iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** XII **Month of publication:** December 2021

DOI: https://doi.org/10.22214/ijraset.2021.39662

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 9 Issue XII Dec 2021- Available at www.ijraset.com

Classification of Melanoma and Nevus for Diagnosis of Skin Cancer by Using Optimized Convolution Neural Network

Neha Maheshwari[1], Routhu Akhila[2], Anushiya S[3], Dr. Damodar Panigrahi[4]
[1, 2, 3, 4]*Department of Electronics and Communication, SRM Institute of Science and Technology*

Abstract: ***Melanoma is taken into account a fatal sort of carcinoma .Differentiating melanoma from nevus is difficult task. Nevus is a common pigmented skin lesion, usually developing during adulthood, which is harmless. Since they look similar it has to be identified and reduce the risk of cancer. The death rate thanks to this disease is in particular other skin-related consolidated malignancies. In this work, we have used convolution neural networks to classify the image into melanoma and nevus. The images are pre-processed using median filter, top-bottom hat filter and are passed through layers of CNN. We have achieved an accuracy of 97.56%, sensitivity of 95.23%.The F1_socre is 97.56.***

Index terms: Melanoma, Nevus, True Positive, True Negative, False Negative, False Positive, Confusion Matrix, Epoch, Convolution Neural Network.

I. INTRODUCTION

Cancer is the deadly disease for human race. According to a survey by World Health Organisation, there are over 10 million deaths world wide in the year 2020 .Among the 10 million deaths, the deaths happening due to melanoma are 1.20 million. Melanoma is considered as a deadly skin-cancer which looks similar to nevus(mole). There can be various reasons for this. Heavy exposure to sunlight, UV radiations are major reasons of Melanoma. Studies have shown that early detection of melanoma will enable doctors to treat it and decrease the mortality lies. There is an existing medial procedure called ELM, which detects malignant type of disease. With the increase in image processing techniques, there are computer-aided detection methods that helps doctors to treat patients at an early stage. In this work, we proposed an optimized convolution neural network algorithm which distinguishes melanoma from nevus with better accuracy and results . We have optimized the algorithm and took the combinations of filters to bring out the best possible detection of the disease. Taking a large dataset helps in training and testing of the model.

II. PROPOSED METHOD

A. Dataset

We have used Hospital Pedro Hispano dataset. We have taken around 580 images which are RGB colour images. These images have a resolution of 768x560pixels.These dermoscopic images are medically approved tested and approved images. We performed image enhancement technique on these images.We have given 500 images for training and 80 images for testing.

B. Methodology

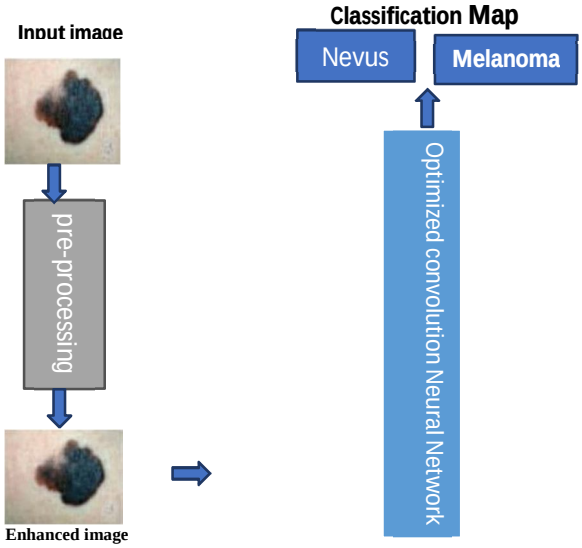


Fig. 1: Block Diagram

©IJRASET: All Rights are Reserved

The block diagram for the work is given in the Fig. 1. The dataset is pre-processed used median filter. The unwanted elements like noise,hair are removed using top-bottom-hat filter.The image is enhanced and the enhanced image used is processed through various layers of CNN. The binary classification of the image into nevus and melanoma is done. The process flow is explained below.

1) *Pre-processing:* The terribly beginning is to pre-process the image which suggests removal of all the fundamental information that contributes the error.

a) *Image:* When a picture pixels are arranged in the form of columns and rows it is known as an Image. An image is apparently a 2-D view of an object which is almost similar to the physical appearance of any object. Transformation of Image Pixels into inches and vice- versa is known as Image Resolution.

b) *Image Processing:* Image processing is a form in which signal is processed where the image is given as the input. The output that it gives can be an image or any features of it which has to be detected or processed. Many processing techniques are added to the image. The image is first acquired using the tools and analysis is done. The image is enhanced and then the extraction of features is been done. We are interested in digital image processing technique here in our work. We have followed pre-processing technique using median filter to remove the noise and also enhanced the image using other techniques.

c) *Image Enhancement:* Image improvement is that the event of digital image quality (wanted e.g. it's for machine analysis), while not the data concerning of degradation source. If the supply of degradation is understood, one calls the maneuver image restoration. Each square measure iconical processes, viz. input and output square measure pictures. Many completely different, typically elementary and heuristic ways square measure accustomed improve pictures in some sense the matter is, of course, not well outlined, as there's no objective live for image quality. Here, we have a tendency to discuss one or two of recipes that have shown to be helpful each for the human observer and/or for machine recognition. These ways square measure terribly downside-oriented: however that works fine in one case might even be utterly inadequate for an extra problem. Apart from geometrical transformations some preliminary gray level changes might even be indicated, to wish under consideration imperfections inside the acquisition system. this may be done component by component, calibrating with the output of a picture with constant brightness. Often space-invariant gray worth transformations also are finished distinction stretching, vary compression, etc. The essential distribution is that the frequency of every gray worth, the gray worth bar graph. Ancient analog image written material is known as photograph retouching, victimization tools like associate airbrush to change images, or written material illustrations with any ancient art medium. Graphic package programs, that is broadly speaking classified into the vector graphics editors, square measure the first tools with that a user may manipulate, and remodel pictures. Several image written material programs are also accustomed render or produce laptop art from scratch.

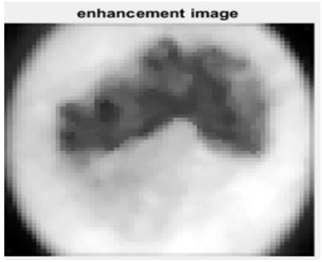


Fig. 2 Enhancement Image

d) *Addition of Salt-pepper Noise*

It is a type of noise which is mostly available on images which causes many type of disturbances in the image signal. It is similar to impulse noise. So, we have added this noise in the images and then did the pre-processing for removing the noise.

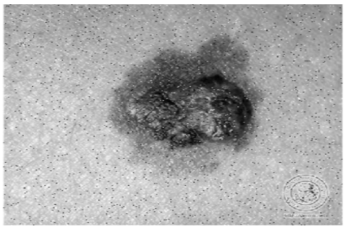


Fig. 3 Noisy Image

e) Comparison Between Filters

Several different filters were taken for the experiment to find out which filters out of them is the most effective one for the removal of noise. Four among them are normal filters and the other four were the combination of some of these filters. The list of filters are:

- *Median Filter:* Median filter is been found as the most effective one for removal of noise, also improves the later processing techniques. It's a non-linear operation.
- *Mean Filter:* When a filter replace its centre value with all the pixel's mean value, then it is said to be mean filter. This is applied for smoothening of a picture.
- *Weiner Filter:* This filter is used in reducing the mean square error which can occur during noise removal by inversion method.
- *Gaussian Filter:* This is a low-pass filter with impulse response as Gaussian Function, and it attenuates the high frequency signal.

Combination of different filters were also done to find the better results, while combining one filter's output was given to another one as input. The combination were:

- Median to Mean
- Weiner to Gaussian
- Weiner to Mean
- Weiner to Median

It has been found that Median Filter gives better result compared to all others and therefore we proceeded with median filter for pre-processing.

f) Median filter: It is mostly uses non-linear filtering technique for removal of noise. This process for removal of noise helps to improve the later processing techniques, this is most commonly used technique because it preserves edges during removal of noise.

g) Output for Median Filter

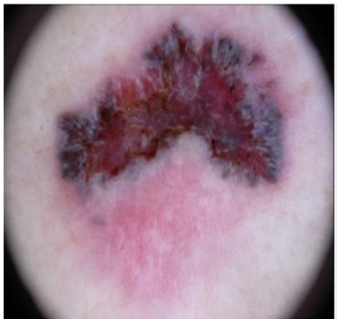


Fig. 4"(a)" Input Image

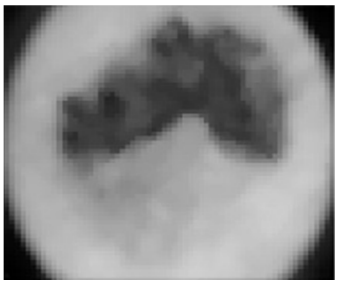


Fig. 4"(b)" Median Filtered Image

h) Algorithm Description: This filter uses the median value not the average. The kernel matrix runs through the image. Just like the mean filter, it replaces the pixel with the median value by considering the neighborhood pixels. This filter has the psnr value compared to others in the work and also less msevalue. The noise is removed from each pixel by replacing it with median value of its neighboring values.

i) Addition of Top-Bottom Hat Filter:

- *Top Hat Filter:* The top-hat filtering, also called top-hat transformation operator or white-top-hat filtering, in the mathematical morphology estimates the trend via morphological opening and then removes this trend from an image.

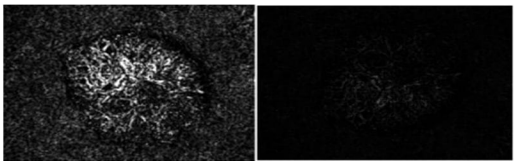


Fig. 5"(a)" Top-Hat Filter Fig. 5"(b)" Top-Hat Filter

- *Bottom Hat Filter:* The bottom-hat filtering, or called black-top-hat filtering has the property of enhancing "valleys" by applying the closing operator. The bottom-hat filter has many applications as well, for instance: Morphological sharpening.

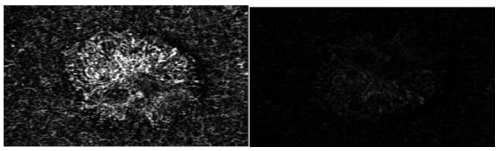


Fig. 6"(a)" Bottom-Hat Filter Fig. 6"(b)" Bottom-Hat Filter

- *Top-Bottom Hat Filter:* An image of skin may contains hair in it so, top and bottom hat filter is used for removal of hairs from the image. We first took the output for both the filters separately and then compared it with the output of combined filters and found that by combining both the Filters we are getting better output with more efficiency.

So, here are the results of combined filters for removal of hair.

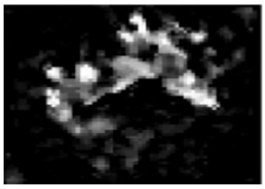


Fig. 7 Top-Bottom Hat Filter

2) Optimized Convolution Neural Network: CNN is a neural network which is used to for image recognition and classification. This can also can be used to recognise objects and humans. Labelled datasets are used to train the system, depending on that the connection between input and the labelled datasets and it comprise two layers. Hidden layer, where the features were extracted and the fully connected layers where the classification is done. Hidden layer consist of convolutional layers, pooling layers and activation functions. Neural network is made of group of neurons where each neuron is connected to its next layer.But the design of hidden layer is different. Here the neurons are not connected,instead they are connected to very few neurons in the next layer.

We have taken four layers.

- *Convolution Layer:* This takes two real value arguments as input and performs the convolution operation. The image given is take as the input and kernel matrix is passed all over its pixels, the output is given as feature map
- *Pooling Layer:* This one takes the feature map from the convolution layer as the input. This layer is usually added after the convolution layer. It reduces the size of the image and helps in reducing the parameters for process
- *Re Lu layer (Rectified linear units):* The operate f(x)=max(x,0) is applied to any or all the input.0 is assigned to the negative activations.
- *Batch Standardization Layer:* This layer can be used at various points in the network. This helps in decreasing the over-fitting of the system model. The input that is given to this batch normalization layer is normalized

A survey was taken to check the output of CNN by adding different no of CNN layers. For the survey we took around 150 images for training and 40 images for testing. At first 2 layers of CNN were taken and we increased it till 10, it is been found that 8 layers of CNN gives better accuracy and least loss compared to all others. Both before and and after of 8 layers the accuracy was less and the loss was more, so we have taken 8 layers for the further process and then added more images for testing and training.

a) *Training of CNN:* Training is a process where the neural network with large no of Dataset (more images) is provided by giving its own classification. CovNet then does the work of processing each and every images with random values and then compare it with its correct label. If the output they get does not match with the label of image which was given during training process automatically a small variation is made in the weights of its neurons which helps getting a result which is mostly correct. These corrections are made with a process known as backpropagation or backdrop. The work of backpropagation is basically to optimize the tunning process because of which it becomes easy for network to take a correct decision rather than just giving a random outputs. One complete cycle of the total dataset training is known as 1 "epoch". So, the CovNet goes through many epochs while training the datasets and keep on adjusting the neurons weight in small amounts. The CNN gets improved as the Weight is reducing, after some particular point, the networks get converged which tells that now its almost similar to correct output. Here the training is done and we test some amount of Datasets of getting the Accuracy, Sensitivity and all other parameters. Here we have taken 80% of datasets for training and 20% for testing. The images we take for training are not a part of training process. Essentially, the test dataset evaluates how good the neural network has become at classifying images it's not seen before. Overfitted happens if the training is good but the testing the data is bad and this mainly happens when we don't have much variety of pictures while training the datasets and all the images has went through many epochs.

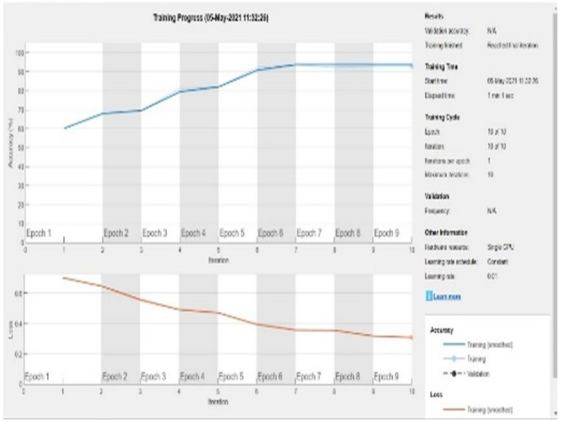


Fig. 9 Output for training of images

III. CONFUSION MATRIX FOR TESTING IMAGES

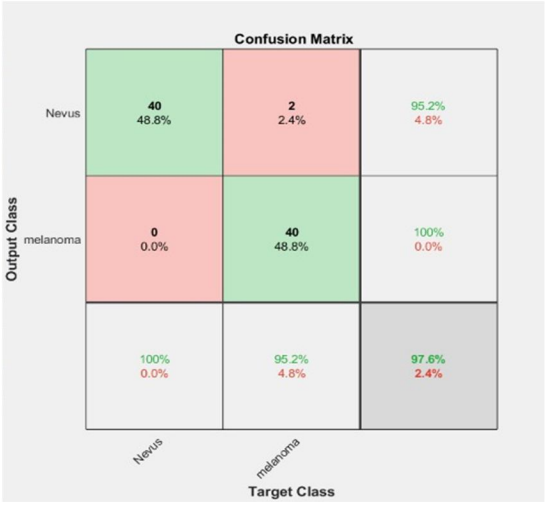


Fig. 9 Confusion Matrix

A confusion matrix is basically an easy way to display the output as a table which can be understood easily. Here the number of correct and incorrect values were counted and represented in each box.The X axis here represent Target class and the Y axis represents Output Layer which is compared to get the TP,TN,FP and FN values.

TN values: if the target is nevus but the output is represented as nevus, it is true negative.
FP value: if the image is not melanoma but it was classified as melanoma, then it is false positive.
FN values: if the input image is melanoma but classifies as nevus, it is false negative.
TP values: if the input is melanoma and the output is also same, it is true positive.
As a result, the accuracy is shown in last box which is 97.6%.

IV. COMPARINIG WITH EXISTING RESULTS

We compared our result with other 3 existing results and we found that the Accuracy we got is better compared to all the three others. Since we have used 8 layers of cnn, we were able to get better accuracy compared to other papers.
Also the value of sensitivity, specificity and F1_score was compared with the papers which in which the values were given and we got the better values compared to others.

Comparison output with existing results

TITLE	Dataset	Accuracy	Specificity	Sensitivity	F1_Score
A Dense CNN approach for skin lesion classification (Pierluigi Carcagn, Andrea Cuna, Cosimo Distante)	IMAGENET	89.2%	----	----	----
Classification of Melanoma and Nevus in Digital Images for Diagnosis of Skin Cancer (Pierluigi Carcagn, Andrea Cuna, Cosimo Distante)	DERMIS	96%	----	----	----
Classification of Melanoma and Nevus for diagnosis of skin cancer by using Convolution Neural Network	**HOSPITAL PEDRO HISPANO**	**97.6%**	**100**	**95.23%**	**97.56**
Melanoma and Nevus Skin Lesion Classification Using Handcraft and Deep Learning Feature Fusion via Mutual Information Measures	HAM10000	92.4%	-----	86.41%	-----

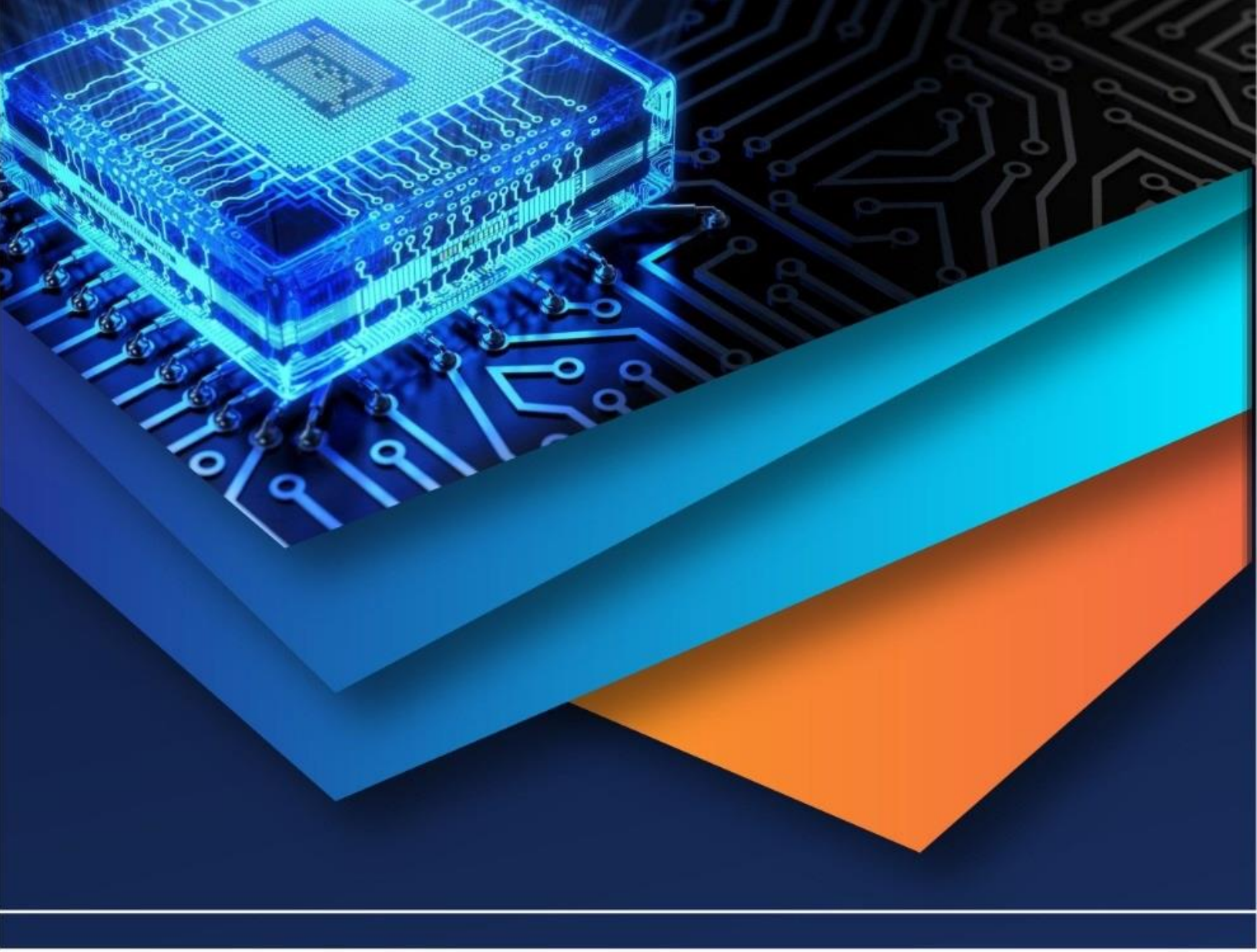
Fig. 10 Comparison of our result with the existing result

V. CONCLUSION

In this work, we presented an optimized convolution neural network for classification of skin cancer into melanoma and nevus. With the efficient accuracy, this model can also be used by doctors to detect the disease at an early stage. We have pre-processed the images to remove the noise, hair and unwanted things using various combinations of filters.8 layers of CNN are using the convolution of images. .This brought us an accuracy of 97.6%. The mortality rate can be decreased to a higher level using this early detection method. The accuracy, sensitivity and various parameters are analysed on hospital pedro hispano dataset.

REFERENCES

[1] R. Ashraf et al., "Region-of-Interest Based Transfer Learning Assisted Framework for Skin Cancer Detection," in IEEE Access, vol. 8, pp. 147858-147871, 2020, doi: 10.1109/ACCESS.2020.3014701.
[2] Damilola A Okuboyejo, Oludayo O Olugbara,'' A Review of Prevalent Methods for Automatic Skin Lesion Diagnosis'',Vol 12,The Open Dermatolgy Journal| 10.2174/1874372201812010l4,2018.
[3] Nawal Soliman ALKolifiALEnezi,'' A Method Of Skin Disease Detection Using Image Processing And Machine Learning'',ELSEVEIR,Vol 163, Procedia Computer Science 163 ,85–92,2019.
[4] Shahanasherin k c ," Classification of Skin Lesions in Digital Images for the Diagnosis of Skin Cancer ", Vol 7,IEEE Xplore Part Number: CFP20V90-ART; ISBN: 978-1-7281-5461-9,2019.
[5] A Dense CNN approach for skin lesion classification Pierluigi Carcagn`ı1 , Andrea Cuna2 , and Cosimo Distante1 1 CNR-ISASI. Ecotekne Campus via Monteroni snc, 73100 Lecce, Italy 2 University of Salento. Ecotekne Campus via Monteroni snc, 73100 Lecce
[6] M. Q. Khan et al., "Classification of Melanoma and Nevus in Digital Images for Diagnosis of Skin Cancer," in IEEE Access, vol. 7, pp. 90132-90144, 2019, doi: 10.1109/ACCESS.2019.2926837.
[7] JoseAugustin "Melanoma and Nevus Skin Lesion Classification Using Handcraft and Deep Learning Feature Fusion via Mutual Information Measures",University of Salento. Ecotekne Campus via Monteroni snc, 73100 Lecce, Italy.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)