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Pre Clinical Diagnosis of MelanomaTumor in skin using Machine Learning Techniques

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Abstract

In today's environment, medical care issues have become a blistering issue, and problems such as the unbalance and inadequate distribution of medical services has become increasingly evident. In this case, the application of ML has been the inevitable pattern in the modern growth of medical treatment. Many cancers and tumors have emerged in the world in recent years as a result of the evolution of cosmetics use. Melanoma is one such deadly cancer or tumor. Melanoma is a cancerous condition in which the pigment-producing cells that give the skin its colour become cancerous. A recent, irregular growth or a shift in an existing mole may be signs. Melanomas can develop on any part of the body. The proposal's key goal is to use effective machine learning methods to detect melanoma tumors.This work involves classification and prediction by novel methods to diagnose the melanoma tumor.

Keywords: Machine learning, Dermatology, support vector machine, melanoma cells, Prediction accuracy.

1. INTRODUCTION

The skin, which is the body's exterior shell, is the main organ of the human body. The underlying muscles, bones, ligaments, and internal organs are protected by up to seven layers of ectodermal tissues in the skin. The antioxidants protect the physical body from harmful elements and bacteria, aids in body temperature regulation, and allows for the sensations of cold, fire, and contact. A skin lesion occurs where a portion of the skin is irregular in comparison to other areas of the skin. Infection in or on the skin is the most common and essential cause of skin lesions.Skin lesions are classified into two types: predominant (present at birth or formed over time) and intermediate (caused by mismanaging the predominant dermoid cyst), all of which can result in premature melanoma. Each year, more than three million individuals in the United States are infected with a kind of skin cancer.

In India, over 5000 skin cancer patients are admitted each year, with over 4000 people dying. Skin tumours are divided into three types: Basal cell carcinoma (BCC), squamous cell

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carcinoma (SCC), and melanoma are three types of skin cancer. Tumors are called cancerous if they are malignant, and is a very serious form of skin cancer that develops quickly and spreads to other areas of the body. A benign tumour, on the other hand, is not really harmful because it spreads but does not spear.As a result, manual skin cancer screening is not very effective, although the dislodging is examined with the unaided eye, where features cannot be observed precisely, resulting in mistreatment and, eventually, death. Early stage diagnosis of accurate skin cancer can improve survival rates. As a result, rapid identification is more effective, resulting in increased precision and performance.(Vidya et al 2020)

Melanoma is caused by skin exposure to UV radiation, which is one of the main causes. Dermoscopy is indeed a procedure for examining the surface of the tissue. Melanoma can be detected using Dermoscopy photographs using an observation-based screening technique. Dermoscopy accuracy is determined by the dermatologist's preparation. Even though skin experts use dermoscopy as a tool for diagnosis, the accuracy of Melanoma Detection will range from 75% to 85%. The system's diagnosis will assist with speeding up and enhance the effectiveness of the diagnoses.(Chung et al 2000)

A computer would be able to retrieve details such as asymmetry, colour contrast, and texture characteristics, which are minute parameters that are not detectable. An automatic dermoscopy image analysis (Jaisakthi et al. 2018) system has three stages: (a) preprocessing, (b) proper segmentation, and (c) feature extraction and collection(Balasundaram et al .2020). The most significant and still plays a crucial part in the phase of future measures. By taking into account criteria such as shapes, heights, and colours, as well as skin styles and textures, supervised segmentation seems to be simple to enforce. This system-based analysis would speed up diagnosis while also improving accuracy. Dermatological pathogens (Hemalatha et al 2018)are one of the most difficult terrains for rapid, simple, and accurate diagnosis due to their high severity, diversity, and scarcity of expertise, particularly in developing and underdeveloped countries with limited healthcare resources. It's also pretty apparent that early diagnosis of certain infections decreases the risk of major consequences. Recent environmental conditions have merely served as a mechanism for the development of these skin diseases. The proposed paper concentrated on the feature extraction and classification method for melanoma tumour prediction.Figure1 showcases sample lesion images related to benign and melanoma.

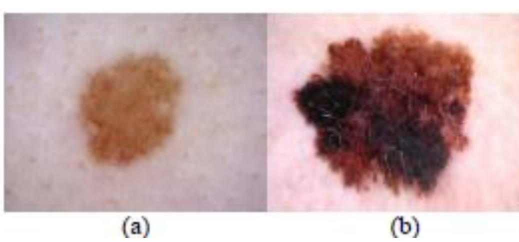

Figure 1 Sample lesion images (a) Image showcasing Benign (b) Image showcasing melanoma (Codella et al 2017)(Vidya et al 2020)

2.Related Works

Jojoa Acosta et al 2021 diagnosed the melanoma cancer using images gathered with respect to dermatoscopy. The Mask R_CNN technique has been used for cropping lesion images to find the normal or malignant class in skin. Inspite of novel techniques utilized, the image clarity is not clearly defined in some abnormal regions.

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Mohammad Ali Kadampur et al 2020 discussed on classification of dermal cell images using an efficient deep learning technique for skin cancer prediction. The authors developed an architecture which based on model-driven behavior with cloud storage.The process of deep learning model have been focused in this work topredict the skin cancer.However the authors have not focused on training level of data with respect to enterprise level.

Ahmad Naeem et al 2020 emphasized on classification of melanoma with respect to malignant area by machine learning models .The authors have focused on the selection of datasets, measurement of performance, and other opportunities and challenges faced during the classification. All the models specified in this article enrich the researchers to select the suitable domains.

Shunichi Jinnai et al. 2020 implemented deep learning concepts for classification of cancer in skin through analysis of pigmented skin lesions. The classification is focused on transformation of brown color to black color segments. However, the authors had less focus on early detection and prognosis based improvements.

Vijayalakshmi 2019 focused on prediction of melanoma cancer using image processing and machine learning techniques. Some of the processes such as removal of hair glare and segmentation was analyzed and prediction results has been compared based on images retrieved. However, there is no detailed mathematical specification is found in the article.

This article, according to Sanjana M and Dr. V. Hanuman Kumar, focuses on identifying skin cancer caused by one of the conditions mentioned above. To predict the stage of cancer, the images are analysed using a mixture of machine learning and image recognition. A derma scope is used to take images of the infected region. Several techniques for detecting skin cancer have been suggested, but the majority of the inputs must be performed manually. The key objective of this work was to create a machine learning algorithm that needs no human involvement.

Melanoma identification necessitates a number of procedures, including pre-processing, segmentation, labelling, and feature extraction. This article focused on various approaches such as Hybrid Artificial Neural Networks, Genetic Algorithms, Neuro Fuzzy Systems, Hybrid Genetic Algorithm and Artificial Neural Networks, SVM, CNN, ABCD law, and unsupervised algorithm – K means algorithm, among others. However, of all the algorithms studied, the SVM algorithm approach is the best for cancer detection because it has the fewest drawbacks. We assume that the neural network technique is the strongest of all the available methods. (NikithaKaut et al (2018)).

Munya A. Arasi et al. (2016) based through an review of recent state-of-the-art of Computer-aided detection/diagnosis (CAD) systems in detecting and identifying malignant melanoma of Dermoscopy photographs, describing the steps from image collection to preprocessing to malignant melanoma recognition of Dermoscopy images. The Discrete Wavelet Transform (DWT) and the approach that blends both texture and colour features to produce performance with very high precision are the most general methods for feature extraction,

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according to the comparative analysis. Nearest Neighbor, Artificial Neural Networks, and Support Vector Machines are the grouping methods.

3.METHODOLOGY

This section entails about the methodology for diagnosis of melanoma cancer using machine learning techniques such as SVM and Back propagation algorithm. The following figure 2 depicts the image processing steps for classification of begin and malignant melanoma.

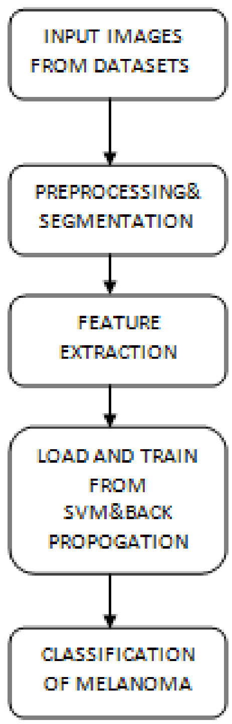

Figure 2 Steps in Proposed Methodology

The support vector machine is the most common kind of classifier (SVM). The primary benefit is the centralised framework; that is, different types of deep learning frameworks can be created by selecting a kernel. The characteristics acquired from the benign and melanoma skin lesions are fed into the SVM classifier.This is accomplished by feeding the segmented and interface generated frames into SVM, which creates a hyperplaneas shown in figure 3 and categorises all nearby features into separate classes.Place the hyperplane in the middle, in which the distance between the closest points is greatest, and have the fewest test errors possible.

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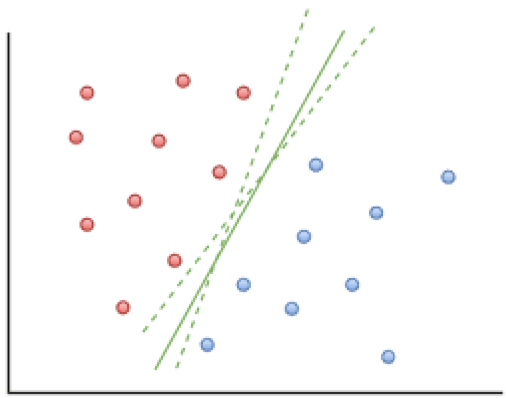

Figure 3 Sample Plot of SVM hyper plane(internet source)

For learning multi-layer perceptrons, Back Propagation is a supervised learning algorithm. We initialise the weights with some random values when modelling the neural networks since we don't know what the weights would be, so we start with certain weight matrix if the service uses an inconsistency with high values. As a result, we must alter the values in order to reduce the minimum error. To generalise, we may simply consider

- Compute the failure – What is the difference between the model's output and the real output?
- The bare minimum Check to see if the mistake has been reduced.
- Review the specifications – If the error is significant, the parameters can be updated (weights and biases). Test the mistake once more after that. Repeat the procedure until the mistake is reduced to a bare minimum.
- Prototype is prepared to make a forecast – Once the uncertainty has been reduced to a minimal, you will feed your model some inputs and it will generate the results.

4. RESULTS AND DISCUSSION

Datasets of skin lesion images obtained from the International Skin Imaging Collaboration are used in the first steps of this work (ISIC) (Codella et al 2017). The datasets used in this study are made up of benign and malignant melanoma skin lesions. There are 328 benign lesion images and 672 malignant melanoma lesion images in total. Photos of skin lesions were gathered from ISIC 2017 datasets. JPEG format is used for the images.

(a) (b)

Figure 3 (a) Normal Image, (b) Grey scale image

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The specificity (SP) and sensitivity (SE) of classifier models are used to assess their efficiency. Equation 1 and equation 2 illustrate how they are described.

$$Specificity = \frac{TN}{TN + FP} \quad (1)$$

$$Sensitivity = \frac{TP}{TP + FN} \quad (2)$$

Where , TP = True Positive Data and False Negative Data

TN = True Negative Data and FP =False Positive Data

Table 1 confusion Matrix

Actual	Predicted	
	Positive	Negative
Positive	TP(True Positive)	FP(False Positive)
Negative	FN(False Negative)	TN(True Negative)

Table 2 Results of Specificity and Sensitivity Parameters

Classifier	**Sensitivity(%)**	**Specificity(%)**	**Prediction accuracy(%)**
Back propagation	80	83	79
SVM	68	78	82

Table 1 describes about the confusion matrix related melanoma prediction. Table 2 depicts the percentage levels of true positive and false negative values. Hence, from the table the prediction accuracy of melanoma cancer has been represented with respect to SVM and Back propagation respectively.

5. CONCLUSION

This paper focused on pre-clinical diagnosis of melanoma in human skin using machine learning techniques such as SVM and back propagation .The methodology has been depicted in section 3 and the results have been evaluated based on sensitivity and specificity in section 4.

The results show the prediction accuracy of 79 % and 82% with respect to back propagation and Support vector machine classifiers. In future the proposal can be applied and analyzed with linear regression and random forest classifiers.

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