IJARCCE

ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 12, December 2021

DOI: 10.17148/IJARCCE.2021.101261

Melanoma classification using deep transfer learning

V. Vinoth Kumar[1], B. Yasaswi[2], I. Vandana[3], C. Sai Joshna[4], N. Mounika[5]

School of Computer Science and Engineering, Department of computer science and Engineering, JAIN (Deemed-to-be university), Bangalore 562112, India [1-4]

Abstract: Melanoma is the most lethal kind of skin malignant growth when contrasted with others, despite the fact that people who are analyzed from the beginning have a decent possibility of recuperation. A few creators have examined different ways to deal with programmed location and conclusion utilizing design acknowledgment and AI methods. The significant objective of this exploration is to evaluate the primary designs of Convolutional Neural Networks for the gig of melanoma skin malignant growth analysis. The four most incessant essential skin malignancies are basal cell carcinoma, squamous cell carcinoma, Merkel cell carcinoma, and melanoma. Among all tumors, melanoma is the most deadly kind of skin disease. It is great 100% of the time to anticipate the infection ahead of schedule to not spread all around the body parts and assist specialists with diagnosing it early. Because of the predetermined number of screening communities early identification of disease is profoundly inconceivable. In any event, deciding if it is harmless or destructive will take time. Assume the impacted individual counsels an essential specialist for analyze without realizing it is malignant growth because of the essential specialist's insight. Here is the place where AI and profound learning approaches become an integral factor for an effective mechanized determination framework that can assist specialists with anticipating the infection in a lot quicker way, and surprisingly ordinary people can analyze a particular affliction. Our exploration exertion presents an answer for the issues of expanding clinical expenses related with finding, decreased recognition precision, and the manual discovery framework's transportability. Melanoma malignant growth Detection System is a prescient model that utilizes profound learning thermoscope pictures.

Keywords: Benign, malignant melanoma, Machinelearning, Deep learning.

1 INTRODUCTION

Melanoma is malignant growth that beginnings in the cells that make melanin (the shade that gives you tone on the skin). Melanoma can create in an assortment of areas on the body, including the eyes, nose, and throat. There is no indisputable confirmation for the beginning of melanomas as of now. In any case, openness to bright radiation from the sun, tanning lights, and beds increment the danger of melanoma. Melanoma hazard gives off an impression of being ascending among individuals younger than 40, particularly among ladies, and the ages between 15 to 29.

A talented dermatologist is found to follow various methodology, starting with an unaided eye assessment of dubious sores, next thermoscopic (infinitesimally amplifying sores), lastly a biopsy. This would require some investment, and the patient may advance to a later stage. Moreover, exact finding is emotional and reliant upon the clinician's capacity. The top dermatologists are displayed to have a precision of under 80% mistakenly diagnosing skin malignant growth. To exacerbate the situation, there is a shortage of qualified dermatologists in general medical care all over the planet.

There have been significant exploration arrangements by building PC picture investigation calculations to analyze skin disease rapidly at the beginning phase and reduce a portion of the previously mentioned concerns. Most of these computational arrangements were parametric, which implied that information must be routinely disseminated to work. These strategies would be inadequate to precisely recognize the illness because of the idea of information, which can't be controlled. Non-parametric arrangements, then again, don't depend on the information being in ordinary conveyance structure.

Profound learning is utilized to give expanded dermatological guide. The fundamental thought behind the strategy is to teach a PC to recognize the issue by looking at skin disease photos. The show is exceptional in that the PC model can be made with no programming abilities. The normal precision of conclusion with this model is at 98.89 percent, with 100% being awesome. The machine-helped conclusion given here takes care of the issue of dermatologists in general wellbeing being late, off base, and few.

Each one individual passes on with melanoma consistently. Melanoma is expanding at a higher rate than any remaining tumors. A spot on the skin that is changing in size, shape, and shading is the main skin disease cautioning sign. so on, as

ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 12, December 2021

DOI: 10.17148/IJARCCE.2021.101261

the rate of skin malignant growth rises consistently. Melanoma is one of the most hurtful types of skin malignant growth, and skin disease identification is moving from the skin sore because of antiquities, low difference, and comparative perception like a mole, scar, etc. As a result, for exactness, viability, and execution measures, robotized identification of skin sores is performed utilizing AI and profound exchange learning methods.

Pre-handling is utilized in the proposed work to upgrade the appearance and straightforwardness of skin injuries by diminishing ancient rarities, for example, skin tone, hair, etc. The proposed calculation utilizes Vgg16, an exchange learning model to extricate highlights, which are then straightforwardly moved to the Xgboost classifier and Light Gradient Boosting Machine (LightGBM) to recognize harmless and dangerous injuries., and this interaction includes both preparing and testing. In this task, Xgboost and LightGBM got a precision of 91.58%,89.4%, individually.

The biggest organ in the human body, the skin shields us from heat, light, disease, and mischief. It likewise can store water, fat, and nutrients. Skin malignant growth is the most deadly kind of disease since it can spread all through our bodies on the off chance that it isn't distinguished and treated early. Basal cell carcinoma is one of three sorts of skin disease. Melanoma and Squamous Cell Carcinoma Melanoma, then again, is the deadliest of all skin malignancies. Melanoma skin disease is turning out to be more normal constantly. Melanoma skin disease should be identified early and treated in its beginning phases assuming the patient is to have a decent possibility of recuperation. They show up as moles or markings on the skin.

The expression "dangerous" alludes to a hurtful condition, though "harmless" alludes to a harmless state. The epidermis, which is the furthest layer, and the dermis, which is the deepest layer, are the two layers that make up the skin structure. They remember pigmented cells for the epidermis that make melanin, the shade that gives human skin its tone. As the skin is presented to the sun, it delivers increasingly more shade, obscuring the shade of the skin and causing skin disease melanoma. Melanoma is brought about by a light complexion tone, burns from the sun, and earlier hereditary variables, just as a debilitated invulnerable framework and extreme openness to bright light beams.

Assuming Melanoma isn't analyzed in its beginning phases, it can possibly develop and spread down the epidermis, the principal layer of skin, to the lymph vessels, and ultimately to the blood. Shape, Color, and size are vital elements for recognizing skin disease, and they present as moles with unpredictable boundaries, structures, shading changes, and breadths more prominent than 6mm.Various painless methodologies have been introduced to look at malignant growth location and recognize on the off chance that it is harmless or melanoma. We utilized picture procurement, preprocessing, division, commotion evacuation, and component extraction in this paper.

2 RELATED WORK

The related work on melanoma classification has beenreported in the literature survey.

[1] This article used supervised learning-based classifiers like Neural Networks and Support Vector Machines for both supervised and unsupervised classification. Vector Machines were employed in supervised classification, and the K-means clustering technique was used in unsupervised learning-based classification. The result's accuracy is compared to that of the other classifiers. With a 52.63 percent accuracy, the k-means algorithm provided a categorization result. n data points are split into k clusters using the k-means algorithm. When melanoma skin cancer is discovered, two clusters form: one for cancer detection and one for non-cancer detection.

[2] Creators A. Demir, F. Yilmaz, and O. Kose applied two profound exchange learning models, ResNet-101 and Inception-v3, and got a precision of 84.09%, 87.42% separately. The outcomes uncover that the Inception-v3 model beats the ResNet-101 model in arrangement.

[3] In this paper, the authors used deep CNNs such as Inception-v4, ResNet-152, and DenseNet161 trained for melanoma classification and seborrheic keratosis classification to construct different deep learning models for melanoma detection using the same dataset with comprehensive data augmentation, and the accuracy for melanoma classification was 82.0%, 88.7%, and 86.3%. The RCNN can detect features for a variety of skin illnesses in the same patient as well as different diseases in different people using an effective training technique.

[4] Two old style AI classifiers and a convolutional neural organization were prepared with an assortment of elements depicting the limits, surface, and shade of a skin sore. The consequences of these techniques are then consolidated utilizing larger part casting a ballot to boost their exactness. The two AI classifiers, knn and svm, have an exactness of 57.3 percent and 77.8 percent, individually, while CNN and greater part casting a ballot have a precision of 85.5 percent and 88.4 percent, separately.

[5] The model is divided into three phases in this paper,which include data collection and augmentation, modelarchitecture, and prediction. We used a variety of AI algorithms, including Convolutional Neural Networks and Support Vector

ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 12, December 2021

DOI: 10.17148/IJARCCE.2021.101261

Machines, to achieve an accuracy of 85%.

[6] This paper centers around a PC helped strategy for recognizing skin disease. Thermoscopic pictures are taken care of into the CAD framework, which then, at that point, goes through extra picture handling like division, include extraction, and order to recognize typical and melanoma pictures. The classifier Resnet-50 was utilized, and it had a precision of 85.18 percent. A compelling CAD-MD framework is intended to further develop melanoma characterization and research the effect of information increase on the presentation of four AI models, in particular SVM, Logistic Regression, KNN, and Random Forest, just as five profound learning-based exchange learning models, specifically LeNet-5, VGG-16, VGG-19, Inception, and Xception, and by utilizing information expansion, we can tackle the information limitation and skewness issue. On the PH2 and ISIC16 datasets, two arrangements of examinations are completed to evaluate the viability of all sent classifiers with and without picture increase.

[7] Melanoma classification was performed using the Mela Net model, which yielded a value of 91.76 percentarea under the curve.

[8] The Principal Component Analysis (PCA) calculation was utilized to pick 13 top highlights from a pool of 187 low-level qualities in light of shading, surface, line, and lopsidedness. Then, at that point, with a precision of 82.2 percent, distinguish melanoma utilizing the SVMclassifier. To beat the obstacles, a division framework in view of U-Nets was conveyed, just as CNN-based classification. Melanoma arrangement by PC in thermoscopy pictures comprises of three stages: division, highlight determination, and investigation. The interaction incorporates two stages: extraction and arrangement. The injury locales are at first found utilizing the VGG 16 calculation and an order framework in view of U-nets. The division interaction is finished, and unmistakable attributes are separated. CNN is being utilized. Besides, the indistinguishable strategy is completed without the utilization of any synthetic compounds. Division is a cycle that partitions individuals into gatherings. From that point forward, the characterizations are thought about. both the consequence of division esteems and the aftereffect of division esteems without division esteems. Tests were led on a test that was available to people in general. In light of ISBI 2016 Accuracy, Sensitivity, and Detection, just as explicitness, Melanoma-related Skin Lesion Analysis Dataset.

3 PROPOSED METHODOLOGY

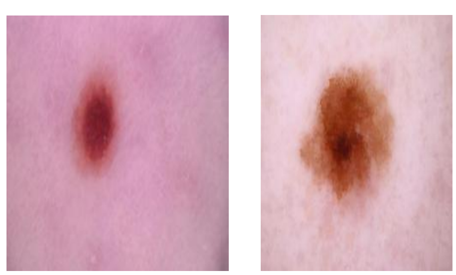
As shown in Figure, there are several steps to detecting skin lesions.

1.Data collection, 2. Pre-processing, 3. Data augmentation, 4. Feature extraction and 5. Classification are all part of process.

Fig. 1 Methodology

3.1 DATA ACQUISITION

The primary stage is information assortment, so information was gotten from the International Skin Imaging Collaboration (ISIC), which contains 1000 harmless and 584 threatening melanoma skin injury pictures. JPEG design is utilized for the documents. For preparing and assessment, the skin sore pictures were separated into 80:20 proportions.



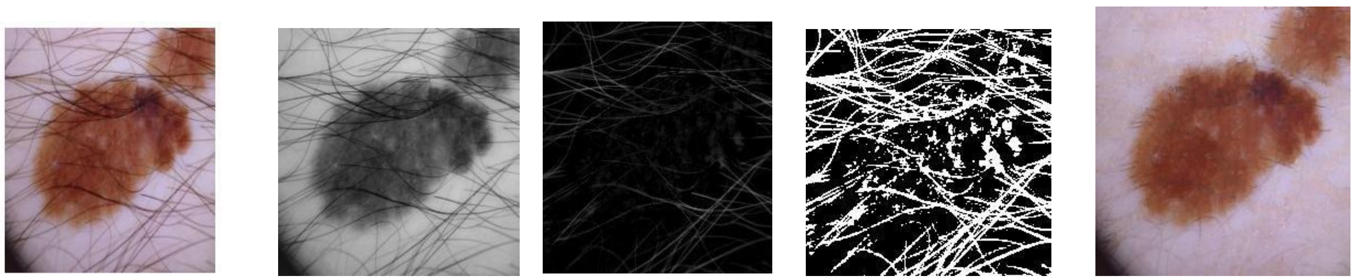
(a) (b)

Fig.2 Shows the examples of (a) Benign image (b) Malignant Melanoma image.

ISSN (O) 2278-1021, ISSN (P) 2319-5940
International Journal of Advanced Research in Computer and Communication Engineering
Vol. 10, Issue 12, December 2021
DOI: 10.17148/IJARCCE.2021.101261

3.2 PRE-PROCESSING

The skin lesion datasets are pre-processed in the second stage. Pre-processing of lesion images allows distinguishing images more reliably by removing unnecessary data other than lesions. Unwanted things such as hair, skin colors, etc. Initially, we need to resize all pictures into one size because while data has been passed through any machine or deep learning model, all the image data should be in one similar size. In this project, (i)images are resized into 224*224 (width*height). (ii) RGB images are converted into Grayscale to perform morphological filtering, which highlights the region of skin lesion and then Perform the Blackhat filtering on the grayscale image to find the haircontours, next intensify the hair contours preparation for the inpainting algorithm, at last, in paint the original image depending on the mask. Performing this process leads to hair removal and highlighting skin lesions, and this process is iterating through all over data present inthe dataset.



(a) **(b)** **(c)** **(d)** **(e)**

Fig. 3 Pre-handled outcomes (a) unique skin injury picture (b) RGB to GRAY changed over picture (c) Blackhat separated picture (d) Hair identified (e) Hair eliminated

3.3 DATA AUGMENTATION

The Third step involves Data Augmentation, data augmentation is a process to solve the problem of imbalance in data which reduces model underfitting. since 416 malignant melanoma images are lesser than benign images we augment the malignant melanoma skin lesion images ofthe dataset, we rotate the malignant melanoma images randomly in-between -250 to +250 and then flip, blur the malignant melanoma skin lesion images. By which 200 malignant melanoma images are increased, still there are 284 malignant melanoma images that are required to equal benign skin lesion images for the remaining images we are using Generative Adversarial Network (GAN).

GENERATIVE ADVERSAL NETWORK (GAN)

GAN is a deep neural network architecture made up of two neural networks that compete for the same task. The two neural networks are named (i) discriminator and(ii)generator. GANs are trained to produce data that resembles a distribution in an adversarial manner.

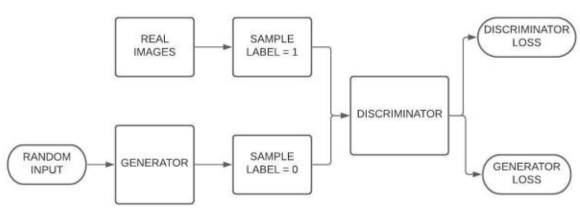


Fig.4 Generative Adversal Network Architecture (GAN)

GAN LOSS FUNCTION

$$\min_G \max_D V(G, D) = E_{x(x)} [\log(D(x))] + E_{z(z)}[\log (1 - D (G (z)))] \quad \text{-----(1)}$$

ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 12, December 2021

DOI: 10.17148/IJARCCE.2021.101261

- Ex is the real data instances from overall expectedvalues.
- The expected random inputs to the generator are given by Ez.

DISCRIMINATOR: The Discriminator 'D' is one of the neural networks with any kind of architecture which are appropriately classified between The Generator generated fake data with a label of 0 and real photos with a label of 1. The loss function that combines the cost function with the generator and discriminator loss functions. But during discriminator training, it uses only discriminator loss to penalize the discriminator that can misclassify a real image as false or a fake image as real D(G(z)).
Backpropagation helps discriminators update the weights based on the loss discriminator so this helps discriminators to avoid misclassification between fake and real data.

DISCRIMINATOR LOSS FUNCTION

$$maxD\ Ez(z)\ [\log(1 - D(G(z)))] \quad \text{-------(2)}$$

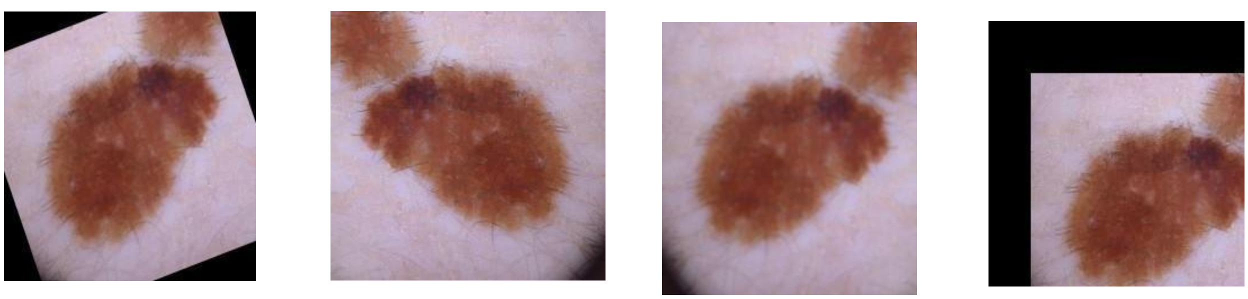
GENERATOR:

The Generator 'G' is one of the neural networks that generate random fake data G(z), by taking some random noise 'z' It tries to fool the discriminator into classifying its output as real by adding feedback from the discriminator.

GENERATOR LOSS FUNCTION

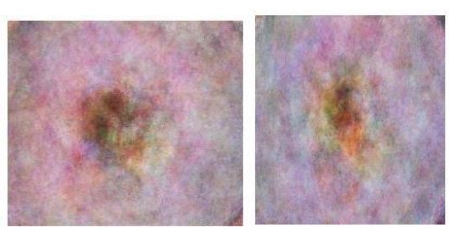
$$minG\ Ex(x)\ [\log(D(x))] \quad \text{-------(3)}$$

In this project, with help of GAN, we generated 200 malignant melanoma images, by which malignant melanoma images are equal to benign images in thedataset.



(a) (b) (c) (d)

Fig.5 shows data augmented results
(a) rotated image (b) flipped image (c) blurred image,and (d) translated images



(a) (b)

Fig.6 shows malignant melanoma images generated byGAN both (a) and (b).

IJARCCE

ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 12, December 2021

DOI: 10.17148/IJARCCE.2021.101261

3.4 FEATURE EXTRACTION

Extraction of features from skin lesion photos is the fourth phase. Feature extraction is used to extract information from lesion photos' border, colour, and skin texture in order to gain reliable information on skin lesion details. As a result, these retrieved traits aid classifiers in making accurate predictions. The vgg16, a pre-trained deep transfer learning model that can assist the model predict more accurate results, was used in this study to extract features.

VGG16

- VGG16, The model archives 92.7% accuracy in theImageNet Competition Vgg16 architecture was one among top 5 test accuracy.

- ImageNet is a database of over 15 million high-resolution images that have been labeled into over 22,000 groups.

- The NVIDIA Titan Black GPU was used to trainVGG16 for weeks.

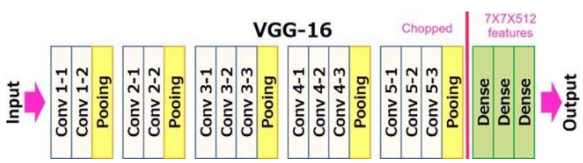


Fig.7 VGG16 Architecture for feature extractor

3.5 CLASSIFICATION

Numerous arrangement models, like SVM, KNN, Naive Bayes, XGBoost, LightGBM, and other AI draws near, are regularly utilized to recognize harmless and dangerous melanoma skin injuries. In this examination, the classifiers XGBoost and LightGBM are applied. where the XGBoost and LightGBM models are given elements extricated from the VGG16 model to perform grouping.

XGBOOST:

XGBoost is a decision tree-based ensemble Machine Learning technique that uses a gradient boosting framework. It was mostly used to categorise unstructured data like text, photos, and so on. In some cases, xgboost algorithms outperform neural networks. When it comes to small to medium data, though, Decision tree-based algorithms are currently the best in class. The model parameters are adjusted when hyperparameter tweaking is completed. The learning rate was set to 0.05, the maximum depth was set to 8, the minimum child weight was set to 1, the gamma was set to 0.3, and the Col sample by tree was set to 0.5.

LIGHT GRADIENT BOOSTING MACHINE:

LightGBM is another gradient boosting framework, where Light means lighter version, means faster, accurate, and efficient algorithm. When we differentiate this with xgboost where xgboost perform level-wise tree growth but LightGBM performs leaf-wise tree growth with this approach sometimes light can lead to overfitting but it can be optimized by defining depth for splitting and many other parameters are been minimized by performing hyperparameter tuning, The model parameters are altered after doing hyperparameter tuning. The learning rate was 0.1, the number of leaves was 24, the feature fraction was 0.1, the bagging fraction was 0.8, the max depth was 6, the max bin was 90, the min data in leaf was 80, the min sum hessian in leaf was 0, and the subsample was 0.01. The learning rate was 0.1, the number of leaves was 24, the feature fraction was 0.1, the bagging fraction was 0.8.

ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Vol. 10, Issue 12, December 2021

DOI: 10.17148/IJARCCE.2021.101261

4 CONCLUSION

Half and half element extraction was utilized to distinguish skin injuries as harmless or melanoma in this review. VGG16 is utilized for highlight extraction to consequently identify a skinlesion. For the characterization, different AI models were proposed, like Xgboost and LightGBM. 20% of Skin injury pictures from ISIC datasets were utilized to test the proposed cycle. This system helps specialists in early sickness conclusion and can likewise be used as a subsequent assessment. With regards to finding, there will without a doubt be a few human mistakes; consequently, to wipe out such blunders, this is a shelter.

REFERENCES

[1] H. R. Mhaske and D. A. Phalke, "Melanoma skin disease identification and grouping in light of regulated and unaided learning," 2013 International Conference on Circuits, Controls and Communications (CCUBE), Bengaluru, India, 2013, pp. 1-5, DOI: 10.1109/CCUBE.2013.6718539.

[2] A. Demir, F. Yilmaz, and O. Kose, "Early detectionof skin cancer using deep learning architectures: resnet-101 and inception-v3," 2019 Medical Technologies Congress (TIPTEKNO),2019.

[3] H. N. Pham, C. Y. Koay, T. Chakraborty, S. Gupta,
B. L. Tan, H. Wu, A. Vardhan, Q. H. Nguyen, N. R. Palaparthi, B. P. Nguyen, and M. C. H. Chua, "Lesion Segmentation and Automated Melanoma Detection using Deep Convolutional Neural Networks and XGBoost," *2019*International Conference on System Science and Engineering (ICSSE),2019.

[4] J. Daghrir, L. Tlig, M. Bouchouicha, and M. Sayadi, "Melanoma skin cancer detection using deep learning and classical machine learning techniques: A hybrid approach," 2020 5th International Conference on Advanced Technologies for Signal and Image Processing (ATSIP), 2020.

[5] Vijayalakshmi M. M, "Melanoma Skin Cancer Detection using Image Processing and Machine Learning," International Journal of Trend in Scientific Research and Development, vol. Volume-3, no. Issue-4,pp. 780–784, 2019.

[6] "Melanoma Skin Cancer Classification Using DeepLearning Convolutional Neural Network," Medico- Legal Update, 2020.

[7] Zunair and A. B. Hamza, "Melanoma detection using adversarial training and deep transfer learning,"Physics in Medicine & Biology, vol. 65, no. 13, p.135005,2020.

[8] Ramezani M, Karimian A, Moallem P., "Automatic detection of malignant melanoma using macroscopic images", Journal of Medical Signals and Sensors, vol 4, no 4, pp. 281-290, 201.

[9] A Melanoma Skin Cancer Detection Using Machine Learning Technique: Support Vector Machine-2021.

[10] The Melanoma Skin Cancer Detection and Classification using Support Vector Machine. Hiam Alquran, Isam Abu Qasmich', Ali Mohammad Alqudah', Sajidah Alhammouri', Esraa Alawnch'. Ammar Abughazaleh', Firas Hasayen.

[11] Melanoma Diagnosis from Dermoscopy Images Using Artificial Neural Network Sharmin Majumder, Muhammad Ahsan Ullah and Jitu Prakash Dhar.

[12] Skin Cancer Classification using ResNet Niharika Gouda, Amudha J.

[13] A Refined Approach for Classification and Detection of Melanoma Skin Cancer Using Deep Neural Network. Manahil Babar, Roha Tariq Butt, Hira Batool, Muhammad Adeel Asghar, Abdul Raffay Majeed, Muhammad Jamil Khan.

[14] Detection of skin cancer using deep neural networks Md. Muzahidul Islam Rahi, Farhan Tanvir Khan, Mohammad Tanvir Mahtab, A.K.M Amanat Ullah, Md. Golam Rabiul Alam, Md. Ashraful Alam.