords**:** ***Convolutional Neural Network, DullRazor software, Lesion, Melanoma, Segmentation.***

I. INTRODUCTION

The Malignant melanoma is a very baneful skin cancer it is rapidly increasing in all over the world. In united states, skin cancer is very common cancer by the estimation there 9,500 peoples diagnosed per day. There are various techniques for detecting skin cancer from dermoscopic images.

Revised Manuscript Received on December 30, 2019.
***** Correspondence Author
Agilandeeswari L*, Associate Professor, School of Information Technology and Engineering, Vellore Institute of Technology, Vellore, Tamil Nadu, India, agila.l@vit.ac.in
Mahajan Tanuja Sagar, M.Tech (CCE), School of Information Technology and Engineering, Vellore Institute of Technology, Vellore, Tamil Nadu, India, tanuja.harishchandra2018@vitstudent.ac.in
Keerthana N, M.Tech (CCE), School of Information Technology and Engineering, Vellore Institute of Technology, Vellore, Tamil Nadu, India, keerthana.n2018@vitstudent.ac.in

the dermoscopy is major imaging that plays an important role in skin cancer diagnosis. Dermoscopy is one of the tools that use by the dermatologist for examining the skin lesion based on the set of morphological features. For evaluating the dermoscopy, the dermatologist uses the ABCD rule of dermoscopy for classifying melanoma or nonmelanoma. ABCD rule is the best rule of dermoscopy that is Asymmetry, Border irregularity, Colour, Diameter. Every parameter value will be utilized the prediction of skin cancer. Image acquisition, Image Pre-processing, Segmentation, Feature Extraction and Classification these steps utilized the skin lesion is dangerous or generous. A lot of research has been carried out on the parameters for detecting and classifying the melanoma in an early stage so the patient can be given appropriate treatment. In the proposed system we concentrating on the segmentation of skin lesion using texture-based segmentation overcoming problem in PH2 dataset dermoscopic images[1][10].

II. LITERATURE REVIEW

A. Deep learning for skin lesion classification

Y. yuan proposed the fully automatic deep neural framework for skin lesion segmentation in dermoscopic images. several challenging strategies in training dataset. They use the PH2 data set provided by ISBI 2016 challenge the image size is 512*512 fixed in PH2. The performance of the proposed segmentation algorithm is used for comparing the computer-generated lesion mask with ground truth created by a dermatologist. They calculate Jaccard distance for checking the performance of the segmentation [1].

Francisco Fábio Ximenes Vasconcelos, proposed a method for automatic skin lesions segmentation using geodesic active contours. The advantage of the proposed system compared to traditional methods its ability to adapt to contours of the lesion using mathematical morphology. In this paper, they compared the proposed method with machine learning or deep learning methods which are used in proposed systems. The resultant method no need of making training dataset and it is more suitable for small dataset instead of for deep learning and machine learning need of a number of dermoscopic images. the proposed method is viable for medical applications [2]. Le Thu Thou proposed deep learning approaches for solving the problem in skin lesion detection they solved two problems. The first problem is they usefully convolutional and deconvolutional architecture to automatically segment the skin lesion area from surrounding skin.

And in the second problem, they used simple convolution network VGG-16 architecture using transfer learning to address two different tasks in the skin lesion classification. The proposed models for ISIC 2017 challenging dataset. They proposed solutions using deep learning approaches and improve the accuracy for detecting skin melanoma [3].

S M Jaisakthi proposed the system for automatic skin lesion segmentation using Grab-Cut and K-means algorithm. In the first pre-processing step they applied the filtering for removing the noise like hair and ruler on the skin lesion area. In the segmentation step, they applied Grab-cut algorithm and K-means algorithm is used for clustering and learned features from colour dermoscopic images dataset to improve the boundary of the segments. The input of this system is dermoscopic images and output is a binary mask of skin lesion. They tested the proposed system for both datasets PH2 and ISIC 2017 challenge respectively [4].

N. C. F. Codella proposed the visual recognition system which consists of two primary contents that are segmentation and classification. The fully convolutional network architecture used for segmentation, with segmentation they distinguished lesion skin and lesion surrounding area. This system allows to performed analysis in two parts. The first part is focused on the lesion area, the tissue is diseased, and the second part is focused within the entire image, including the surrounding area from that patterns can disease state of the lesion [5].

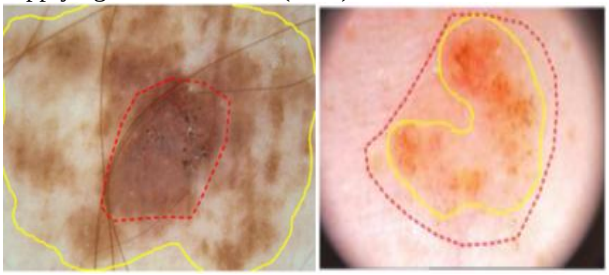
Thanh-Toan Do propose the system for detection of melanoma using smartphones and mobile image analysis. They proposed the entire mobile imaging system for earlier melanoma detection. they focus on acquiring smartphone captured images for detecting melanoma. The proposed system has two major challenges. The first challenge is in this system the image acquiring from a smartphone so this image may be distortions. And the second challenge is memory constraint because all segmentation is done in the mobile imaging system. This system proposed for small datasets [6].

Euijoon Ahn proposed the saliency-based lesion segmentation using background detection in dermoscopic images. The proposed Bayesian framework for depicting the shape and boundaries of the lesion. they used unsupervised lesion segmentation methods. In this system, they remove the hair on lesion by using the pre-processing technique. They used the superpixel algorithm to divide the image into the number of segments. They created the template for measure boundary connectivity. In this multi-scale background, detection is done. In this, the proposed method is giving better performance in identification and characterization of dermoscopic images [7].

Pegah Kharazmi proposed the system an application to Basal Cell Carcinoma Classification for segmentation and detection of skin lesion. This method detecting and segmenting the vessels in two types of lesions that are pigmented and another is non-pigmented as a result in decomposition framework. This method capable of eliminates the effect of elimination of appearance of blood vessels on the lesion area. In this system, they used the K-means algorithm for clustering the haemoglobin component. Then the result of this system is vessel mask generated by global thresholding [8].

III. PROPOSED METHODOLOGY

In previous research, there is a problem in skin lesion segmentation in dermoscopic images due to the contrast of the image, there is two major problem, under segmentation and over-segmentation as shown in Fig.1. We concentrating on segmentation of skin lesion. In the proposed system we are using Texture-based segmentation GLCM (Gray Level Co-occurrence Matrix). In the lesion area has two fabric things normal skin and infected skin. These two textures in skin lesion image. Firstly, applying filters for removing hair particles and air bubble in the lesion area. In the second step extracting the features using GLCM matrix, Correlation, Contrast, Energy, Homogeneity and other features. In the next step based on extracted feature pass to neural network tool for checking the performance of classification. Deep learning Algorithm CNN (Convolution Neural Network) used for classification the skin lesion is melanoma or Non-melanoma, we applying on PH2 dataset (ISBI).



IV. PROPOSED SYSTEM ARCHITECTURE

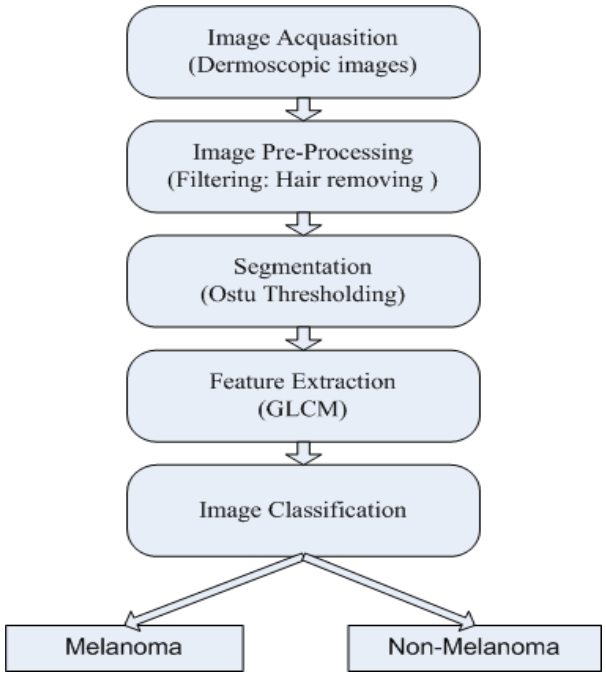


Fig.1 Proposed system for skin lesion classification using NN.

A. Image acquisition

Image Acquisition is the first stage in image processing, dermoscopy is a medical imaging technique for observing the pigmented skin lesion based on the biomedical entities in melanoma diagnoses.

Identifying malignant melanoma in dermoscopic images exploitation human vision alone inaccurate, subjective. We used dataset released by the 2016 International Symposium on Biomedical Imaging (ISBI 2016). This dataset is a challenging dataset for segmentation in dermoscopic images.

B. Image Pre-processing

In dermoscopic images having some unwanted noise parts like hair particles and air bubbles on the lesion area.

Preprocessing important step in image processing. We used a Gaussian filter for removing the air bubbles on the skin lesion. Gaussian filter is effectively used in smoothening the dermoscopic images and it is basically used to blur the images with reducing the contrast. The hair existence is a major problem in dermoscopic images, in this, if the skin lesion is covered by hair it will be difficult for segmentation, pattern recognition, and classification task. Morphological filtering is the best technique for removing the hair particle on skin lesion [9]. In figure (a) shows the result of Gaussian filter and DullRazor filtering applied on dermoscopic images for removing the noise and hair on skin lesion respectively. Dullazor is a software for removing hairs on skin lesion part result shows in Fig.2.

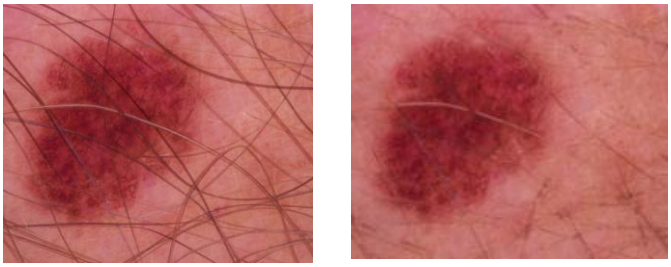


Fig. 2 Otsu Segmentation image

C. Image segmentation and feature Extraction

Image segmentation is a process of dividing the image into regions or categories. In the dermoscopic images two types of fabric things first normal skin and second is lesion area so here we have done segmentation with Otsu thresholding technique as shown in Fig.2. Using Texture-Based segmentation extracting the features from the image. GLCM (Gray Level Co-occurrence Matrix) is the statistical method of examining the spatial relationship between the pixel. This technique works by creating the co-occurrence matrix were to calculate the frequency of occurrence of a pixel with the grey-level value is adjacent to a pixel with grey-level value j in any given direction and selected separating distance The GLCM matrix gives four statistics Correlation, Contrast, Energy, Homogeneity. There is some problem in segmentation of dermoscopic images due to the contrast of images like under segmentation and over-segmentation so we are concentrating on segmentation based on texture features.

D. Image Classification

Deep learning: Today Deep learning is very popular in the modern era. Deep learning is one of the best techniques for image classification. Based on the texture features we are training the dataset for classification. Here first we are giving Extracted feature to the Neural network for checking performance of image classification then we are using CNN (Convolutional Neural Network) it is one of the deep learning techniques for classification, Dermoscopic images classification is done in two categories Melanoma and Non-Melanoma, it is done by using automated extracted features by CNN images. In this step, we are passing Preprocess Images to the CNN classification. In this system, we have used resnet50 pre-trained convolution layer for training new dermoscopic images. DAGNetwork properties of the pre-trained network indicate, nnet.cnn.layer.Layer Layers with 192X2 connections.

E. Figures

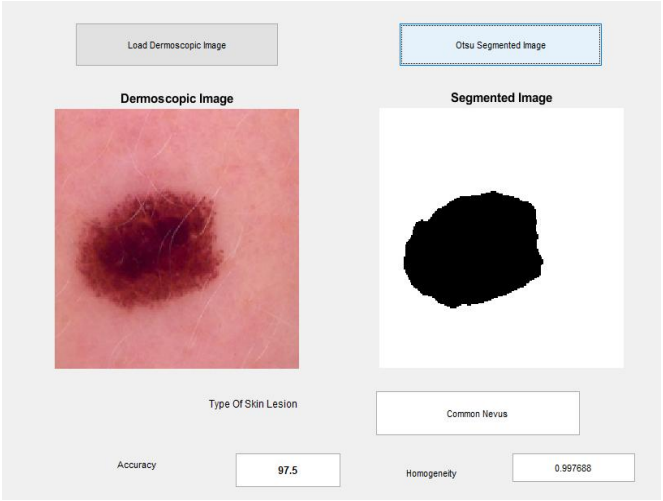


Fig .3 classification result using CNN (common nevus image)

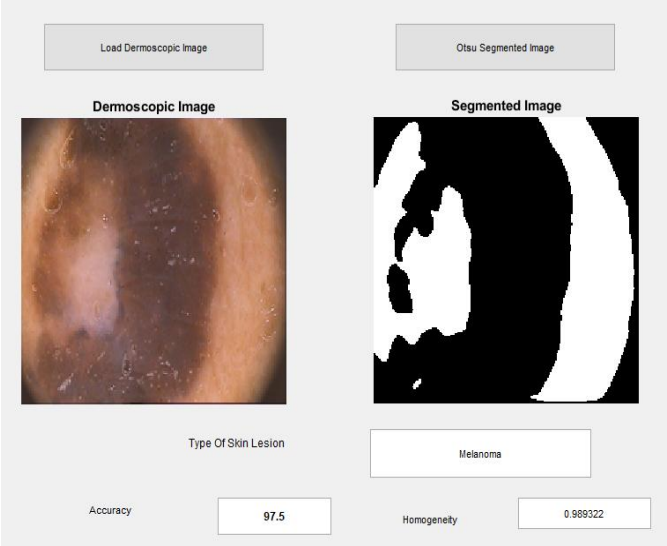


Fig. 4 classification result using CNN (Melanoma Cancer)

V. RESULT AND DISCUSSION

Dermoscopic image dataset loaded for processing and filtering is done by using DullRazor application and Gaussian filtering it's giving better result in preprocessing step. Otsu thresholding used for segmenting the image as shown in fig. Features Extracted by GLCM and we have checked accuracy by using Neural network toolbox. By comparing the accuracy of Neural Network tool and convolutional neural network. By using CNN, we are getting accuracy averagely 96% for classification of dermoscopic images

Classification step resulting as the image is melanoma or non-melanoma type cancer. Fig.3 shows the result of segmentation, types of skin lesion and accuracy of classification. In Fig.3 showing the type of skin lesion is common nevus or non-melanoma.

VI. CONCLUSION

According to the experimental result we have observed that our proposed method provides better segmentation, classification and accuracy as we have used preprocessing technique such as noise removal using filters and these preprocessed images are further extracted by GLCM and we have fed these features i.e. contrast, correlation, energy, homogeneity and other features to Neural network but by using CNN to classify the images is a faster and efficient way. By this classification, we are able to know the type of skin lesion that is melanoma or non-melanoma.

REFERENCES

1. Yading Yuan, Ming Chao, and Yeh-Chi Lo, Automatic Skin Lesion Segmentation Using Deep Fully Convolutional Networks with Jaccard Distance, IEEE transactions on medical imaging,2017.
2. Lee T, Ng V, Gallagher R, Coldman A, McLean D. DullRazor: A software approach to hair removal from images. Computers in Biology and Medicine 1997;27:533-543
3. Ximenes Vasconcelos, F.F., Medeiros, A.G., Peixoto, S.A., Rebouças Filho, P.P., Automatic skin lesions segmentation based on a new morphological approach via geodesic active contour, Cognitive Systems Research 2018.
4. Le Thu Thao, Nguyen Hong Quang, "Automatic skin lesion analysis towards melanoma detection", 2017 21st Asia Pacific Symposium on Intelligent and Evolutionary Systems (IES), pp. 106-111, 2017.
5. Seetharani Murugaiyan Jaisakthi, Palaniappan Mirunalini, Chandrabose Aravindan, "Automated skin lesion segmentation of dermoscopic images using GrabCut and k-means algorithms", IET Comput. Vis. pp. 1-8, 2018.
6. N. C. F. Codella Q.-B. Nguyen S. Pankanti D. A. Gutman B. Helba A. C. Halpern J. R. Smith, "Deep learning ensembles for melanoma recognition in dermoscopy images", IBM J. RES. & DEV. VOL. 61 NO. 4/5, 2017
7. Thanh-Toan Do, Tuan Hoang, Victor Pomponiu, Yiren Zhou, Zhao Chen, Ngai-Man Cheung, Dawn Koh, Aaron Tan, and Suat-Hoon Tan, "Accessible Melanoma Detection using Smartphones and Mobile Image Analysis", IEEE Transactions on Multimedia, 1520-9210 (c) 2018.
8. Euijoon Ahn, Jinman Kim, Lei Bi, Ashnil Kumar, Changyang Li, Michael Fulham, and David Dagan Feng," Saliency-based Lesion Segmentation via Background Detection in Dermoscopic Images", IEEE Journal of Biomedical and Health Informatics, 2017.
9. Pegah Kharazmi, Mohammed I. AlJasser, Harvey Lui, Z. Jane Wang, Tim K. Lee, "Automated Detection and Segmentation of Vascular Structures of Skin Lesions Seen in Dermoscopy, with an application to Basal Cell Carcinoma Classification", IEEE Journal of Biomedical and Health Informatics, 2016.
10. Julie Ann Salido, Conrado Ruiz Jr "Hair Artifact Removal And Skin Lesion Segmentation Of Dermoscopy Images" Asian J Pharm Clin Res, Vol 11, Special issue 3, 2018.
11. Ms Amulya P M, Mr Jayakumar T V, "A Study on Melanoma Skin Cancer Detection Techniques", International Conference on Intelligent Sustainable Systems, 2017, pp.764-766.
12. Teresa Mendonça, Pedro M. Ferreira, Jorge Marques, Andre R. S. Marcal, Jorge Rozeira. PH² - A dermoscopic image database for research and benchmarking, 35th International Conference of the IEEE Engineering in Medicine and Biology Society, July 3-7, 2013, Osaka, Japan.

AUTHORS PROFILE

Agilandeeswari.L completed her PhD and working as HOD & Associate Professor in the Department of Digital Communications, School of Information Technology & Engineering (SITE), VIT Vellore. She received her Bachelor's degree in Information Technology and Master's in Computer Science and Engineering from Anna University during 2005 and 2009 respectively. She got best researcher award for the past four years from 2015 to till date. She is having around 13+ years of teaching experience and published 50+ papers in the peer reviewed reputed journals. Her reputed publications includes research articles in peer reviewed journals namely Expert Systems with Applications, Journal of Ambient Intelligence and Humanized Computing, Multimedia Tools and Applications, Journal of Applied Remote Sensing indexing at Thomson Reuters with average impact factor of 5. She is the peer reviewer in journals include IEEE Access, Array, Artificial Intelligence Review, Informatics in Medicine Unlocked, Neuro computing, Computers and Electrical Engineering, Journal of King Saud University – Computer and Information Sciences, IET ReView, Journal of Engineering Science and Technology (JESTEC), etc. She also published about 13 engineering books as per Anna University Syllabus. She is a life time member in Computer Society of India. Her areas of interests include Image and video watermarking, Image and Video processing, Neural networks, Fuzzy Logic, Machine Learning, Cryptography, IoT, Information Centric Networks and Remote Sensing.

Mahajan Tanuja Sagar received her Bachelor's in Computer Engineering from Shri Gulabrao Deokar college of Engineering, Jalgaon, Maharashtra, India in 2018 and currently pursuing her Master's in computer and communication engineering from Vellore Institute of Technology, Tamilnadu, India.

Keerthana N received her Bachelor's in Information Technology from Tamilnadu College of Engineering, Coimbatore, Tamilnadu, India in 2015 and currently pursuing her Master's in computer and communication engineering from Vellore Institute of Technology, Tamilnadu, India.