Review of the Study of Automated Skin Cancer Detection Using Digital Image Processing

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Abstract. The unbalanced and inadequate distribution of medical services, for example, has grown more and more obvious in today's climate, where medical care challenges have intensified. In this instance, the use of Machine Learning has been a natural progression in the development of modern medical care. As a result of the development of cosmetics use, numerous malignancies and tumors have appeared in the world in recent years. One such dangerous cancer or tumor is melanoma. The malignant illness known as melanoma occurs when the pigment-producing cells that give the skin its color turn cancerous. Signs could include a sudden, erratic growth or a change in an existing mole. Any area of the body might acquire melanoma. Hence Using methodologies involving lesion detection for accuracy, efficiency, and performance criteria, skin lesions are automatically detected. For the purpose of early skin lesion identification, the suggested approach employs feature extraction utilizing the ABCD (Asymmetry, Border, Color, Diameter) rule, GLCM (Gray Level Co-Occurrence Matrix, and HOG (Histogram Of Oriented Gradients) feature extraction. Pre-processing is used in the proposed work by researchers to enhance the skin lesion's clarity and quality while reducing artefacts such skin color and hair. The lesion part was segmented individually using Geodesic Active Contour (GAC), which was also effective for feature extraction. To extract the properties of symmetry, border, color, and diameter, the ABCD scoring method was utilized. Textural characteristics were extracted using HOG and GLCM. Different machine learning approaches, such as SVM (Support Vector Machine), KNN (K-Nearest Neighbor), and Naive Bayes classifier, are used to categories skin lesions between benign and melanoma utilizing the retrieved features.

Keywords: Diabetic Retinopathy · Eyes · Deep learning · Machine Learning

1 Introduction

The primary organ of the human body is the skin, which serves as the body's outermost layer. The skin has up to seven layers of ectodermal tissues that shield the internal organs, muscles, and bones beneath. Antioxidants help regulate body temperature, shield the physical body from bacteria and dangerous substances, and allow for the sensations of cold, fire, and contact. When a section of the skin differs significantly from other parts

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of the skin, it becomes a lesion. The most frequent and primary cause of skin lesions is infection within or on the skin. Prevalent (existing at birth or developed through time) and intermediate (produced by improper management of the predominant dermoid cyst) skin lesions are the two categories into which skin lesions are divided. Prevalent (existing at birth or formed over time) and intermediate (caused by improper management of the prevailing dermoid cyst) are two categories of skin lesions that can all lead to early melanoma development. In the United States, more than three million individuals are diagnosed with a specific type of skin cancer each year.

Each year, more than 5000 people with skin cancer are admitted to hospitals in India, and more than 4000 of them pass away. The three categories of skin tumors are as follows: Skin cancer is available in three distinct forms: basal cell carcinoma (BCC), squamous cell (SCC), and melanoma. Benign tumors, which are a very deadly form of skin cancer that develops quickly and spreads to other parts of the body, are referred to it as cancerous tumors. On the other side, a benign tumor spreads but does not penetrate, therefore it is not truly hazardous. The dislodging is checked with the unaided eye, where features cannot be observed correctly, making manual skin cancer screening ineffective. This can lead to maltreatment and, eventually, death. Rates of survival can be increased by correct early stage skin cancer detection. Rapid identification is therefore more efficient, leading to improved performance. In 2020, Vidya et al. One of the primary causes of melanoma is skin exposure to UV light. Dermoscopy is a technique for evaluating the tissue's surface. Dermoscopy images can be used to screen for melanoma utilizing an observation-based method. The dermatologist's planning determines dermoscopy accuracy. Although dermoscopy is a diagnostic procedure used by skin specialists, melanoma detection accuracy will be between 75 (2000) Even minute aspects that are impossible to discern, such asymmetry, color contrast, and textural qualities, could be retrieved by a computer. Three steps make up an automatic dermoscopy image analysis system (Jaisakthi et al. 2018): preprocessing, correct segmentation, and feature extraction and collecting. The most significant and continuing to play a vital role in the phase of future actions supervised segmentation appears to be easy to enforce by taking into consideration parameters including forms, heights, and colors, as well as skin types and textures. System-based analysis would hasten diagnosis while enhancing precision. Due to their high severity, diversity, and lack of competence, dermatological pathogens (Hemalatha et al. 2018) are one of the most challenging areas for quick, easy, and accurate diagnosis, particularly in poor and impoverished nations with inadequate healthcare resources. It is also very obvious that early detection of some infections reduces the likelihood of severe effects. These skin illnesses only developed as a result of the recent environmental conditions. The focus of the suggested paper was on the feature extraction and classification approach for the prediction of melanoma tumours. Figure 1 displays representative photos of benign and malignant lesions.

Due to the diversity of racial and ethnic groups, melanoma incidence and mortality rates vary from one country to the next. UV exposure, living in low latitudes, heavy alcohol use, eating fatty meals, the existence of melanocytic or dysplastic naevi, a personal or family history of melanoma, and phenotypic features such as fair hair, eye, and skin colors are all recognized risk factors for melanoma. The development index is associated to both the occurrence and death of melanoma (HDI), The HDI index

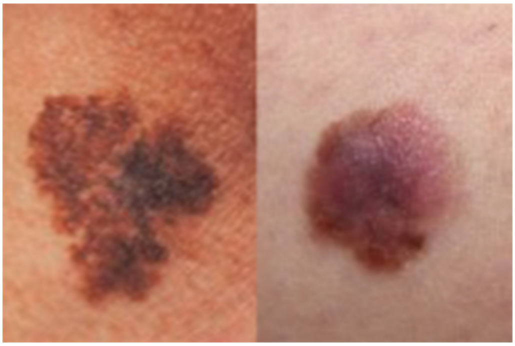

Fig. 1. Melanoma Skin Cancer

rises, enhancing access to medical care, early disease detection, and early disease treatment, each of which reduce mortality. However, statistics reveal that for those who received a diagnosis of melanoma at an early stage, the 5-year relative survival rate is almost 98However, doctors advise patients to regularly perform self-examination if they discover any suspicious-looking lesions. When in doubt, remove it, advises board-certified plastic and reconstructive surgeon Darrick Antell, MD, of New York. Utilizing supportive imaging methods that have been demonstrated to enhance and facilitate the diagnosing process becomes crucial in this case. These methods were developed based on methods developed by doctors to find melanoma early. A number of processes are involved in the automatic detection of melanoma, including preprocessing, extraction of the interesting area, post-processing, and lesion assessment. These steps resemble those of a traditional pattern recognition system, whose key design pillars are image capture, image processing, lesion segmentation, and lesion classification technique. Long-term exposure to ultraviolet (UV) rays from the sun, the presence of numerous or unique moles, skin types, and a family history of melanoma are all risk factors for skin cancer. Melanoma often has a relatively high death rate, but if detected early, there is a 99.

Due to the great degree of similarity between benign and malignant lesions, it can often be challenging for dermatologists to determine whether a lesion is benign or malignant. In order to improve categorization accuracy, dermatologists employ a few techniques including the ABCD rule (Atypical, Border, Color, and Diameter), although human knowledge is still necessary. Dermatologists also discourage the frequent use of biopsies. According to International Skin Imaging Collaboration, the amount of unneeded culture tests which are being performed drastically vary depending upon several aspects which include clinical setup, expertise of dermatologist, and the technology employed. Consider the situations of children, whose melanoma rates are remarkably low; 500000 culture tests are conducted annually to examine about 400 melanomas. Skin biopsy with immunohistochemistry is the gold standard for detecting skin cancer. However, the invasive technique used to obtain the skin tissue sample makes this operation uncomfortable. Using medical imaging instruments including dermoscopy, cross-polarized light and fluorescence photography, high-frequency ultrasound, optical coherence tomography (OCT), and confocal microscopy is one of the common techniques. The main benefits of digital dermoscopy are its usage as a long-term surveillance tool and as a low-cost diagnostic tool. Dermoscopy image analysis has experienced a significant uptick in activity since 2016 as a result of the International Skin Imaging Collaboration (ISICrelease)'s of a sizable public dataset, the development of open source machine learning software, and the low cost of computing resources. There are 133 publications from 2011 to 2016 that discuss skin cancer diagnosis applications for mobile devices, and as of July 2014, 39 apps are available for iPhone and/or Android. If melanoma skin cancer is found or diagnosed in the very early stages, it can be treated sooner and save the patient's life. However, if melanoma is discovered in the late stages, there are greater chances that the illness will penetrate deeply into the skin. It will be more challenging to receive treatment after it has spread deeply. Melanocytes, which are found throughout the body, are the primary cause of melanoma.

The biopsy procedure is the official method for diagnosing skin cancer. In this approach, a human body cell fragment is removed, and it is then sent to a lab for testing. It is the hardest and most difficult task to do it. The amount of time needed for testing will be significantly longer. The testing process requires extra time from both patients and doctors. Using the biopsy approach has a higher risk because there is a chance that the disease will spread to other body areas. On this study, the majority of the researchers suggested various detection methods. Pre-processing, segmentation, feature extraction, and classification are the four basic stages of the common detection technique, which is used to identify melanoma, a kind of skin cancer. To obtain the region of interest, the segmentation method isolates the lesion portion from the skin. Due to its efficiency and ease of application, the GLCM methodology has served as the foundation for the feature extraction methodology used by several computerized melanoma detection systems. Dermoscopy techniques are created to acquire the clear skin lesion spot, and by reducing reflection, the visual effect is improved. However, there are a few challenges in automatic skin lesion recognition, including artefacts, low contrast, skin color, hairs, veins, and similar visuals of melanoma and non-melanoma. Pre-processing procedures can minimize all of this. To determine the exact location of the skin lesion, the segmented skin lesion picture is used. Multiple segmentation techniques exist, including the wavelet algorithm, basic global thresholding, region-based segmentation, watershed algorithm, snakes method, Otsu method, active contours, and geodesic active contours, among others. Geodesic active contour is used for segmentation. Later, features are extracted from the segmented skin lesion image using a variety of techniques, including the CASH rule, ABCD rule, GLCM, HOG, LBP, and HLIFS, among others. Asymmetry, color, border, and diameter features are extracted using the ABCD rule, which is a scoring technique. The authors of this work show how to take the overall dermoscopic score and use it to classify melanoma and non-melanoma with an accuracy of 90.

2 Related Work

In the field of melanoma skin cancer detection, numerous researchers were active. They employed a variety of computer vision techniques, such as image processing, segmentation, feature extraction, and classification. These methods are employed in other research articles as well. This computer-based analysis will shorten diagnosis times and improve accuracy. Given the intricacy of dermatological conditions, it is particularly challenging to make a quick, simple, and accurate diagnosis in developing and developed nations with limited healthcare resources.

The dermoscopy images were preprocessed in using the suggested system to remove hair, glare, and shading. For the aim of segmentation, the Otsu segmentation method and watershed methods were employed. The SVM and CNN are utilized to classify the extracted color, shape, size, and texture data. Furthermore, it goes without saying that the likelihood of serious results is decreased in cases of many diseases by early detection. These types of melanoma skin illnesses have been triggered by a small number of pertinent environmental variables [1].

Support Vector Machine (SVM) technique is the foundation of the diagnosing methodology in for the categorization goal. The median filter is applied to eliminate unwanted noise. And the contrast enhancement is employed in order to produce images of higher quality. Then, maximum entropy thresholding is used to segment the data. For the purpose of feature extraction from texture images, only GLCM approach is employed [2].

The majority of the scholars who worked on this study suggested several detecting methods. Pre-processing, segmentation, feature extraction, and classification are the four basic stages of the common detection technique, which is used to identify melanoma, a kind of skin cancer [3].

To obtain the region of interest, the segmentation method isolates the lesion portion from the skin. Due to its efficiency and ease of use, the GLCM methodology has been heavily included into the feature extraction methodology of many computerized melanoma detection systems [4].

The segmentation in is done using the Grab Cut algorithm, and features are extracted using the ABCDE rule (ABCDE rule: Asymmetry, Border irregularity, Color, Diameter and evolving size). SVM is used to classify these extracted features as malignant or non-cancerous moles. Evaluation tests were performed with 200 photos for this paper (100 of melanoma and 100 of benign) [5].

In the results of the suggested system demonstrate that SVM with a linear kernel provides the best accuracy. The segmentation process uses the Otsu thresholding approach. The edges of the output image become erratic when Otsu thresholding is complete. This is the rationale behind the application of the morphological filter to soften the edges. The given skin image will be used to extract the color, perimeter, area, irregularity, and texture features in this system. SVM is utilized for classification in this instance as well [6].

In, this proposed approach, Otsu thresholding and morphological operations are two ways for separating the lesion portion from the improved image. The ABCD rule aids with feature extraction. The TDS value is calculated using the retrieved feature values. Dermoscopy images are examined for the presence or absence of melanoma using the computed TDS value. The ABCD rule is used to calculate TDS. The TDS value establishes the Melanoma [7].

It uses the color and texture characteristics of skin photographs to extract the attributes of the proposed system. The texture attribute is handled using the GLCM approach. In order to categories the given dermoscopic images into melanoma images using extracted color and texture information, the SVM classifier is chosen to be applied. The performance of the suggested approach for the identification of melanoma is assessed using the PH2 dataset [8].

The input dermoscopy images in are preprocessed using dull razor and rapid median filtering procedures, and the preprocessed images are then segmented using the maximum entropy threshold approach. Following the feature extraction process using GLCM algorithms on the segmented image. After that, an artificial neural network (ANN) was deployed for categorization [9].

Preprocessing is the process of shrinking images and adjusting brightness and contrast in proposed system. Additionally, image segmentation employs edge detection and background subtraction. The features are analyzed using the ABCD rule. Additionally, they combined an ANN with a propagation technique for classification purposes [10].

The DWT method and the PCA algorithm were utilized in the suggested system, respectively, for feature extraction and feature reduction. And they used two supervised learning algorithms; ANN and KNN for the classification [11]. To create the most accurate diagnosing system, employs background illumination correction for segmentation and iterative dilation for noise removal. The ABCDE rule — asymmetry, border, color, diameter, evolving — is used to extract features. Finally, SVM was utilized by the researcher for classification. And the research's accuracy was 70.

A strategy for accurate lesion region extraction based on deep learning methodologies was proposed by researchers in. The input image used a segmentation mask to identify the region of the lesion and reduce noisy artifacts.

The quality image of the mask is further enhanced using several post-processing techniques. Their input images were taken using regular cameras; they were afterwards preprocessed to handle noisy artefacts. To reduce the photos' noise, they applied a filter. One patch was generated locally, and the other was created globally. A window around each pixel serves as the representation of the local patch. A strategy for accurate lesion region extraction based on deep learning methodologies was proposed by researchers in. The input image used a segmentation mask to identify the region of the lesion and reduce noisy artefacts. The quality image of the mask is further enhanced using several post-processing techniques. Their input images were taken using regular cameras; they were afterwards preprocessed to handle noisy artefacts. To reduce the photos' noise, they applied a filter. One patch was generated locally, and the other was created globally. A window around each pixel serves as the representation of the local patch [13]. For the collection of the most discriminant kinds, they presented a feature selection strategy via regulating entropy. A variety of datasets were used to validate their suggested system. They used the approach they suggested and had remarkable accuracy [15]. Using DCNN, researchers in suggested a novel automated method for identifying and detecting skin lesions. They took three actions. The photos' contrast was initially improved using local laplacian filtering and HSV color conversion. The second phase was applying the color CNN methodology's XOR function to retrieve the lesion boundaries. The last step was to apply transfer learning to extract the features using InceptionV3 in order to fuse the features using the hamming distance technique as described in [16].

3 Conclusion

One of the frequent eyesight issues, we specifically suggested a feature extraction approach, a classifier, and a pre-processing phase for a classification system. Applying more contemporary pre-processing steps (such data augmentation), feature extraction, and classifier will allow the melanoma classification work to continue (such as convolutional neural network). We think that applying neural networks can enhance categorization outcomes even more. This review details the diagnostic abilities of non-invasive procedures that can be used in place of dermoscopy to diagnose cutaneous melanoma. Only three studies, however, disclosed the performance measures for the diagnostic task that was examined, raising questions regarding the reliability and variability of these indicators. Rising doubts about the veracity of stated performances are being examined in the light of the occurrence of rather broad sensitivity and specificity CIs across all techniques (particularly optical spectroscopy and multispectral imaging). The adoption and practical application of a technique may be hampered by factors other than the reported metrics, such as other immeasurable but significant elements like technique usability, convenience of use, findings interpretability, and clinical acceptance. When choosing the best technique for a particular clinical case, timing, or workflow, meta-analytical evidence from the analysis of the literature included in this review may be used as a quantitative and methodologically sound support, always keeping the clinician at the centre of the decision-making process.

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