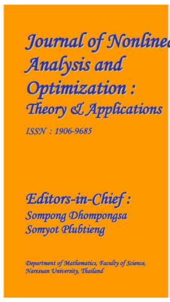
Journal of **N**onlinear **A**nalysis and **O**ptimization
Vol. 15, Issue. 1, No.15 : 2024
ISSN : **1906-9685**



Paper ID: ICRTEM24_119 **ICRTEM-2024 Conference Paper**

CNN MODEL FOR IDENTIFICATION OF SKIN CANCER

#1Dr.K.L.S.Soujany, ***Professor,***

#2S.Sohan, ***UG Student,***

#3K.Varsha, ***UG Student,***

#4M.Jyothika, ***UG Student,***

Department of Information Technology,

CMR COLLEGE OF ENGINEERING AND TECHNOLOGY, HYDERABAD.

ABSTRACT: Skin cancer, one of the most serious forms of cancer, is becoming more common year after year.Early identification of skin cancer is critical for successful treatment outcomes. Skin lesions are identified automatically utilizing lesion detection technologies that are designed to meet accuracy, efficiency, and performance standards. The suggested approach employs deep learning to detect skin cancer. It also recognizes the different forms of malignant lesions. A deep learning network is trained to classify skin lesions using a broad collection of dermoscopic pictures (ISIC). The recommended model uses convolutional neural networks (CNNs) and feature extraction techniques to successfully identify key patterns indicative of maligancy. The results show that the model has good accuracy, sensitivity, and specificity, highlighting its potential as a useful tool for dermatologists in early diagnosis and management, thereby improving patient care outcomes.

Keywords: *Convolutional Neural Network, ISIC data set, Deep Learning, Skinlessions.*

1.INTRODUCTION

Over two Americans lose their lives to skin cancer every hour, according to data from the World Health Organization (WHO). Over the past ten years, a number of skin cancer forms have increased in frequency. Approximately 132,000 cases of melanoma skin cancer are diagnosed globally each year. Smoking, bad lifestyle choices, heredity, and ultraviolet (UV) radiation are the main causes of skin cancer. Statistics show that UV radiation is the main factor responsible for the majority of skin malignancies. It is anticipated that as the ozone layer rapidly thins, more dangerous UV radiation will reach Earth's surface, leading to an increase in skin cancer incidence. Early identification of skin cancer increases the chances of a successful treatment and stops the disease from spreading to other organs. Early diagnosis can be aided by dermoscopy, a non-invasive method for analyzing pigmented skin lesions at the surface. It is difficult for even seasoned dermatologists to diagnose a patient at an early stage. This problem arises from the fact that there are several types of skin cancer. Because image-based Computer Aided Diagnosis (CAD) systems have the potential to significantly increase early detection and screening of melanomas through the use of dermoscopic images, hospitals have been employing them. In order to determine whether these images are benign or malignant, CAD systems analyze texture, color, and shape. Determining the kind is crucial in the event that a skin cancer test is positive since it aids in choosing the most effective course of therapy. Cancer comes in a variety of forms, hence this kind of classification is very nonlinear. Therefore, as recent research have shown, Deep Convolutional Neural Networks (DCNNs) can effectively classify them. Different malignancies are described in Figures 1, 2, and 3.

Fig 1 : Basal Cell Carcinoma[13]

Fig 2 : Squamous Cell Carcinoma[15]

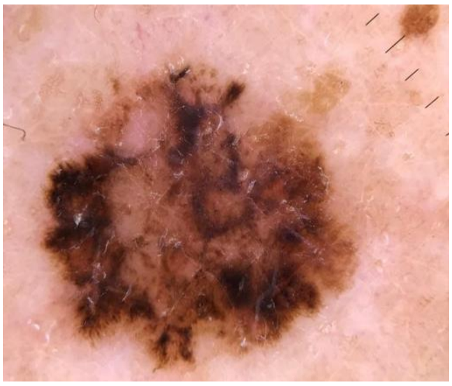


Fig 3 : Melanoma[14]

There are five stages in total for melanoma, basal cell carcinoma, and squamous cell carcinoma. Each stage is completed in four steps. Cancer typically manifests as a little mole in the first stage and spreads to a certain extent in the second stage. The cancer spreads throughout the body in the latter stages of BCC and SCC, but in the final stage of melanoma, it penetrates the body.

2.EXISTINGSYSTEMS

Mehwish Dildar et al. discussed artificial neural networks, or online techniques with a structure similar to the human brain. ANN consists of three layers: the input layer, the intermediate layer, and the hidden layer. These layers help to evaluate whether a picture is benign or cancerous. The data can be layered or unlayered, and the method can be supervised or unsupervised.

Nour Aburead et al. proposed that CNN could swiftly detect skin cancer. He employed a DCNN, which comprises of two convolutional layers and one max pooling layer that are repeated three times, followed by two tightly coupled layers and a flattening layer. This uses VGG16, VGG19, and ResNet.The kernel sizes of all convolutional layers are 3 * 3 with a stride value of 1, and all maxpooling layers are 2 * 2 with a stride value of 1.The activation function for the buried layers is ReLuis. Softmax is utilized as an activation function since the output layer has seven distinct categories.

Xiaoxiao et al. modified and refined two effective CNN architectures for image classification, ResNet50 and VGG, to encode image features. To classify skin lesions into seven groups, both networks' fully connected (FC) layers were adjusted by removing the last FC layer and replacing it with FC layers containing 128 kernels and seven classes, respectively. We used LightGBM to combine multiple CNN model characteristics. LightGBM is an algorithm that improves tree-based learning. It has various hyper-parameters for optimizing performance.

Youssefetal described a deep learning algorithm called multiscale decomposition that can assist clinicians in diagnosing and classifying pigmented skin lesions.A multiscale decomposition breaks down the input image into texture and object components. The object component was segmented first. The retrieved ROI with the texture of the lesion is then created by projecting the texture and segmentation simultaneously. The Convolutional Neural Network uses many convolution layers to extract and classify data produced solely from the textural layer.

Nikhil J. Dhinagar demonstrates a deep learning technique that comprises pre-processing, important skin feature extraction, skin change monitoring over time, and risk projection.

With the exception of color image enhancement utilizing CLAHE and MSRCR, Agung W. Setiwan et al. use an RGB color image as input. Because CLAHE can only handle one image channel, the first step is to color split it into three. As a result, each channel applies three image enhancement techniques to produce three higher-quality images. Color merging is the next step in producing an RGB color-enhanced image.[10]The skin lesion is more visible in the improved shot than in the original. The classifier used in this study is a Convolutional Neural Network (CNN), which is a common tool in dermoscopy image analysis. The CNN architecture used in this study is VGG16.

3.PROPOSEDSYSTEM

The suggested system employs CNN and image pre-processing as part of a multi-phase deep learning approach. The input image is dissected into texture and object components at various scales. The Convolutional Neural Network obtains and classifies data based solely on textural lesions through the use of various convolution layers. One key concern is the high level of noise in skin cancer photographs. It may have a considerable impact on the segmentation and classification results. Poor segmentation causes erroneous lesion identification, which reduces the classification rate. The objective is to utilize a pre-processing model to aid in lesion diagnosis while also removing the noise surrounding the lesion. CNN, or Convolutional Neural Network: The primary goal is to learn from textural lesion photographs by identifying hidden traits and patterns.Figure depicts how the CNN operates.The convolutional and pooling layers that comprise the ConvolutionNeuralNetwork help to reduce the spatial dimension of the feature representation.The entire system is made up of patient data saved in a database, which we constructed with Python.

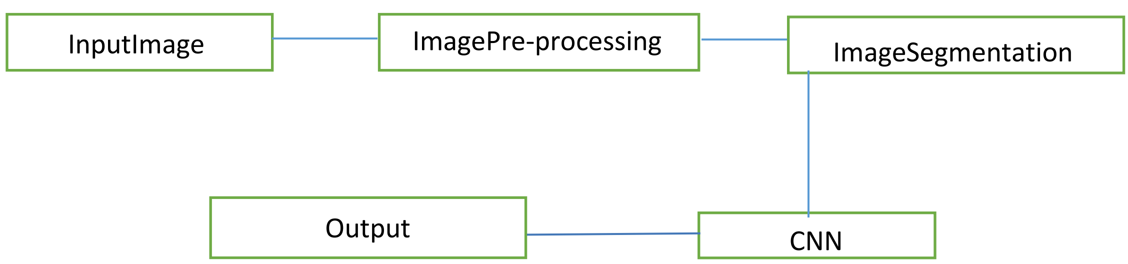


Fig 4 : Block Diagram

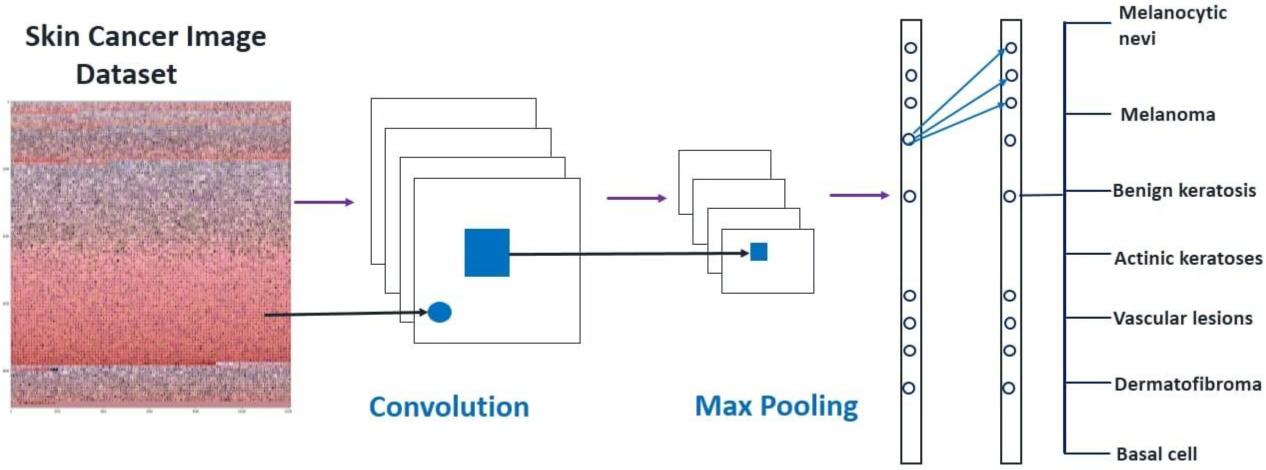


Fig5: CNNarchitecture[5]

First, the patient's information is collected and stored in a database. The patient's image is then compared to the previously learned dataset.Initially, we will utilize CNN to compare the trained dataset to the pre-processed original image of the patient. CNN's several layers play an important role in detecting skin cancer. It consists of many hidden layers, a maxpooling layer, and a convolutional layer, each of which serves a specific purpose. When all tasks are completed, the output will be displayed as high, medium, or low, indicating that a high result will be acquired if immediate treatment is required and a low result if the cancer is in the medium stage.

The graph below compares several detection techniques:

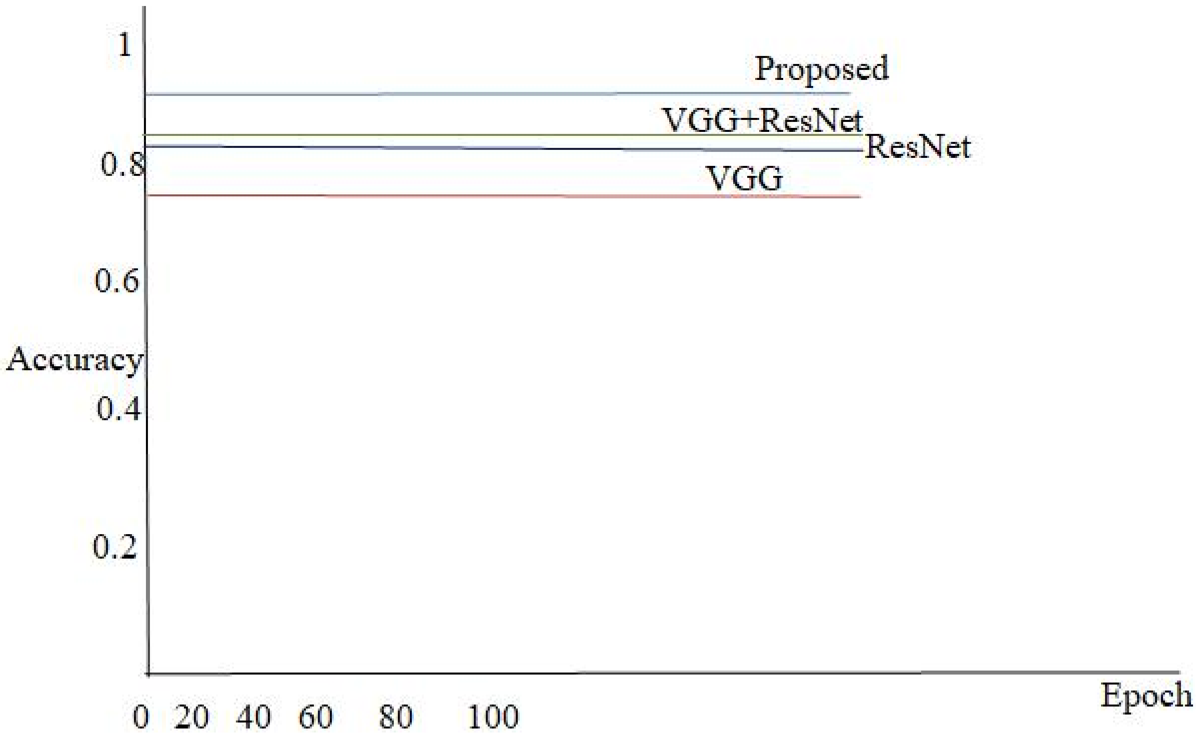


Fig.6Comparison of different algorithms

CNN, VGG, and ResNet demonstrate several stages of evolution in convolutional neural network designs. A CNN is a common term for networks made up mostly of convolutional layers of varying complexity. Early CNNs consisted of fewer layers and were simpler.In contrast, VGG is a distinct sort of CNN that employs many convolutional layers with small receptive fields, followed by max-pooling layers. It is distinguished for its depth and consistency in design. It is more complicated than simple CNNs, with 16 or 19 layers on average, and is distinguished by its depth and simplicity (VGG16, VGG19).

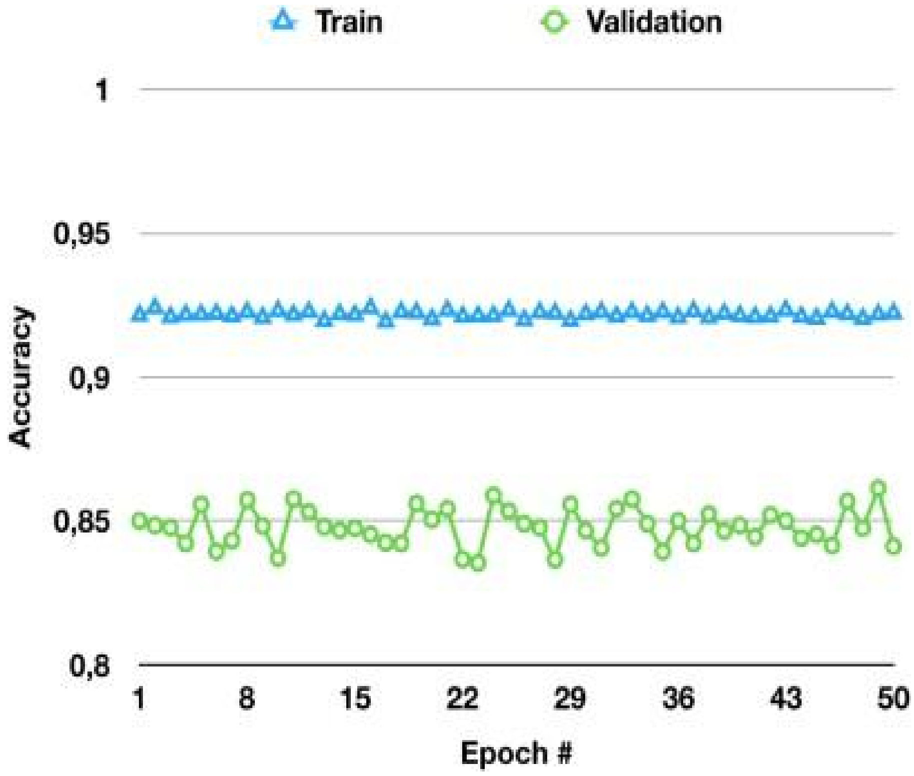


fig.7Train andvalidation accuracy oftheoriginal imagedatasets[9]

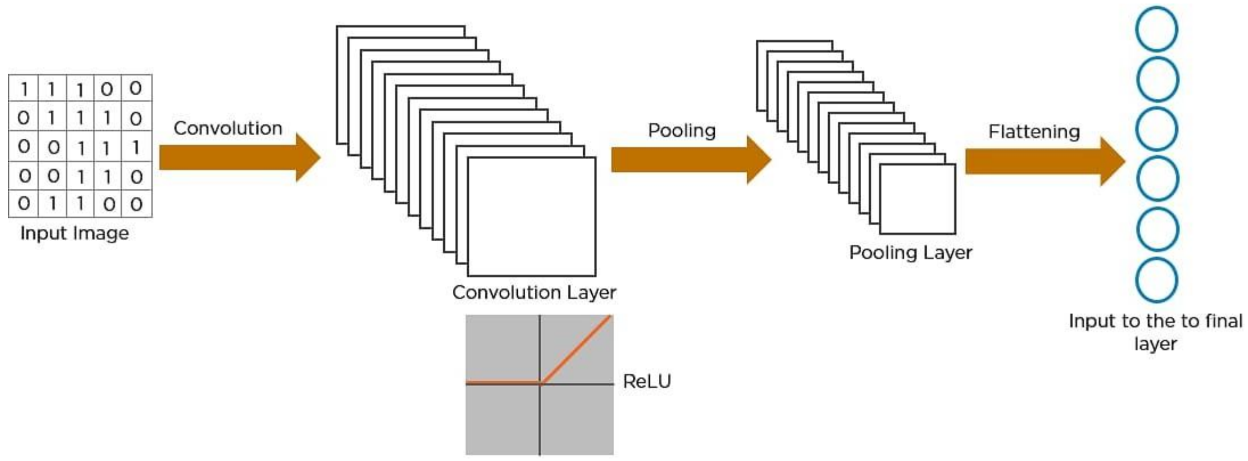


fig.8 ProposedCNN Architecture

The phrase "CNNalgorithm" refers to Convolutional Neural Networks, a type of deep neural network that is commonly employed to analyze visual images.CNNs use convolution in one or more layers.

The layers of the CNN structure are listed below:

1. Convolutional Layer: This layer's main goal is to extract features from the input image.Convolution employs tiny squares of input data to learn visual features while preserving pixel associations.
2. Activation Function (ReLU): The system is made more nonlinear by an activation function known as ReLU (Rectified Linear Unit).It assists the network in resolving complex difficulties.
3. PoolingLayer: Pooling, also known as downsampling or subsampling, reduces each feature map's dimensionality while retaining the most important data. Maxpooling is a typical strategy.
4. Fully Connected Layer: The neurons in a completely linked layer are fully related to every activation in the layer preceding it. To determine the image's class, this layer incorporates all of the knowledge gained from previous stages.
5. Output Layer: When it comes to multi-class classification, the last layer employs a softmax function to provide probabilities for each class.

CNNs are widely utilized in machine learning applications including natural language processing, recommender systems, image classification, medical image analysis, and image and video recognition. After completing all required operations, we compute the accuracy, precision, and recall as follows:

$$\text{Accuracy} = \frac{\text{Number of correct predictions}}{\text{Total number of predictions}} * 100\% \text{ ----------- (1)[5]}$$

$$\text{Precision} = \frac{\text{True positive}}{\text{True positive} + \text{False positive}} \text{ -------- (2) [5]}$$

$$\text{Recall} = \frac{\text{True positive}}{\text{True positive} + \text{False Negative}} \text{ --------(3)[5]}$$

4. CONCLUSION

Deep learning models can be applied into a range of digital platforms, such as telemedicine and mobile health applications. This will increase access to skin cancer screening and diagnosis, particularly in remote or impoverished areas. Deep learning has been shown to improve the efficiency and accuracy of early skin cancer diagnosis. Deep learning algorithms can accurately identify many types of skin cancer by evaluating large volumes of data, such as photographs and other clinical information. Deep learning models have proven to be highly accurate in detecting skin cancer, frequently matching or even outperforming dermatologists. This could result in timely intervention and early detection, which would enhance patient outcomes. Deep learning algorithms can examine vast datasets more quickly, allowing for faster skin lesion studies and patient diagnoses. This is especially useful in hectic medical environments when rapid diagnosis is required.

REFERENCES

1. DildarM,AkramS,IrfanM,KhanHU,RamzanM,MahmoodAR,AlsaiariSA,SaeedAH,AlraddadiMO,MahnashiMH.Skincancerdetection:areviewusingdeeplearningtechniques.Internationaljournal of environmentalresearch and publichealth.2021 May20;18(10):5479.

2.Nahata, H. and Singh, S.P., 2020. Deep learning solutions for skin cancer detection anddiagnosis.MachineLearningwithHealthCarePerspective:MachineLearningandHealthcare,pp.159-182.

3.N.Aburaed,A.Panthakkan,M.Al-Saad,S.A.AminandW.Mansoor,"DeepConvolutionalNeuralNetwork (DCNN) for Skin Cancer Classification," 2020 27th IEEE International Conference on Electronics, Circuits and Systems (ICECS), Glasgow, UK, 2020, pp. 1-4, doi:10.1109/ICECS49266.2020.9294814.

4.MuhammadRushamirHakimiRuslan,Siti'AisyahSa'dan,UmmuFatihahMohdBahrin,SitiSalbiah Hamzah, Sharifah Nurulhikmah Syed Yasin, Siti Nurul Hayatie Ishak, "Melanoma Recognition Using Negative Selection", 20234th International Conference on Artificial Intelligence and DataSciences(AiDAS),pp.114-119,2023.

5.Vidya,Maya,andMayaV.Karki."Skincancerdetectionusingmachinelearningtechniques."In 2020IEEEinternationalconferenceonelectronics,computingandcommunicationtechnologies (CONECCT),pp.1-5.IEEE,2020.

6.X. Li, J. Wu, E. Z. Chen and H. Jiang, "From Deep Learning Towards Finding Skin LesionBiomarkers,"201941stAnnualInternationalConferenceoftheIEEEEngineeringinMedicineandBiologySociety(EMBC),Berlin,Germany,2019,pp.2797-2800,doi:10.1109/EMBC.2019.8857334.

7.Y.Filali,H.ElKhoukhi,M.A.Sabri,A.YahyaouyandA.Aarab,"TextureClassificationofskin lesion using convolutional neural network," 2019 International Conference on WirelessTechnologies, Embedded and Intelligent Systems (WITS), Fez, Morocco, 2019, pp. 1-5, doi:10.1109/WITS.2019.8723791.

8.N. J. Dhinagar and M. Celenk, "Early diagnosis and predictive monitoring of skin diseases,"2016IEEEHealthcareInnovationPoint-Of-Care TechnologiesConference(HI-POCT),Cancun,Mexico,2016,pp.33-36,doi:10.1109/HIC.2016.7797690.

9.A. W. Setiawan, "Effect of Color Enhancement on Early Detection of Skin Cancer usingConvolutionalNeuralNetwork,"2020IEEEInternationalConferenceonInformatics,IoT,andEnablingTechnologies(ICIoT),Doha,Qatar,2020,pp.100-103,doi:10.1109/ICIoT48696.2020.9089631.

10. Jain, Shivangi, and Nitin Pise. "Computer aided melanoma skin cancer detection usingimage processing."ProcediaComputerScience48(2015):735-740.

11. Jerant, Anthony F., Jennifer T. Johnson, Catherine Demastes Sheridan, and Timothy J.Caffrey. "Early detection and treatment of skin cancer." American family physician 62, no. 2(2000):357-368.

13.https://www.sciencephoto.com/media/1281780/view/basal-cell-carcinoma-on-a-patient-s-forehead.

14.https://en.m.wikipedia.org/wiki/Melanoma

15.https://www.health.com/squamous-cell-carcinoma-7553774