IJCSE International Journal of Computer Sciences and Engineering Open Access
Review Paper Vol.-7, Issue-3, March 2019 E-ISSN: 2347-2693

Computer System for Diagnosis of 'Melanoma' Type of Skin Cancer Using Classification

V.D. Kulkarni[1], S.S. Gaikwad[2], T.M. Gawade[3], P.L. Karande[4], P.A. Umare[5]

[1,2,3,4,5]Dept. of Computer Engineering, Bharati Vidyapeeth's College of Engineering for Women, Savitribai Phule Pune University, Pune, India

**Corresponding Author: gaikwad45shru@gmail.com, Tel.: +919923710241*

DOI: https://doi.org/10.26438/ijcse/v7i3.340343 | Available online at: www.ijcseonline.org

Accepted: 08/Mar/2019, Published: 31/Mar/2019

***Abstract*—** Skin cancer is nothing but the increasing growth of abnormal skin cells. It occurs when unrepaired DNA damage to skin cells begins the mutations, or genetic defects, that lead the skin cells to multiply rapidly and form malignant tumors. Malignant melanoma is considered as one of the most dangerous skin cancers as it increases the mortality rate. Computer-aided diagnosis systems can helps to detect melanoma early. In the last decades, skin cancer increased and its incidence becoming a public health problem. Technological advances have allowed the development of applications that helps the early detection of melanoma. In this context, an Image Processing was developed to obtain Asymmetry, Border, Color, and Diameter (ABCD of melanoma). Using neural networks and NB which are used perform a classification of the different kinds of moles.

***Keywords*—** Melanoma; Image Processing; Artificial Intelligence; Convolutional Neural Networks; Naïve Bayes.

I. INTRODUCTION

Malignant Melanoma is considered as one of the most dangerous type of skin cancer as it increases the mortality rate. Cancer arises when the genes of one DNA cell, that control cell division and reproduction, are damaged. Damaged genes make the cells divide and grow without control or order, becoming a malignant tumor. Computer-aided diagnosis systems help to detect melanoma at early stage. Technological advances have allowed the development of an application that help the early detection of melanoma. In this, an Image Processing was developed to obtain an Asymmetry, Border, Color, and Diameter (ABCD of melanoma). Using Neural Networks need to perform a classification of the different kinds of moles. In the proposed system we need to find the types of moles which is detecting melanoma, so that represents a tool of care and prevention for physicians and patients. For feature extraction Convolutional neural network (CNN) is used and for classification Naïve Bayes (NB) classification algorithms are used. We need to find accuracy of both classifiers.

In the rest paper, brief introduction of Melanoma skin cancer discussed in section-I, Related work briefly in section-II, Motivation is mention in section-III, System architecture is described in section IV, algorithms are described in section-V and section-VI concludes research work.

II. RELATED WORK

Cancer arises when the genes of one DNA cell which control cell division and reproduction, are damaged. Damaged genes make the cells divide and grow without any control or order, becoming a malignant tumor [1]. In the case of melanoma, the damage to DNA is caused by overexposure to ultraviolet rays (UV), and the affected cells are the melanocytes that produce melanin (pigmentation of the skin). Usually, the first tumor that develops is found on the skin. Melanoma grows and spreads in the first layer of skin before inflow into the deeper layers and then grows towards the lymph vessels and blood, if it is not detected [2].

An effective framework of a CAD (Computer-Aided Diagnosis) system for melanoma type of skin cancer is developed mainly by application of an SVM (Support Vector Machine) model on an optimize set of HOG (Histogram of Oriented Gradient) base descriptors of skin lesions. Experimental results obtained by applying the presented methodology on a large, publicly accessible dataset of dermoscopy images demonstrate that the proposed framework is a strong contender for the state-of-the-art alternatives by achieving high levels of sensitivity, specificity, and the accuracy (98.21%, 96.43% and 97.32%, respectively), without sacrificing computational soundness[3]. Some paper presents a novel framework for

automated melanoma recognition in dermoscopy images. The proposed framework splits into deep learning method merits and encoding strategy of local descriptors. ImageNet used a very deep residual neural network pre-trained to extract the deep representations of a dermoscopy image. Then these local deep descriptors are aggregated by fisher vector (FV) encoding to build a holistic image representation. Finally, the encoded representations are classified using SVM[4].

The Congress of biomedical engineering held in Toronto, Canada has presented the software for the detection of melanoma, based on artificial neural networks and computer vision. The software initially omitted the parameters of "color and evolution" of "alphabet of injury" because those photos are handled in two dimensions and are processed in grayscale. Early diagnosis is of great importance for treating this disease as it can be cured easily at early stages. To improve the diagnosis of this disease, dermoscopy has been introduced to assist dermatologists in clinical examination since it is a non-invasive skin imaging technique that provides clinicians high-quality visual perception of skin lesion. Compared with the conventional macroscopic (clinical) images, fewer surface reflection, more sufficient deep layers' details, and lower screening errors make dermoscopy images achieve much better visibility and recognition accuracy [5]. Since melanoma is more deadly than non-melanoma skin cancer, discrimination between cancer and non-cancerous melanoma dermoscopy images has attracted considerable interest. Clinically, several heuristic approaches, such as "ABCD" rule and "CASH", have been developed to enhance clinicians' ability to distinguish melanomas from benign nevi. The early detection of the skin cancer increases the chances of a cure unlike when it is discovered in advanced stages. In this way, it could reduce the mortality rate for this type of disease(cancer). Also, recent studies have shown that the values of performance on the classification of melanoma to a dermatologist are in the range of 75 to 84 % [6].

Several researchers over time have created different methods and software for the detection of this disease by artificial vision. The National University of Colombia presented a tool supporting diagnosis of melanoma using dermatoscopic images. In which, by morphological operations quantifies the presence of three features: atypical reticular pattern, asymmetry of patterns and bluish-white veil. As a result of the classification of elements with the technique of vectors of support, the proposed system gets a performance of 90.62 - 100% for the values of sensitivity and specificity [7]. Researchers from the Universities of Seville, Cordoba and Loyola Andalusia in Spain have developed a system capable of classifying melanomas from dermatoscopic images, to avoid the biopsy, which is of type invasive. The system developed gets 80 features of the images: texture, the shape, and the color, which vary in the different stages of melanoma [8]. In some paper, automatic ABCD scoring of dermoscopy lesions is implemented. The ABCD (asymmetry, border irregularity, color and dermoscopic structure) rule of dermoscopy is a scoring method used by dermatologists to quantify dermoscopy finding and effectively separate melanoma from begin lesion. Automatic detection of ABCD features and separation of begin lesions from melanoma could enable earlier detection of melanoma. Bad contour detection and the inability to detect structures[9].

However, the correct diagnosis of a skin lesion is not trivial even for experienced professionals. Furthermore, dermoscopic diagnosis made by human visual inspection is often laborious, time-consuming and subjective. Hence, the unsatisfactory accuracy and poor reproducibility are still issues for diagnosing this disease.

III. MOTIVATION

Most of the skin cancers are locally destructive cancerous (malignant) growth of the skin. They originate from the cells of epidermis, the superficial layer of the skin. Unlike cutaneous malignant melanoma, the vast majority of these sorts of skin cancers rarely spread to the other parts of the body (metastasize) and becomes life-threatening.

IV. SYSTEM ARCHITECTURE

The program developed which classifies the types of moles detecting melanoma, so that represents a tool of care and prevention for physicians and patients. A system of learning, recognition, and classification must consist of the so-called "ABCDE" or alphabet of melanoma [2] which consists of the following points: - Asymmetry of the form: one-half of the moles are different from the other half. - Borders: blurry, irregular, festooned, diffuse or imprecise. - Color: varied in the same place or multiple colors on the same mole as red, white, black, and brown - Diameter: greater than 6 millimeters. - Evolution in time: changes (growth, bleeding, itching, etc.). For feature extraction Convolutional neural network is used and for classification NB (Naïve Bayes) classification algorithms are used.

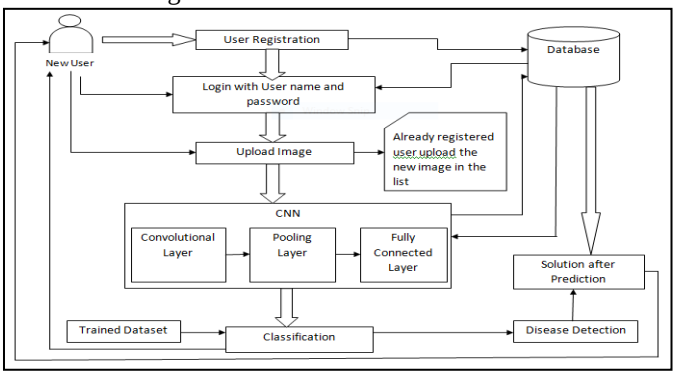

Fig.1 The Proposed System

I. **Upload Image**: This module is used to store image of the user into the database. User uploads the image into system, system uses that image as a testing dataset

II. **Fetch Image**: This module is used to pass image to the classifier for the predication of the disease. System fetch that uploaded image for feature extraction and classification.

III. **Prediction**: These module shows the result or predication of the disease in which CNN algorithm is used for feature extraction and NB is used for classification.

IV. **Solution:** This module will provide solution to user in the form of suggestion after prediction.

V. ALGORITHMS

We are using two algorithms in our proposed system i.e. CNN and naïve bayes. CNN is used for prediction and NB algorithm is used for classification. These algorithms and their steps are explained below:

A. CNN Algorithm

In CNN algorithm, there are three layers which are

1. Convolutional layer
2. Pooling layer
3. Fully connected layer

1. Convolutional layer:

Convolutional layer apply a convolution operation to the input, passing the result to the next layer. The convolution emulates the response of an individual neuron to the visual stimuli.

2. Pooling layer:

Convolutional network may includes local or global pooling layer, which combine the output of neuron clusters at one layer into a single neuron in the next layer. For example, max pooling uses the maximum value from each of a cluster of neurons at prior layer. Another example is average pooling, which uses the average value from each of a cluster of neurons at prior layer.

3. Fully connected layer:

Fully connected layer connects every neuron in one layer to every neuron in another layer. It is in principle the same as traditional multi-layer perceptron neural network (MLP).

- Steps for algorithm

1. Image resizing

2. Grayscale conversion of the colored images

3. Image from training set and tune set are considered to train the system.

4. Image is converted to its pixel value so as to undergo CNN steps.

5. Epochs are specified i.e. How many number of times the CNN steps will be repeated.

6. The image undergoes convolution step

$$(f*g)(t) = \int_{-\infty}^{\infty} f(T)g(t-T)\,dT$$

$$= \int_{-\infty}^{\infty} f(t-T)g(T)\,dT$$

Where, f*g = integral product of two function

f(t) = weighted function

g(t-T) = time delayed function of g(t)

7. The output of convolution step is given as input to ReLU.

8. Pooling step is than performed, where the maximum value (from the stride under consideration) is considered for further processing.

9. The fully connected layer combines the data from all the above operation i.e. integrates the bits and the parts done of an image.

10. Error of the output obtained is calculated.

$$e_j(n) = d_j(n) - y_j(n)$$

Where,

d = target value,

y = value produced by perceptron

11. This error is back propagated to calculate gradient that is required in calculation of weights to be used in network.

$$E = \frac{1}{2n}\sum_{x}\left(y(x) - y'(x)\right)^2$$

Where,

e= error function,

y'(x) = derivative of y(x)

12. The above steps are repeated for the number specified in maximum epoch's value.

B. Naïve Bayes Algorithm

Using Naïve Bayes classifier, we predicate the result , depend upon training dataset. In this, Naïve Bayes classifier is used to classify the values. Naive Bayes classifier considers that the presence of specific feature in class is not related to the presence of any other feature.

Naive Bayes model is used for large data sets and this model is easy to build. Naive Bayes is mainly use due to its simplicity and highly sophisticated classification methods.

We can calculate posterior probability P(c|x) from P(c), P(x) and P(x|c) by using Bayes theorem. Look at the equation below:

$$P(c \mid x) = \frac{P(x \mid c)P(c)}{P(x)}$$

Above,

- $P(c|x)$ is the posterior probability of *class* (c, *target*) given *predictor* (x, *attributes*).
- $P(c)$ is the prior probability of *class*.
- $P(x|c)$ is the likelihood which is the probability of *predictor* given *class*.
- $P(x)$ is the prior probability of *predictor*.

VI. CONCLUSION

The system which is developed for the detection of melanoma as an instrument, which provide a second opinion for the diagnosis of this disease, due to the analysis of the ABCD, giving a high degree of reliability. In the same way, the system gives a result with greater efficiency, due to the analysis of image and image processing being done in small intervals at time, limited by the type of computer and the processor that has at its disposal, obtaining an efficient timely result. For classification NB algorithm is used. The solution is provided after prediction.

REFERENCE

[1] Simes, M. C. F., J. J. S. Sousa, A. A. C. C. Pais. "Skin cancer and new treatment perspectives : A review." Cancer letters, Vol.357, Issue.1, pp.8-42, 2015.

[2] DS. Rigel, J. Russak, R. Friedman, "The evolution of melanoma diagnosis: 25 years beyond the ABCD," *CA: To Cancer J.*, no. 5, pp. 301- 316.

[3] Samy Bakheet, "An SVM Framework for Malignant Melanoma Detection Based on Optimized HOG Features" Computation 2017, Vol.5, Issue.1, pp.1-4, 2017.

[4] Zhen Yu, "Aggregating Deep Convolutional Features for Melanoma Recognition in Dermoscopy Images", Springer International Publishing Switzerland, pp. 238–246, 2017.

[5] C. Marín, GH. Alferez, J. Córdova, V. Gonzalez. "Detection of Melanoma Through Image Recognition and Artificial Neural Networks," in *Proc. World Congress on Medical Physics and Biomedical Engineering (TOILET'2015),* Toronto, Canada. Jan. 2015.

[6] C. F. Ocampo, "Tool support the diagnosis of melanoma using images dermatoscopic or to Support Tool for Melanoma Diagnosis by using Dermoscopy Images," Ph.D. dissertation, Univ. of Manizales Colombia, Colombia. 2011.

[7] Ferris, Laura K., et al. "Computer-aided classification of melanocytic lesions using dermoscopic images." Journal of the American Academy of Dermatology, Vol.73, Issue.5 , pp.769-776, 2015.

[8] Alcn, Jos Fernndez, et al. "Automatic imaging system with decision support for inspection of pigmented skin lesions and melanoma diagnosis." IEEE journal of selected topics in signal processing , Vol.3, Issue.1, pp.14-25, 2009.

[9] Kasmi, Reda, and Karim Mokrani. "Classification of malignant melanoma and benign skin lesions: implementation of automatic ABCD rule." IET Image Processing , Vol.10, Issue.6, pp.448-455, 2016.

[10] Wilson F. Cueva, F. Muñoz, G. Vásquez., G. Delgado ," Detection of skin cancer "Melanoma" through Computer Vision", Published in IEEE XXIV International Conference on Electronics, Electrical Engineering and Computing (INTERCON) , Cusco, Peru, pp.5090-6363, 2017 IEEE .

[11] Shraddha Tadmare, Bodireddy Mahalakshmi, "A Survey on Plant Disease Detection and Classification Using Different Machine Learning Algorithms" , Vol.7, Issue.2, pp.338-341, Feb-2019.

[12] H. Chandrashekhara, M. Suresha, "Classification of Healthy and Diseased Arecanuts using SVM Classifier", Vol.7, Issue.2, pp.544-548, Feb-2019.

