IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 7.047 ⁜ Vol. 10, Issue 2, February 2022

DOI: 10.17148/IJIREEICE.2022.10229

FUSION OF STRUCTURAL AND TEXTURAL FEATURES FOR MELANOMA AND SKIN DISEASE RECOGNITION USING IMAGE PROCESSING

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Abstract: The biggest organ of the body is the human skin. Its weight lies between six and nine pounds and its surface area is about two square yards. The inner part of the body is separated by the skin from the outer environment. Melanoma is a type of cancer that mostly starts in pigment cells (melanocytes) in the skin. To improve the diagnostic performance of melanoma, a dermoscopy technique was developed. Dermoscopy is a non-invasive skin imaging technique of acquiring a magnified and illuminated image of a region of skin for increased clarity of the spots on the skin. Dermatological diseases are the most prevalent diseases worldwide. Despite being common, its diagnosis is extremely difficult and requires extensive experience in the domain. Melanoma is the deadliest form of skin cancer. While curable with early detection, only highly-trained specialists are capable of accurately recognizing the disease. As expertise is in limited supply, automated systems capable of identifying disease could save lives, reduce unnecessary biopsies, and reduce costs. We use a dual-stage approach that effectively combines Computer Vision on clinically evaluated histopathological attributes to accurately identify the disease. In the first stage, the image of the skin disease is subject to various kinds of pre-processing techniques followed by feature extraction. The second stage involves the use of algorithms to identify diseases based on the histopathological attributes observed on analyzing the skin.

Keywords: Image Recognition, Skin Diseases, Melanoma, Dermoscopy Images, Classification Learner App.

1. INTRODUCTION

Digital image processing handles the implementation of digital images with the help of a digital computer. Digital image processing is a subfield of signals and systems but focuses particularly on images. They focus on improving a computer system that can handle processing on an image. The input is a digital image and the system process that image by efficient algorithms and produces an image as an output. The most common example is adobe photoshop. Digital image processing is one of the widely used applications for processing digital images.

Image processing includes the following three steps:

a. Providing the image with an optical scanner or digital photography

b. Analysing and manipulating the image which includes data compression and image enhancement and spotting patterns that are not visible to human eyes like satellite photographs.

c. Output is the final stage in which the result can be a Modified Image or else a report that is based on image analysis.

2. LITERATURE SURVEY

2.1 A Study on Different Techniques for Skin Cancer Detection Page Layout

In this paper, Raut, Nikita, et al. [1] have examined various non-invasive techniques for skin cancer classification and detection. Melanoma detection requires various stages like pre-processing, segmentation, feature extraction, and classification. This survey focuses on different strategies like Genetic Algorithm, SVM, CNN, ABCD rule, etc. Thus, outweighs other algorithms like K-mean clustering and backpropagations of neural networks are also used. The major drawback of the proposed method is it is not useful in some cases when the diameter of the skin lesion is less than 6mm.

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2.2 Analysis of Skin Cancer using ABCD Technique

In this paper, T. Yamunarani [2] have proposed an ABCD technique to detect malignant melanoma at an early stage to reduce the medical cost of taking the biopsy. First, the skin image is filtered by using a wiener filter and then segmented to extract the features by using the otsu thresholding and boundary tracing algorithm. The advantage of these methods for image segmentation is to obtain an accurate result for the feature extraction. The histogram of gradient method is used to extract the features of the segmented image and then the ABCD technique is applied to differentiate mole and melanoma and find the spreading chances of melanoma. The major drawback of the proposed method is it is not useful in some cases when the diameter of the skin lesion is less than 6mm.

2.3 Non-Invasive ABCD Monitoring of Malignant Melanoma Using Image Processing in MATLAB

In this paper, Patil, M. R., et al. [3] have proposed the parts of a system to help within the melanoma interference and early detection. The planned system has 2 parts. the primary part could be a period awake to facilitate the users to forestall skin burn caused by daylight. The part is an automatic image analysis module wherever the user is going to be able to capture the photographs of skin moles and this image process module classifies underneath that class the moles fall into; benign, atypical, or skin cancer. The associate alert is going to be provided to the user to hunt medical facilitate if the mole belongs to the atypical or skin cancer class. The planned machine-controlled image analysis method enclosed image acquisition, hair detection and exclusion, lesion segmentation, feature extraction, and classification. The state of the art is employed within the planned system for the dermoscopy image acquisition, which ensures capturing sharp dermoscopy pictures with a hard and fast distance to the skin and consistent image quality. The image process technique is introduced to observe and exclude the hair from the dermoscopy pictures, getting ready for more segmentation and analysis, leading to satisfactory classification results. additionally, this work proposes an automatic segmentation algorithmic rule and novel options. This novel framework can classify dermoscopy pictures into benign, atypical, and skin cancer with high accuracy. specifically, the framework compares the performance of 3 planned classifiers and concludes that the two-level classifier outperforms the one-level classifier. The major drawback of the proposed method is the classification of benign, atypical, and skin cancer pictures with an accuracy of ninety-six percent.

2.4 Automatic Skin Cancer Detection in Dermoscopy Images Based on Ensemble Lightweight Deep Learning Network

In this paper, Lisheng Wei., et al. [4] have designed a discriminant dermoscopy image lesion recognition model. It uses a pre-trained lightweight network as a feature extractor to construct a dermoscopy image lesion classification branch network and lesion feature discriminant branch network, through the joint training of each branch network, the proposed model achieves the classification of lesion type and the similarity of lesion features at the same time, so it can extract more discriminative lesion features, Compared with the existing multi CNN fusion method or the method based on local depth feature Fisher Vector coding, our framework can achieve an approximate or even higher model performance with a lower number of model parameters end-to-end; Meanwhile, Based on the feature extractor of the lesion recognition model of the proposed dermoscopy image, we constructed a lightweight semantic segmentation model, by replacing the feature extraction module with a lightweight feature extraction module and combining with a migration training strategy, the proposed method achieves higher segmentation accuracy while maintaining small amount of model parameters. The major drawback of the proposed method is improving the accuracy of the model and deploying the model to the mobile end or the web end for people to assist in the diagnosis of skin diseases and timely discover the potential lesion risk.

2.5 Feature Selection Using Sequential Backward Method in Melanoma Recognition

In this paper, Mustafa, Suleiman [5] studied numerous research involving computer-aided diagnosis through image processing to detect melanoma. Pre-processing techniques have been rarely applied but in cases where they have, they include ROI extraction, hair removal filtering, shading effect, color space transform, Morphological closing operations with median filtering, enhanced contrast with color normalization, black border cropping, and vignette. For image segmentation, the techniques from the literature have included random walker, adaptive thresholding, region-based, Otsu's thresholding, Euclidean distance transform, Color space transformation, iterative thresholding, and watershed segmentation applied to in previous studies as summarized. In this work, we use image enhancement and color space transform for pre-processing and the Grab Cut algorithm for segmentation. Features are extracted from the segments and our method is applied for feature selection. The major drawback of the proposed method is not including the validation of the proposed method using dermatologist determined ground truth and the estimation of its generalization error on a larger image set using k-fold cross-validation.

TITLE	TECHNOLOGY	DISADVANTAGE
A Study on Different Techniques for Skin Cancer Detection	ABCD rule	Not useful in some cases E.g. When the diameter of the lesion is less than 6mm.

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Analysis Of Skin Cancer Using ABCD Technique	ABCD rule	Not useful in some cases E.g. When the diameter of the lesion is less than 6mm.
Non-Invasive ABCD Monitoring of Malignant Melanoma Using Image Processing in MATLAB	Lesion Segmentation Method	The experimental results show that the projected system is economical, achieving classification of the benign, atypical, and skin cancer pictures with an accuracy of ninety-six.
Automatic Skin Cancer Detection in Dermoscopy Images Based on Ensemble Lightweight Deep Learning Network	Image Lesion Classification	To improve the accuracy of the model and deploy the model to the mobile end or the web end for people to assist in the diagnosis of skin diseases and timely discover the potential lesion risk.
Feature Selection Using Sequential Backward Method in Melanoma Recognition	Sequential Backward Method	It does not include the validation of the proposed method using dermatologist determined ground truth and the estimation of its generalization error on a larger image set using k-fold cross-validation.

3. PROPOSED METHODOLOGY AND FUTURE WORK

The biggest organ of the body is the human skin. Its weight lies between six and nine pounds and its surface area is about two square yards. The inner part of the body is separated by the skin from the outer environment. Melanoma is a type of cancer that mostly starts in pigment cells (melanocytes) in the skin.

To improve the diagnostic performance of melanoma, a dermoscopy technique was developed. Dermoscopy is a non-invasive skin imaging technique of acquiring a magnified and illuminated image of a region of skin for increased clarity of the spots on the skin.

Dermatological diseases are the most prevalent diseases worldwide. Despite being common, its diagnosis is extremely difficult and requires extensive experience in the domain. Melanoma is the deadliest form of skin cancer. While curable with early detection, only highly-trained specialists are capable of accurately recognizing the disease. As expertise is in limited supply, automated systems capable of identifying disease could save lives, reduce unnecessary biopsies, and reduce costs.

We use a dual-stage approach that effectively combines Computer Vision on clinically evaluated histopathological attributes to accurately identify the disease. In the first stage, the image of the skin disease is subject to various kinds of pre-processing techniques followed by feature extraction. The second stage involves the use of algorithms to identify diseases based on the histopathological attributes observed on analyzing the skin.

In this proposed system, as mentioned in the 3.1 Block Diagram, we were using many algorithms to convert the original image to a greyscale image, sharpening filter, median filter, smooth filter, binary mask, RGB extraction, histogram, and Sobel operator. The RGB values of the images are extracted before converting them into a grayscale image. A filter is applied to the grayscale image to sharpen the details of the infected region.

The number of components of the skin affliction was extracted from the image using the Euler value. For the classification, we will use GLCM (Gray Level Co-occurrence Matrix) and LBP (Local Binary Pattern). Contrast Enhancement is used to maintain intensity level. After the segmentation process, Graphical representation is also plotted in numerical ways.

Classification Learner App is used to estimate accuracy and volume estimation. A threshold limit was imposed on the Euler value heuristically, exceeding which was an indicator of the presence of many inflictions. This is an important distinguishing feature characteristic of diseases.

Hence, for future work in skin cancer detection, we recommend further research on fusing the structural and textural features for melanoma and skin diseases using a novel method based on very deep CNNs to find automated melanoma recognition in dermoscopy images of classification learner apps to estimate accuracy and volume estimation.

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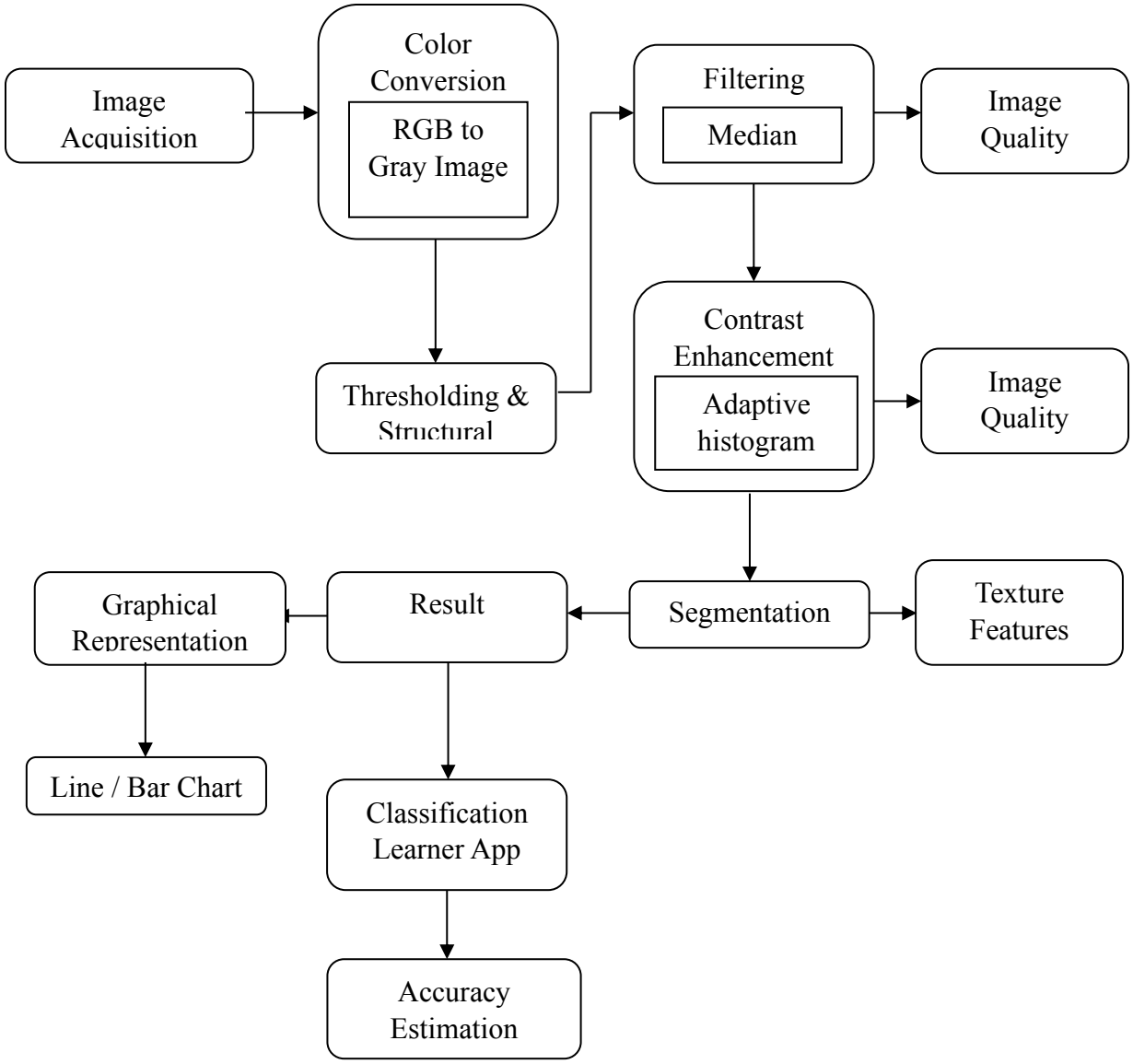
3.1 BLOCK DIAGRAM - MATLAB UNIT



4. CONCLUSION

In this study, we have analyzed various research papers to examine the techniques used for skin cancer classification and detection with their disadvantages. To overcome those drawbacks, we have introduced a new method based on structural and textural features of melanoma and skin diseases using a CNN method to recognize the cancer-affected area by classification learner app to estimate its accuracy and volume. From all these existing approaches, we can conclude that classification based on the convolutional neural network technique is better than others.

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