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Skin Cancer Diagnosis: Integrating CNN and Machine Learning Models

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Abstract:

Skin cancer is serious health concern that arises from abnormal growth of skin cells. It encompasses of three types, melanoma being the most aggressive form of cancer. The skin cancer starts to arise globally so accordingly there is being necessary public awareness, prevention for this, and strategies for early detection. Accurate diagnosis treatment and Early detection are better for effective management which will improve accuracy and efficiency for diagnostic process. Also, the Machine learning and deep learning algorithms we research and analyse for better outcomes and for innovation in fields of skin cancer detection. And for better treatment for patients, to reduce healthcare costs and overall management of skin cancer. Better constituency and through ongoing research we can try to overcome with help of future advancements in technology and the learning algorithm model. According to our reports and research we did through the dataset of skin images ML and deep learning we got 73% through Naïve Bayes 90% accuracy through random forest algorithm and 89% through CNN model algorithm. We do not conclude that Machine learning algorithm can be better since there are many other factors use in different algorithms so results are not based on high accuracy reports.

Keywords: Deep learning, CNN model, Machine learning, Skin cancer

1. Introduction

Skin cancer occurs when there is growth of unwanted cells on layer of skin and after some time the skin cells start to die and these cells occupy the then and try to spread at all other parts of body, also including vital organs. Skin cancer is increasing for the last few decades and rising through it as well. Despite technology and science rapidly rising, still skin cancer is becoming a major cause in diagnostic and treatment techniques. Mostly in particular regions where there is exposure in high levels of ultraviolet rays (UV) in radiation exposure. In many parts of the world, it is been arising in recent years in men and women as well so cases are rising ever year, underscoring the urgent need for improved methods of analysis and prediction to mitigate its impact on population health.

It arises from mostly from over exposure of UV rays, tanning beds, and sunlamps and sometimes it can also arise and cause damage as a sunburn. Among the skin cancer the most common forms are: Basal cell Carcinoma (BCC), Squamous cell carcinoma (SCC) and Malignant melanoma (MM) cancer. The BCC and SCC can be cured and taken care but with expensive treatments. But MM cancer is deadious and spread to other parts of the body quickly if not precautious. Early detection gives you best chance for successful skin cancer treatment. By collecting the data, some factors, environmental methods, and some features so that we develop algorithms which can identify individuals at risk of skin cancer and through surveillance strategies. We use the methodology techniques in our study and some analytical techniques.

2. Review of Literature:

Skin cancer is significant public health concern worldwide, with its rapidly rising over the past few years. In US, it is believed that around 4 million cases of skin cancer are diagnosed with cancer each year, so there is much more needs for better and proper method for prediction and analysis for the impact on population health [1].

Through Dermoscopy it does increases accuracy of melanoma diagnosis, but sometimes lack some features particular for early detections of melanoma. It is not good for diagnosis melanoma treatment but need to improve accuracy for survival rate of patient [2].

The increase advancements in technology and science have also result of non-invasive image methods for the availability and for detection of skin cancer. But for this cost, available and expertise of tools are the widespread challenges [3].

Skin cancer is type of cell disease which grows in the cells of skin and then compared to other of cancers. It also effects the large number of people around the world and the important cause is exposure of sunlight and more than 50% of UV sun rays are received by the age of 24 [4].

Skin cancer diagnosis is also based on methods such as surgery, radiotherapy and chemotherapy, some studies have shown that use in technologies of computer such as image processing methods which are related for classification and diagnosis in cancer have been acted in great success. Among the different kinds of cancer which has been occurring melanoma is been the 19th most common cancer increasing in men as well as women [5].

Some methods which include Machin Learning and deep learning algorithms it was helpful so that we can make it awareness to the people who wants to know about skin cancer or need information about related to skin diseases and to detect this kind of skin images, the image processing method has been be used more even by the researchers which had been contributed and gave proper direction as well [6].

3. Methodology:

Input data: The ISIC dataset contains high resolution dermoscopic images of various skin lesions, including benign and malignant images. They are captured and use through imaging techniques which provides detailed view for diagnosis and for skin conditions. This helps to research understand context of images and learning models and contains image for detection and classification of types of skin cancers.

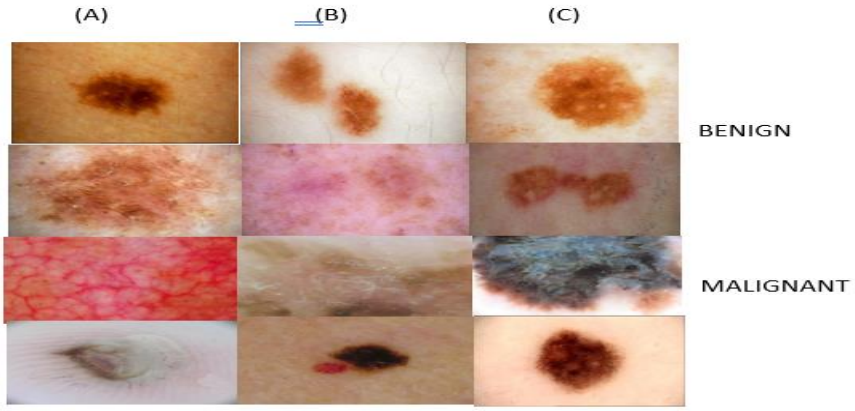

Fig 1. Images of Benign and Malignant

Pre-processing: You load image labels to check whether it is malignant or benign. Then you change the suitable size of skin image for CNN architecture that you are using. Then normalization is applied which is use to scale the pixel value of images to range, which consist between 0 and 1, which helps in learning process during training includes Gaussian blur, YCbCr colour space and discrete Fourier transform technique.

Segmentation: It is process in research of skin cancer according to areas of interest of skin images which focus on the region which are suspected of malignancy. Some techniques are use with quantitative analysis of the characteristics (e.g. shape, colour, size, etc) of skin cancer.

Feature extraction: In this process it involves information from images or dataset to change or differentiate skin. To validate and evaluate the extracted features for accurate diagnosis and treatment strategies for skin cancer patients.

Classification: In this technique it involves categorization which is based on features and criteria and images extracted from dataset images, algorithms, and treatment planning. It involves through machine learning or Deep learning CNN.

1) CNN are composed with different convolutional layers as building blocks. It applies filter to the image and slide over the image which captures patterns which ate edges, texture or shapes. The layers connect in one layer to another through neuron which allows network to learn high level feature and make the predictions.

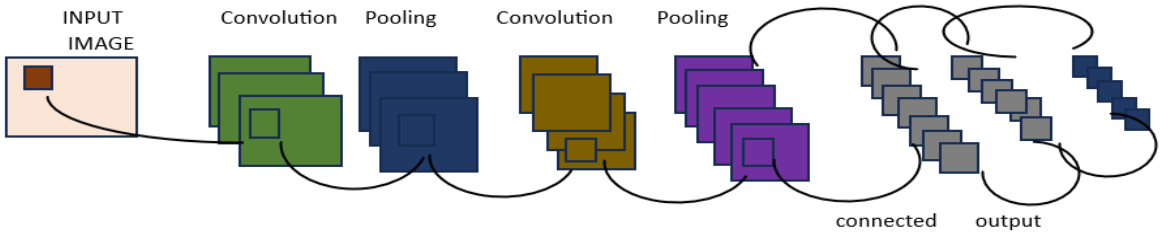

Fig 2. Convolutional Neural Network (CNN) Model

MODEL WITH EXPERIMENT RESULT:

From the below diagram through the ISIC dataset, detection system has been found through two ways. One goes with deep learning method detection and the other goes with machine learning method detection.

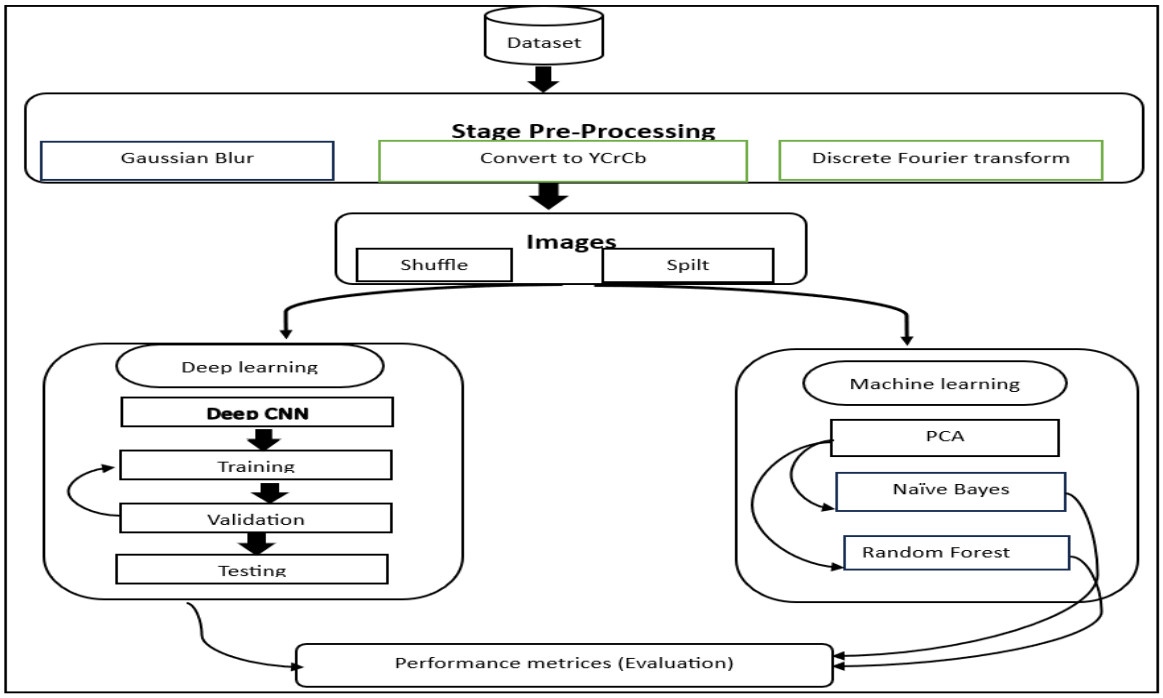

Fig 3. Methodology Model

The ISIC dataset used in where individuals develop and change Machine learning and deep learning algorithms for tasks such as segmentation, classification, and diagnosis of data. During implementing result pre-processing is common stage for both detection Models. It is use for evaluating the performance of the images.

1) Gaussian Blur: It is commonly used in image processing technique that helps to reduce image and detail overall structure of edges and nodes. Large the size of kernel is there will be more result in blurring of image.

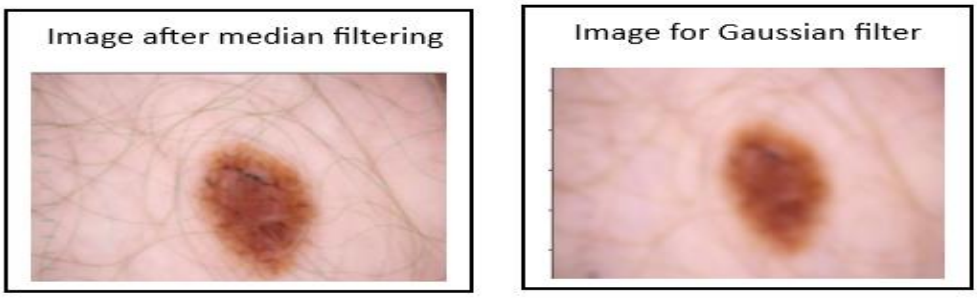

Fig. 4 Gaussian Blur Image

2) YCbCr colour space: It represents using components of Y(luminance), Cb (blue chrominance) and Cr (red chrominance). Y represents brightness of image and Cb and Cr represents colour information.

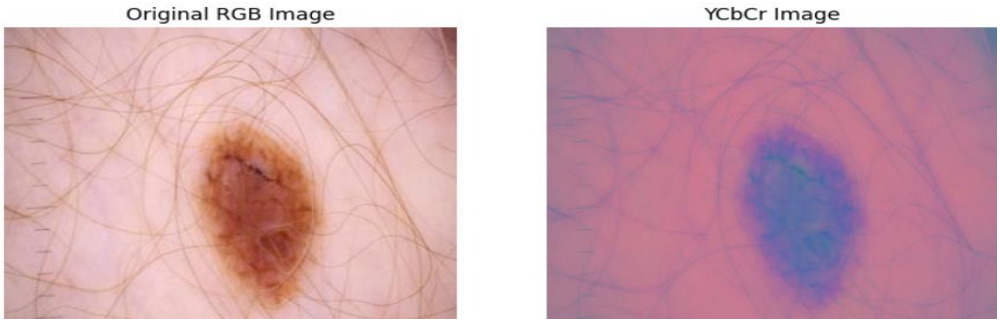

Fig. 5 YCbCr Image

3) FFT: It is use to transform the data and to analyse the frequency of image content which is represented by combination of different amplitudes and frequencies.

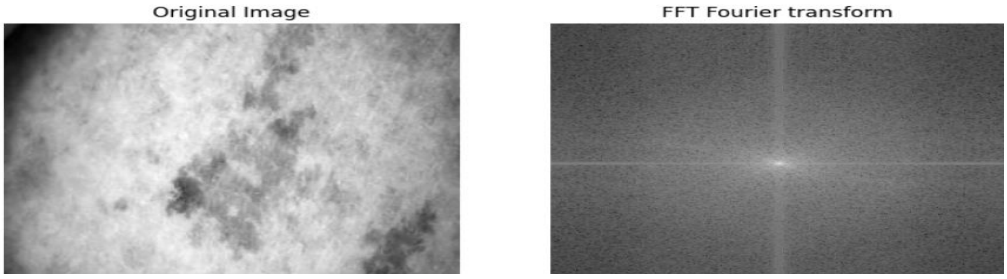

Fig 6. FFT Fourier Transform Image

From the below diagram by taking the image of skin and going through segmentation process. We go through learning model which can be through Machine learning or Deep learning CNN.
Then after that prediction is done whether the image is Benign or Malignant.

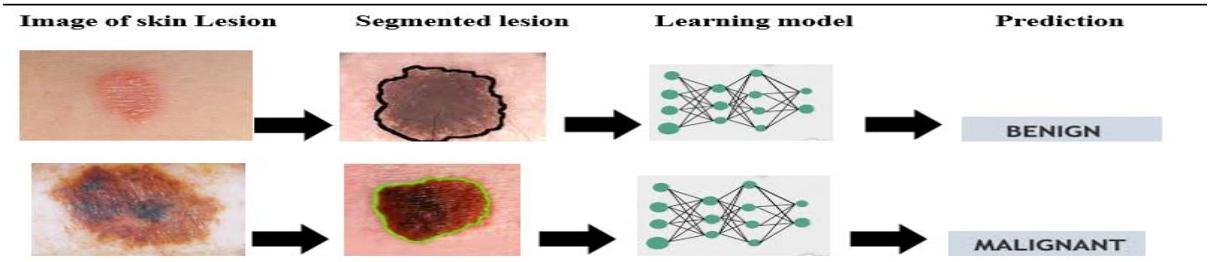

Fig. 7 Prediction Model

4. The results of classification stage:

The consequences of the future system in classification stage for both of machine and deep learning have been presented as the following:

MACHINE LEARNING ALGORITHMS:

1) Principal Component Analysis: It is an unsupervised learning algorithm and is technique which draws strong patterns from the given data by reducing the variances. The main goal is to reduce the dimension of data set by reducing it and then finding new set and smaller than original set.
2) Naïve Bayes: It is supervised learning algorithm which helps in fast and quick predictions. It is probabilistic classification based so it predicts according to the object of probability.
3) Random Forest: It is supervised learning algorithm which is mostly use for set of decision trees. It combines the dataset of various decision trees to avoid overfitting ao that we can get more accurate predictions.

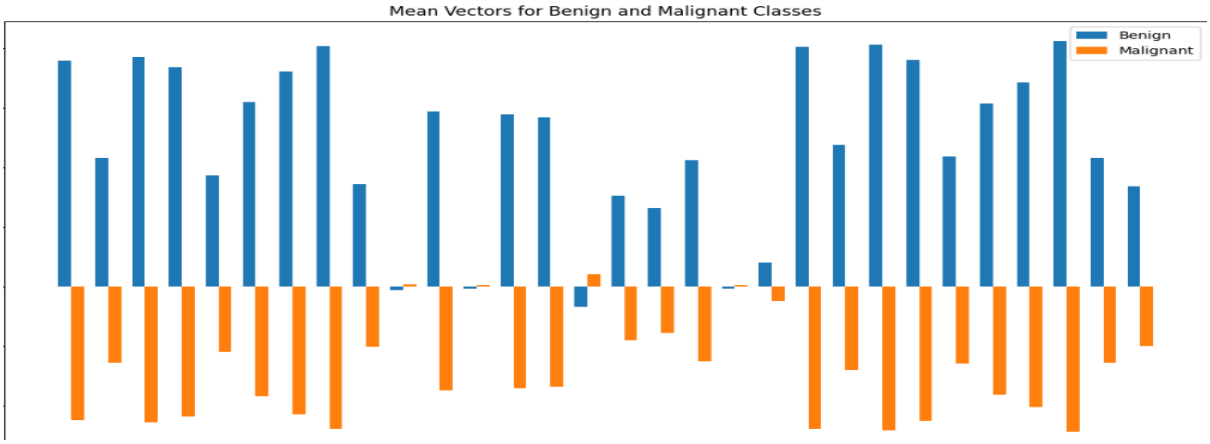

Fig 8. Mean vector Model

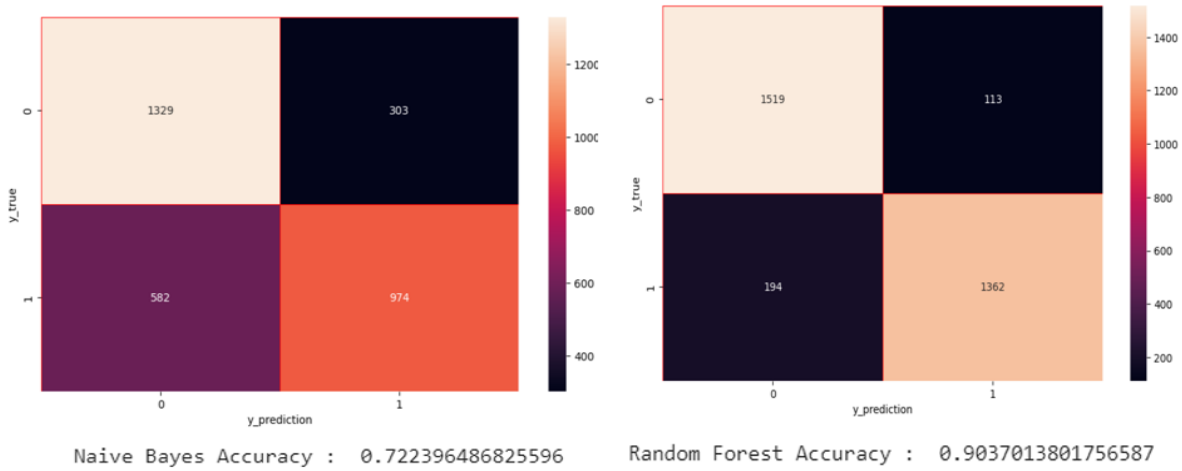

Fig. 9 Confusion Matrix Model with Accuracy

DEEP LEARNING CNN:

CNN is type of deep learning neuron model for network architecture which is commonly used for computer vision. And is also type of deep learning algorithm which take any input image of skin, configure according to the features and then to compare from one to another. It is mostly use for image classification and for other processing tasks. The convolutional layers, Pooling layers and fully connected layers are the types of CNN other layers.

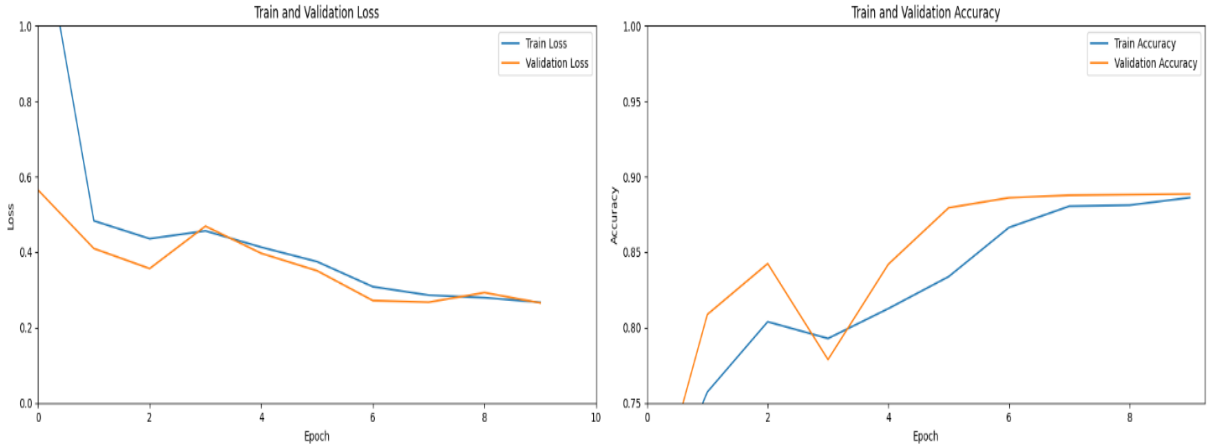

Fig. 10 Loss and Accuracy Graph

	precision	recall	f1-score	support
0	0.88	0.91	0.89	1252
1	0.90	0.87	0.88	1153
accuracy			0.89	2405
macro avg	0.89	0.89	0.89	2405
weighted avg	0.89	0.89	0.89	2405

Fig. 11 Classification Report

Confusion matrix is use to check the performance in the learning model which does represents accuracy of classification model. It offers true positive and true negative, false positive and false negative for overall model comprehension of precision, recall and accuracy based on metrices of dataset. Here is a breakdown of the confusion matrix theory in the context of skin cancer.

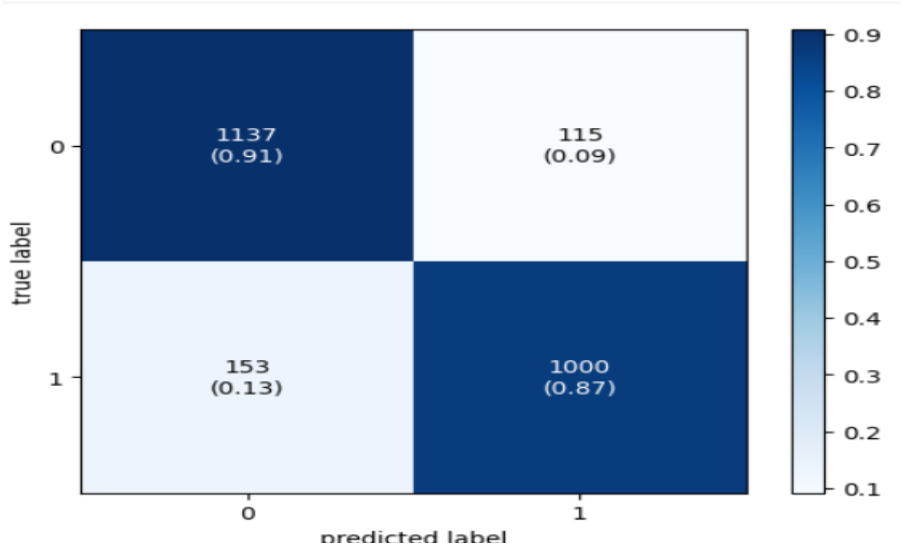

Fig 12. Confusion Matrix Model

5. CONCLUSION:

Skin cancer can be reduced through by taking care of our own self. Some better precautions, away from UV rays and better cure. Also, public campaigns and awareness and regular skin check-ups also plays vital role in this. The two classes i.e. Benign and Malignant of mean vectors shown are results applied by the algorithms for the confusion matrix. For Machine learning, Naïve Bayes got satisfactory result of 72% with images of dataset. Then the Random Forest was shown 90% with the number of skin images. Then the Random Forest shown high results of 89% when compared with other two learning models and work attached to it. Both Machine learning and deep learning algorithms can analyze large number of datasets. We cannot justify that Machine learning model are more predictable since the analysis are based on different factors since there is slight difference between the analysis Furthermore, ongoing advancements in technology and research of Deep CNNs and ML algorithms for analyse are been continue to enhance the understanding and management of skin cancer so in better future with few cases and improved results for individuals affected by skin cancer.

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