

A Review on Automatic Skin Cancer Detection in the Field of Image Processing

Nitin Kumar Nagle¹, Naveen Jain², Ankur Taneja³

PG Student, Department of Computer Science & Engineering, SAM College of Engineering & Technology, Bhopal, Madhya Pradesh, India¹

Assistant Professor, Department of Computer Science & Engineering, SAM College of Engineering & Technology, Bhopal, Madhya Pradesh, India^{2,3}

ABSTRACT: Skin cancer is increasing in different countries especially in India. Automatic skin cancer detection is one of the major challenging tasks in field of medical image processing. Automatic skin cancer detection system works on two incumbent steps –first one is skin anomalies detection and second one is identifying the benign or malignant. Historically, the diagnosis of skin cancers has depended on various conventional techniques which are of an invasive manner. A variety of commercial diagnostic tools and auxiliary techniques are available to detect skin cancer. This paper discusses the various methods used for skin cancer detection. There are various phases for skin cancer detection includes image preprocessing and classification methods. Preprocessing is the first stage of detection to improve the quality of images, removing the irrelevant noises and unwanted parts in the background of the skin images. This comprehensive review critically analyses the literature associated with the field and summarizes the recent updates along with their merits and demerits.

KEYWORDS: Automatic Skin Cancer Detection, Support Vector Machine, Convolutional Neural Network, Machine Learning, Image Processing, Melanoma.

I. INTRODUCTION

Skin cancer is a common type of cancer that emerges from the skin. It is an abnormal growth of cells over the skin and spreading gradually. There are three major types of skin cancer — basal cell carcinoma, squamous cell carcinoma and melanoma. Skin cancer can develop primarily due to sun-exposed skin, including the scalp, lips, face, ears, neck, chest, hands and on the legs. But it can also form rarely on your palms, beneath your fingernails. Skin cancer affects people of all skin tones, including darker shades [1].



Fig. 1. Skin Cancer [1]

When melanoma occurs in people with dark skin tone, it is likely to occur in areas that are not normally exposed to the sun, such as in the soles of hands and feet. Basal cell carcinoma usually occurs in sun-exposed areas of your body, such as your neck or face. Most often, squamous cell carcinoma occurs on sun-exposed areas of your body, such as your

face, ears, and hands. People with darker skin are more likely to develop squamous cell carcinoma on areas that are not often exposed to the sun. Melanoma can develop anywhere on your body, otherwise in normal skin or an existing mole that becomes cancerous. Melanoma most often appears on the face or torso of affected men. In women, this type of cancer most often develops on the lower legs. In both men and women, melanoma can occur on skin that has not been exposed to the sun [1]. In recent times, skin cancer is seen as the most dangerous form of cancer found in humans. Skin cancer is found in various types such as melanoma, basal and squamous cell carcinoma of which melanoma is the most unpredictable. Detection of melanoma cancer in the early stages can be helpful in treating it. Computer vision can play an important role in medical image diagnosis and has been proven by many existing systems. In this paper, we present a computer aided method for the detection of melanoma skin cancer using image processing tools. The input of the system is a skin wound image and then by applying novel image processing techniques, it analyzes it to draw conclusions about the presence of skin cancer. The Lesion image analysis tool checks for various melanoma parameters such as asymmetry, border, color, diameter, (ABCD), etc. by analyzing texture, shape, and size for image segmentation and feature steps. The extracted feature parameters are used to classify the image as a normal skin and melanoma cancer lesion. This paper illustrates the various models of automatic skin cancer classification that may differ in recognition rate and classify the type of cancer with malignant and benign.



Fig. 2. Types of Cancer Cell [2]

Of the three basic types of skin cancer, namely, basal cell carcinoma (BCC), squamous cell carcinoma (SCC) and melanoma, melanoma is the most dangerous in which survival rates are very low. Early detection of melanoma may possibly improve survival rates. The skin cancer detection technique is broadly divided into four basic components, image prepositioning that includes hair removal, de-noise, accelerating, resizing a given skin image, segmentation [3].

II. RELATED WORK

There are several researches have been done in the field of automatic skin cancer detection. This paper is intended to review those researches and find out the common challenges with them. The accuracy of the system is often important because correct recognition can better emulate the system with correct classification and recognition. Farzam Kharaji Nezhadian et al. [4] proposed a system which is based on standard segmentation method where cancer affected skin area can be extracted and later classify the cancer using 2-D discrete wavelet transform. This paper uses SVM as well as color texture recognition for better classification. But transformation model is weak that resulted sharpen the image that loses the sensitivity of the disease. The purpose of this study was to diagnose benign and malignant melanomas. The most important step is segment image with high accuracy. Therefore the active counter model was used and the initial district was determined by the user to increase accuracy. Texture-based features and RGB components were used to extract the image feature. The TC features were chosen as the most efficient feature for the approximation matrices of wavelet transforms. Several studies on large and complete databases are needed to increase the performance and speed of diagnosis.

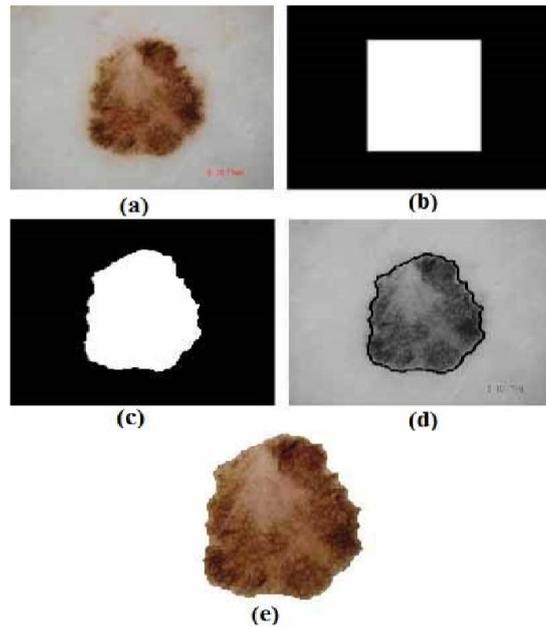


Fig. 3. Preprocessing steps for malignant lesion. original image (a), initial segmentation (b), active contour model segmentation (c), border of the segmentation on gray scale image (d), colored ROI (e) [4]

Amulya P M et al. [5] proposed a system which is also based on SVM Classifier. The system depends upon the training samples and machine iterations. In this study, we have investigated various strategies for melanoma classification and detection. The process of melanoma detection is completed in various stages such as preprocessing, division, feature extraction, post handling, and arrangements that use advanced systems and software to obtain accurate results. As per the review conducted for ABCD rule based classification, we need proper and accurate feature extraction for accurate classification. The SVM classifier gives the highest accuracy compared to k-means clustering and tree classifiers. From all these existing approaches we can conclude that the classification based on neural network technique is better than others. But one issue is that the appropriate correct identification requires a lot of time to train the system. True detection increases the critical level by reducing the computing time with the development of a robust algorithm. Prachya Bumbrungkun et al. [6] proposed a system which is based on SVM classifier and snake model. This paper has been reported the causes of death in Thailand due to skin cancer. So, based on the SVM test; it helps to consider the template that compare with the input image. It has been considered that input skin cancer images may have curves, circles, rectangles and ellipse. It also uses snake model which is an edge detection technique that has been used for extracting the edges of the features that later compare with the templates. However the unwanted area can be eliminated and classified that does not affect the correct recognition rate. But snake model is not a good model for extracting edges from skin feature templates.

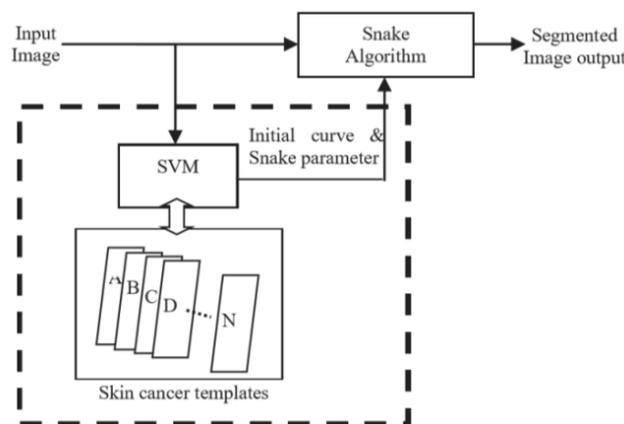


Fig. 4. System Process [6]

Soniya Mane et al. [7] proposed a system which is based on preprocessing and classification techniques such as segmentation by thresholding and SVM classifier resp. Clustering is known as the process of grouping of similar data items together, while the items in the other clusters are as dissimilar as possible. This paper represents an efficient method to detect skin cancer. The system uses computer aided diagnosis to detect skin cancer. Detecting skin cancer manually is not only exhausting, but also a time-consuming task. The traditional method to detect skin cancer is biopsy. In this method, part of the suspected lesion is cut and sent for laboratory testing. So this method is aggressive, painful and time consuming. Therefore, computer aided diagnosis is needed to resolve the above issues. In this system the skin image is preformed, then segmented using a segmentation technique, followed by feature extraction. Classification is done on extracted attributes.

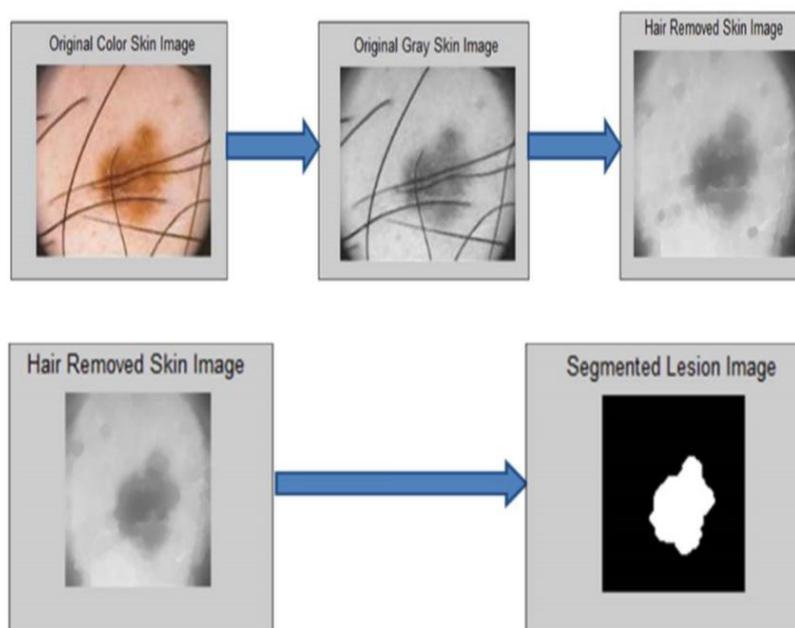


Fig. 5. Preprocessing [7]

The SVM classifier is applied for classification. It has been observed that the SVM linear function performs better than the radial basis function and the Bayesnet classifier. The SVM linear function gives the highest accuracy for classification of melanoma from benign lesion. To detect cancer in this system, only the skin image is required so that there is no physical contact with any part of the body. This system will detect non-invasive skin cancer due to image. There is no need for laboratory testing. So this system takes less time. This system is less expensive as only the camera is required to capture the skin image so this system is used efficiently and effectively [7]. Shalu et al. [8] proposed a system which is based on Naïve Bayes, Decision Tree and KNN classifier. In this paper, a system has been developed to detect melanoma skin cancer. First, various preprocessing and segmentation techniques were used to enhance the image and extract the region of interest. Many features were removed from the HSV and YCbCr color space. Feature displays are tested on three types of classifiers: Na Bayve Bayes, Decision Tree and KNN Classifier. In comparison, it determines that the decision tree classifier performs better than other classifiers by achieving an accuracy of 82.35%. The specificity of the developed system is greater than the sensitivity means that the system identifies benign cases more correctly. The overall accuracy of the system is higher than previously developed techniques. To increase sensitivity, some more features (such as border features, shape features, and texture features) that are compatible with features extracted from the HSV and YCbCr color space.

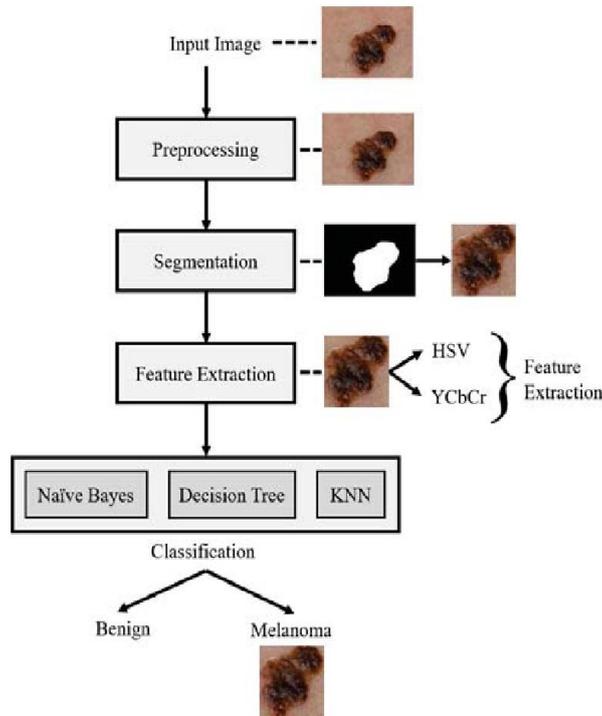


Fig. 6. Work Flow [8]

Noel B. Linsangan et al. [9] proposed a system which is based on k-Nearest Neighbors. The resulting system is a skin wound analyzer using image processing technology in a single board computer. Through the geometric features of the skin lesion, the researcher was able to classify suspected skin cancer samples from malignant, benign, and unknown. The system was able to perform tests to determine its accuracy. It was found that there are images that are not processed by the system and mostly give errors referring to the extraction of features in the image.

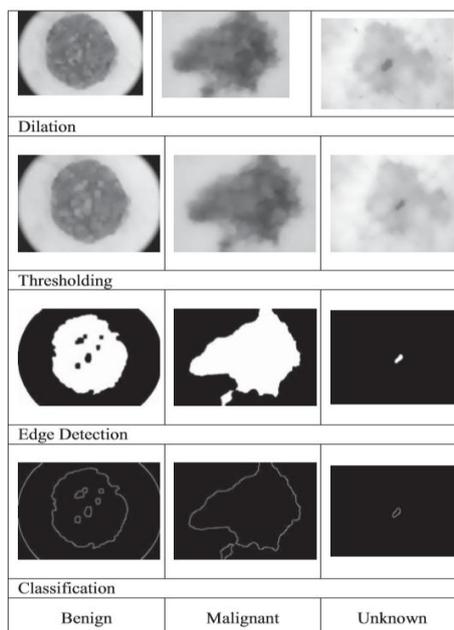


Fig. 7. Resulting Image [9]

Giulia Mansutti et al. [10] proposed a system that uses substrate integrated waveguide (SIW) technology. This work presents a novel millimeter-wave design near the skin large probe to detect skin cancer. The probe has been designed and tested through full-wave numerical simulations at CST: it can reach a lateral resolution of 0.2 mm and a depth of

0.4 mm, and is therefore capable of detecting early-stage skin tumors. Furthermore, since the probe relies on SIW technology and it uses microstrip feeds, it is inexpensive and easy. For these reasons, the device has the potential to be adopted as a practical aid for skin cancer diagnosis. As a future work, the design of the probe is being fabricated and tested on a skin phantom to validate the simulated results.

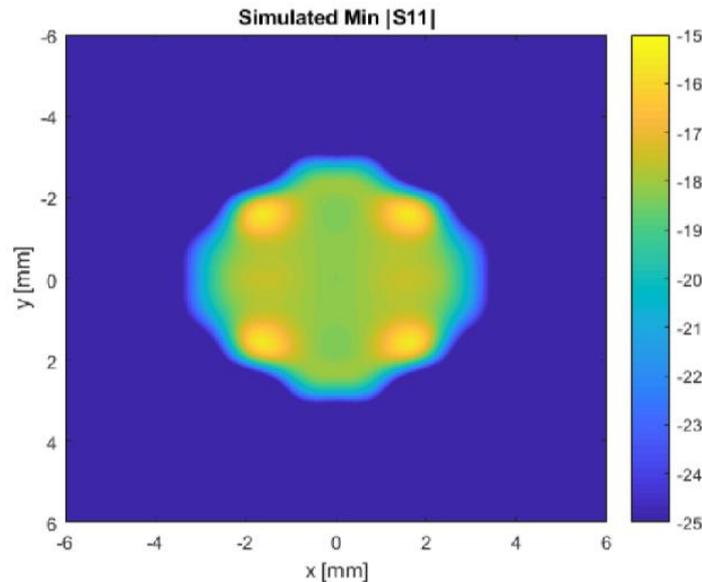


Fig. 8. Scan of an elliptical cancer target [10]

Md. Zahid Hasan et al. [11] proposed a system that uses ANN (Artificial Neural Network) for classifying skin disease from infected area. System uses machine learning methodology for training datasets with various samples of skin diseases. System also erodes the non cancerous area on the basis of skin color and highlights the cancerous part. But train a system on the basis of supervised sample is not enough capable to dealing with irregular or undefined cancerous disease. Neural network is limited with samples and hard to predict correct decision on the basis of that. In machine learning a best classification method can classify the cancerous part effectively. System achieved 95 % of accuracy which could be bit higher. In this research, the effects of dimensionality are investigated using the Rough set on skin cancer decision support systems with multiple classifications such as Artificial Neural Network (ANN), Support Vector Machine (SVM) and Random Forest (RF). Results for the proposed model demonstrated that ANN is working with the aim of improving through a limited number of three types of at-risk skin cancer (common nevus, atypical nevus, and melanoma) datasets.

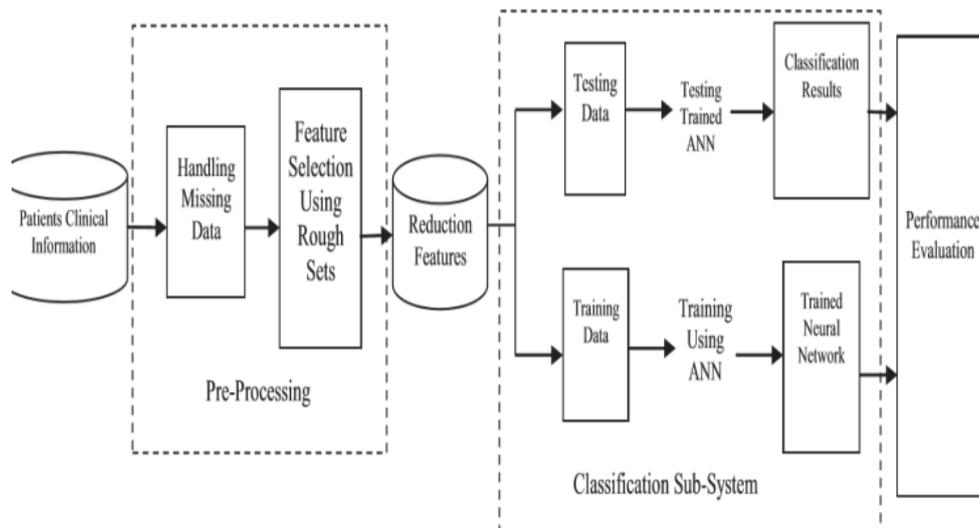


Fig. 9. Architecture [11]

III. CONCLUSION & FUTURE SCOPE

This paper is successfully reviewed some systems which have been implemented till now where there are some flaws over there. Most of the system uses machine learning methods to train the system with various samples. But a large dataset can consume the large amount of memory that increases the execution time where it is very important to communicate as earlier as possible with high level of accuracy. This paper describes the method of detecting melanoma using image processing tools. Efficient equipment support Quantitative medical diagnosis is computer analysis and image processing. So the feature extraction step is enough depending on the area where the disease is detected. So, appropriate segmentation algorithm is required which can be effectively Find skin melanoma pixels in the information image. Pre-processing approach employed in detection of dermoscopic images is included at various stages, filtering images using sluggish razor filtering for removal Hair and air bubbles in the image, converted to gray scale, split images using noise filtering, threshold, hybrid threshold, repetition threshold, multilevel threshold and automatic threshold. In future a system can be developed that may have good accuracy rate with less false alarm or recognition that acquire less execution time.

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