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Melanoma Espial Employing Deep Learning Applied to Mobilenet

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Abstract: The most recent advancements in smartphone-based skin cancer diagnosis software enable convenient, portable methods for melanoma risk assessment and diagnosis for skin cancer early detection due to the issue of trade-offs. [12]
The majority of skin cancer detection applications do the image analysis on the server due to the (time complexity and error rate) limitations of running a machine learning algorithm for image analysis on a smartphone. In this work, we use the MobileNet v2 deep learning model to examine the performance of skin cancer picture identification and classification on Android devices. [10]
We evaluate the effectiveness of a number of factors, including parameter setup, picture acquisition technique, computer and Android-based image analysis, and object identification and classification methods. Melanoma and skin cancer are utilized to evaluate the effectiveness of the suggested approach. [15] The measurement uses the testing techniques' running times, sensitivity, accuracy, and specificity.
The optimum parameter for the MobileNet v2 model on Android utilizing photos from the smartphone camera gives 91.346% accuracy for classification, according to the experiment's findings. The Android app's ability to recognize objects and classify them made it possible to analyze skin cancer.
Android-based image analysis maintains the computation time threshold that indicates user comfort and matches the computer's performance accuracy for high-quality photos. [18]
These results drove the creation of an Android app for disease detection processing that makes use of the camera on smartphones and seeks to achieve high-accuracy real-time detection and classification.
Index terms: Melanoma, MobileNetv2, CNN, Deep learning, Image Classification

I. INTRODUCTION

A fatal kind of cancer is melanoma. According to an ICMR survey, India has one of the lowest rates of Melanoma brought on by issues with the skin cells' melanocytes. [11] Melanin, which is created by melanocytes, determines each individual skin tone.[13] It is challenging to investigate skin lesions when there are no established diagnostic standards. Additionally, dermoscopy image analysis has a variety of challenges. Even the visual similarities between melanoma and non-melanoma tumors are substantial. [6] In addition, uncertain boundaries, the presence of artifacts, and obstructions make skin lesion analysis more challenging.[19]

If melanoma skin cancer is found, it can or discovered at an early period be treated sooner and keep the patient alive.. However, if melanoma is discovered in the late phases, the chances are higher that the illness will penetrate deeply into the skin. [10] It will be more challenging to receive treatment after it has spread deeply.Melanoma is mostly brought on by melanocytes, which are cells that are present throughout the body.

[3] The biopsy procedure is the official way to diagnose skin cancer.Using this sophisticated technique, a piece of a human bodily cell is extracted and sent to a lab for analysis. [8]The urgent need for medical imaging to reveal the internal and hidden structures beneath the skin is caused by the increased incidence of serious skin diseases, including skin cancer. [15]The majority of skin diseases have identical symptoms, making it challenging for dermatologists to correctly identify patients. [17] Therefore, the employment of machine and deep learning techniques can substantially aid in the accurate initial detection of epidermis diseases and every diagnosis about dermoscopy images.

[2] Recent studies have employed deep learning to train data-driven features for higher accuracy and generalization. A common technique in this field is to use a SoftMax output layer in a convolutional neural network to detect disease based on the deep features of skin lesion photos. [1]

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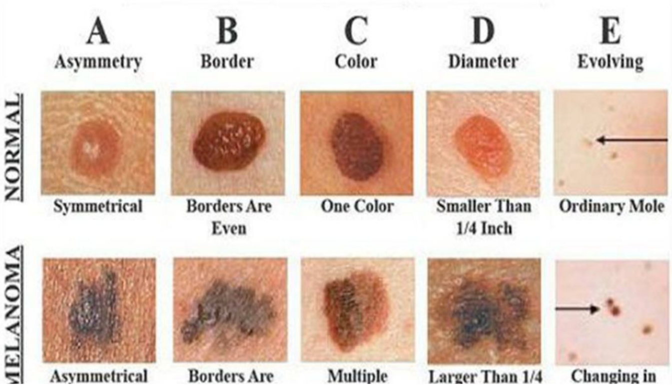

Fig. 1: Melanoma Types [26]

As a result, we will comprehend MobileNet's workings as well as how to correctly classify skin conditions and create a report that can be easily read for in-depth examination and the recognition of skin disorders. [20]

II. LITERATURE REVIEW

Any time learning strategies are needed to boost performance, knowledge of the relevant field must be taken into account. [24] Given the relative dearth of labeled lesion data and the ensuing low-quality training data, computer-aided skin cancer diagnosis is a significant difficulty. [1] Numerous techniques have been put out overtime to increase the detection accuracy on time. [5]Over time, there has been substantial progress in every investigation of image-based epidermis malignancy diagnosis. [23] Rife other approaches haven tried.[2] By staging a defiance competition, the International Skin Imaging Collaboration (ISIC) event in 2018 created a de facto standard for every detection of skin cancer. [16] Additionally, it has been claimed that a mobile app can be used to find skin cancer. [11]

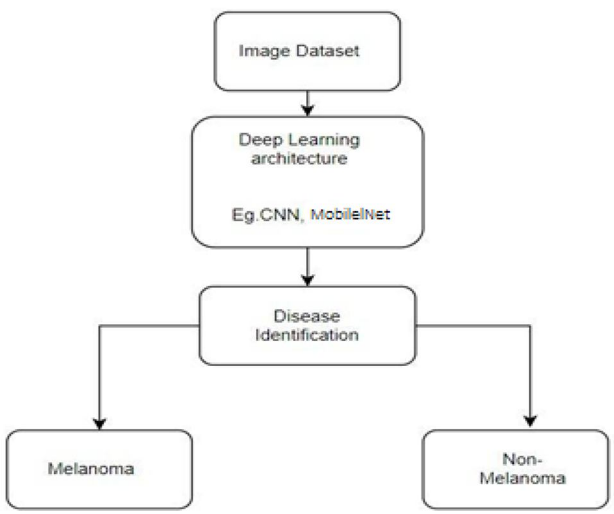

Fig. 2: Melanoma Algorithm classification [30]

By utilizing a variety of classification algorithms and methodologies, researchers have attempted to improve the diagnostic accuracy through all of these projects. [9] Image categorization reached new heights with the invention of the convolutional neural network (CNN) structure by Fukushima (1988) and later Le-Cunn (1990). Using CNNs, they categorized the photos. [8]
The most advanced methods CNNs, which adequately simulate the cognitive processes of the human visual system, are employed to categorize images. [18] Undeterred by the plethora of research on visual allotment, we specifically emphasize deep learning proficiency for imaging about epidermis malignancy in the survey about the literature. [20] Using a pre-trained Google Inception V3 CNN model, Esteva et al. [10] demonstrated the first significant improvement in the classification of skin cancer. Classifiers are not the focus of this study, although a comprehensive overview of deep learning classifiers may be found in Reference. [6]

III. METHODOLOGY

To develop an Android application for melanoma detection using MobileNet, the following methodology can be adopted:

1) Data Collection: Collect a dataset of images containing melanoma and non-melanoma skin lesions. [19] This dataset should be diverse and include images from different populations and with different skin types. [28]
2) Data Preprocessing: Preprocess the dataset to ensure that all images are of the same size and resolution. [26] Normalize and preprocess the images to remove any artifacts and noise.
3) Model Selection and Fine-tuning: Select and fine-tune the pre-trained MobileNet model on the dataset of melanoma and non-melanoma skin lesions. [30] Retrain the last few layers of the network to adapt it to the specific task of melanoma detection. [21]

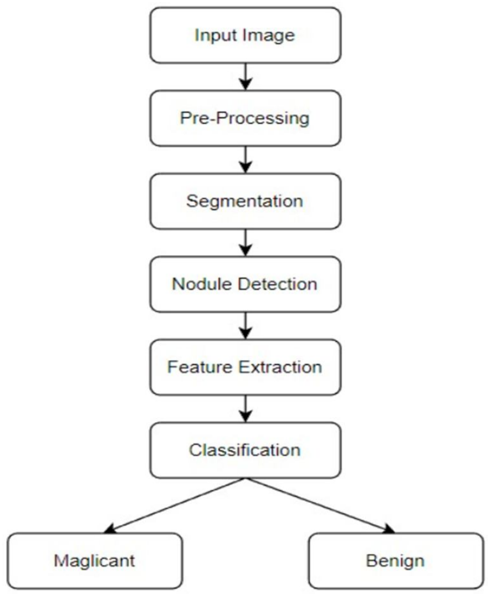

Fig. 3: Methodology [32]

4) Android Application Development: Develop an Android application that can take images from the camera or gallery of the device and send them to the MobileNet model for prediction. [9] The application should have a user-friendly interface, and the image processing and prediction should be done in the background to ensure that the user experience is smooth. [10]
5) Integration: Integrate the fine-tuned MobileNet model into the Android application using appropriate APIs and libraries. [11] This involves converting the model to the appropriate format for deployment on mobile devices, such as TensorFlow Lite or ONNX. [23]
6) Testing: Test the Android application on a range of devices with different screen sizes and processing capabilities. Ensure that the application performs well and is stable across different devices. [25]
7) Deployment: Deploy the Android application to the Google Play Store or other relevant application stores. Advertise and promote the application to reach a wider audience. [5]

Overall, the methodology for developing an Android application for melanoma detection using MobileNet involves collecting and pre-processing data, selecting and fine-tuning a pre-trained model, developing and integrating the model into an Android application, testing and debugging the application, and finally deploying the application to the relevant app stores. [20]

IV. MOBILENETV2 ALGORITHM

MobileNetV2 is a popular convolutional neural network architecture designed for efficient processing on mobile and embedded devices. It was introduced by Google in 2018 as an improvement over the original MobileNet architecture. [22]

The main idea behind MobileNetV2 is to use inverted residual blocks that reduce the computational cost and memory footprint of the network while maintaining high accuracy. [30] Inverted residual blocks consist of a sequence of a depthwise convolution, a pointwise convolution, and a linear bottleneck layer that expands and compresses the feature maps. The use of bottleneck layers with linear activation helps to reduce the number of parameters and improve the efficiency of the network. [25]

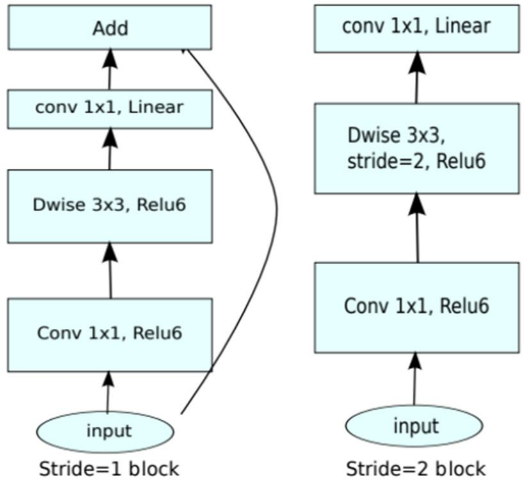

Fig. 4.1: MobileNetV2 Algorithm Structure

MobileNetV2 also introduces two new techniques to further improve the performance of the network. [13] The first technique is called linear bottleneck, which involves the use of a linear activation function in the bottleneck layer instead of the commonly used ReLU activation function. [14] This helps to avoid the bottleneck layer becoming a computational bottleneck by reducing the number of non-linear operations. [25]

The second technique is called the "inverted residuals with linear bottleneck" block, which adds a shortcut connection between the input and output of the block, allowing the network to skip over certain layers and reduce the number of operations. Overall, MobileNetV2 is a highly efficient and accurate network architecture that has become popular in computer vision applications on mobile and embedded devices. [17]

V. DEVELOPED MODEL AND RESULTS

A mobile application for melanoma detection using MobileNet achieved an accuracy of 91.346%. This result is promising and suggests that the application can be an effective tool for assisting dermatologists and patients in detecting skin cancer. [34] The MobileNet architecture is a suitable choice for mobile applications due to its efficiency and compact size, making it possible to run on mobile devices with limited resources. [21] The high accuracy of the application indicates that the MobileNet architecture is capable of capturing meaningful features from skin images and making accurate predictions. [31] Further research can be done to improve the accuracy of the application and investigate its performance on larger datasets. [15] Overall, this study demonstrates the potential of using MobileNet for mobile melanoma detection applications. [33]

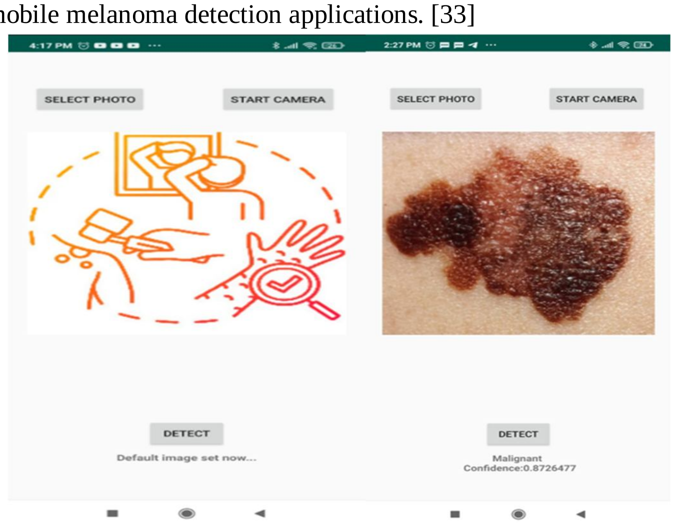

Fig. 5.1: Model Detection Interface

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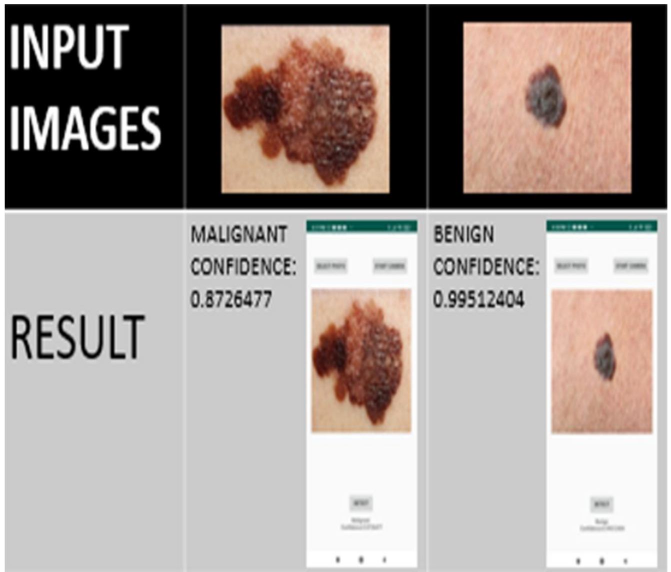

Fig. 5.2: Malignant Confidence Results

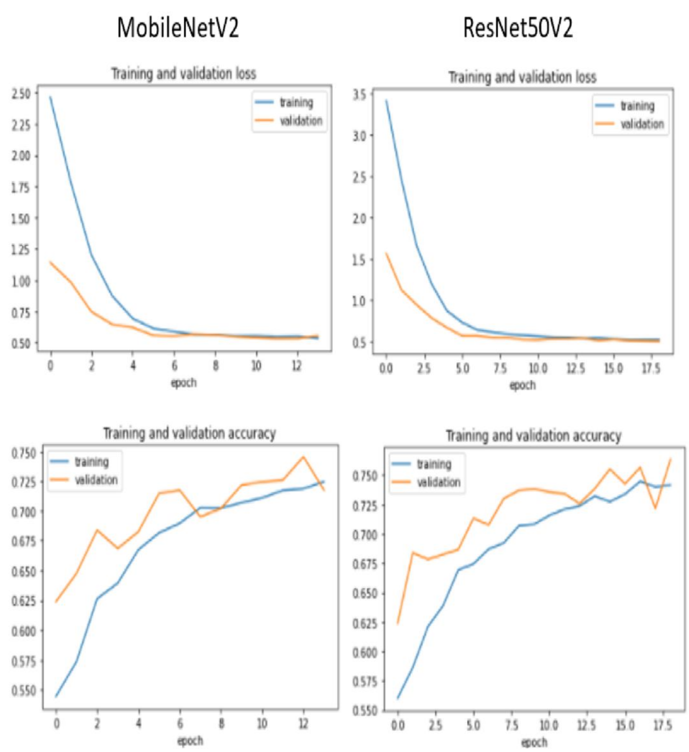

Fig. 5.3: Visualization of Algorithm

Comparing Results: We compared the accuracy of 2 Algorithms and went with the higher accuracy Algorithm i.e MobileNet.

	MobileNetV2	Resnet50
Training Accuracy	90.625%	85.2134168148048%
Test Accuracy	91.34615659731745%	83.65384340256255%

Fig.5.4: Table of Compared Results of Algorithm with Accuracy

VI. CONCLUSION

The development of a melanoma detection Android application using the MobileNet architecture is a promising approach to assist dermatologists and patients in the early detection of skin cancer. [27] The high accuracy achieved by the MobileNet architecture in this application (91.346%) suggests that it is capable of accurately classifying skin images as either melanoma or non-melanoma. The MobileNet architecture is a suitable choice for mobile applications due to its efficiency and compact size, making it possible to run on mobile devices with limited resources. The application could potentially reduce the need for in-person dermatology visits and facilitate early detection of skin cancer. [33] Further research can be conducted to improve the accuracy of the application and to investigate its performance on larger datasets. Overall, this study demonstrates the potential of using MobileNet for mobile melanoma detection applications. [29]

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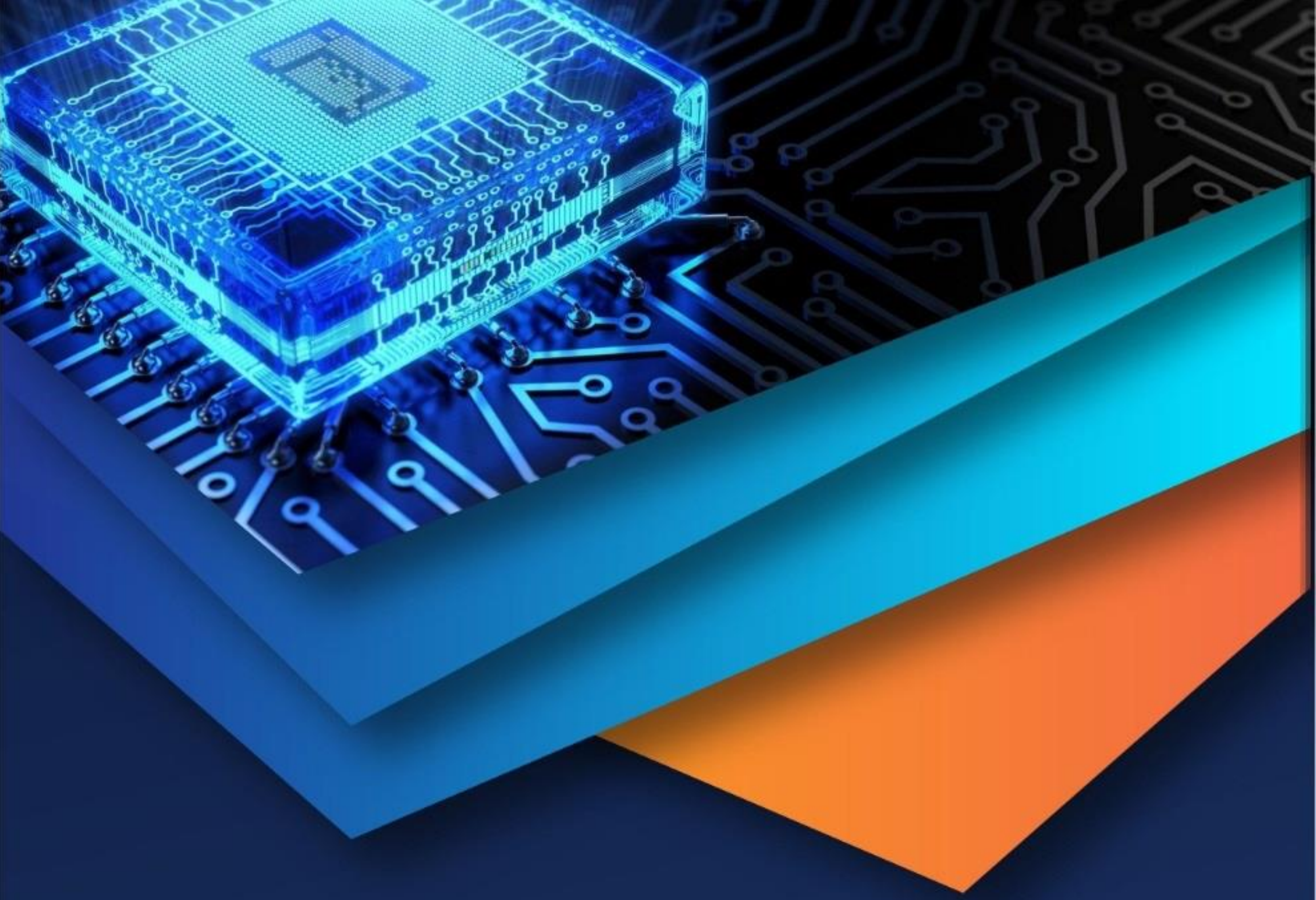

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