Final Report:

MelanomaDetector: An AI-Powered Melanoma Skin Cancer Detection App Using Transfer Learning

Written by:
Md. Injamul Haque
Dept. of CSE.
Daffodil International University

Table Content

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Abstract: The "MelanomaDetector" app presents a groundbreaking solution addressing the critical need for early detection of melanoma cancer, distinguishing between benign and malignant cases. This paper outlines the development and implementation of an Artificial Intelligence (AI) powered application, aimed at providing users with a user-friendly tool for monitoring skin health, facilitating early melanoma detection, and prompting timely medical intervention. The proposed application, "MelanomaDetector," utilizes a Convolutional Neural Network (CNN) model, specifically a modified version of the VGG16 architecture pre-trained on the ImageNet dataset, for accurate melanoma detection. The development process encompasses seven key phases: data collection, preprocessing, model selection, model customization, app development, and testing & validation. By leveraging state-of-the-art AI technology, this application seeks to enhance public awareness and education on melanoma, ultimately contributing to improved healthcare outcomes. We have achived highest accuracy 99 and 95 for training and testing respectively .

Keywords: Melanoma cancer,Benign,Malignant,App development and medical industry.

1. Introduction:

Melanoma, the most serious type of skin cancer, arises from cells (melanocytes) that produce melanin, the pigment that determines skin color. Melanoma can occur in the eyes and, rarely, in other parts of the body, such as the nose and throat.The risk of melanoma appears to increase in people under the age of 40, especially women.According to the American Cancer Society [**1**], an estimated 106,110 new cases of melanoma skin cancer will occur in the United States (USA) in 2021, and about 7,180 deaths are expected in 2021. They also found that the current prevalence in the United States is about 23 per 100,000 people. However, early detection and appropriate treatment of melanoma can reduce these overwhelming statistics. Experimental studies suggest that malignant melanoma can be cured if detected early **[2, 3]**.There is currently no app specifically designed to accurately detect melanoma, a type of deadly skin cancer, leaving a huge gap in the market.

My goal is to provide both medical professionals and individuals with a valuable tool as an AI-powered solution that enables early detection and improves patient outcomes in the fight against melanoma.

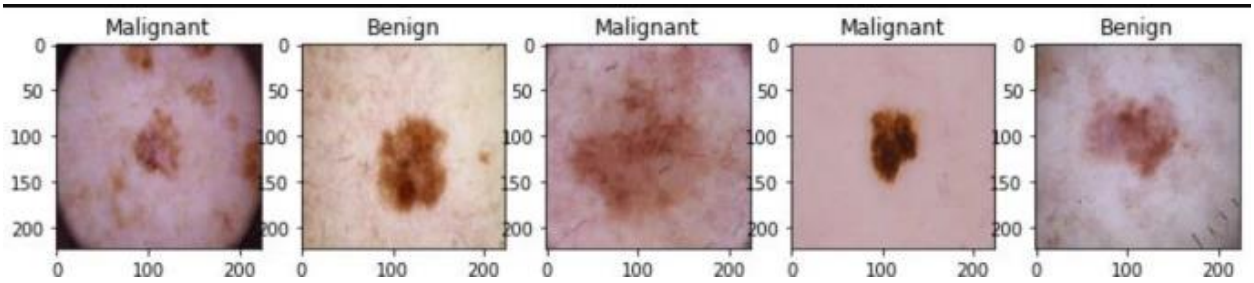


Figure 1: shows the picture of Benign and Malignant Cancer

In **Figure 1,**we can see some images that belong to the Malignant and Benign class.

2. Literature review

Recently, significant research efforts have been made to develop computerized systems for medical applications **[4, 5]**. In particular, advances in deep convolutional neural networks have proven their effectiveness in classification and object recognition tasks in medical imaging applications **[6,7]**.An innovative melanoma detection pipeline that utilizes ensemble learning to combine the predictive power of multiple deep convolutional neural network models was proposed by Guergueb et al. **[8]**. And the authors proposed approach achieved high performance with an area under the curve (AUC) of 99.02%, outperforming many state-of-the-art algorithms.

Burada et al. proposed a computational diagnostic method for detecting melanoma skin cancer using a radial basis function network. Firstly , their model converts the color image to a grayscale image, then applies a filter such as median that removes noise and other distinct objects. And then, they use a segmentation method to detect lesion segments and extract features. Finally, a radial basis function network classifies the segmented image as either malignant melanoma or benign cancer.They got the highest performance using their proposed method. Their accuracy was 88.89 percent**[9]**.Rahman et al.In their work ,Initially they extract the feature using cnn models and then classify using traditional machine learning models**[10]**.An automated method for segmenting the skin melanoma at its earliest stage by employing a deep-learning-based approach was proposed by Nawaz et al.Their proposed method attains an average accuracy of 95.40, 93.1, and 95.6% on the ISIC-2016, ISIC-2017, and PH2 datasets**[11]**. Alfi et al. used Hand-crafted features to extract the feature and then used

traditional machine learning techniques to classify benign or malignant class**[12].** An explainable CNN-based stacked ensemble framework to detect melanoma skin cancer at earlier stages was proposed by Shorfuzzaman et al. state that ,they got the highest performance with their proposed model compared to other CNN models.

3. Methodology

In this paper,we have divided our workflow into seven categories,(i)Data collection (ii)Preprocessing (iii)Apply pre-trained CNN model(VGG16,Vgg16,fine-tune on VGG16) (iv)Model Training and Evaluation (v)Use pre-trained model in App development detect Melanoma cancer disease (vi) Validation & Testing (vii)Deployment and monitoring .

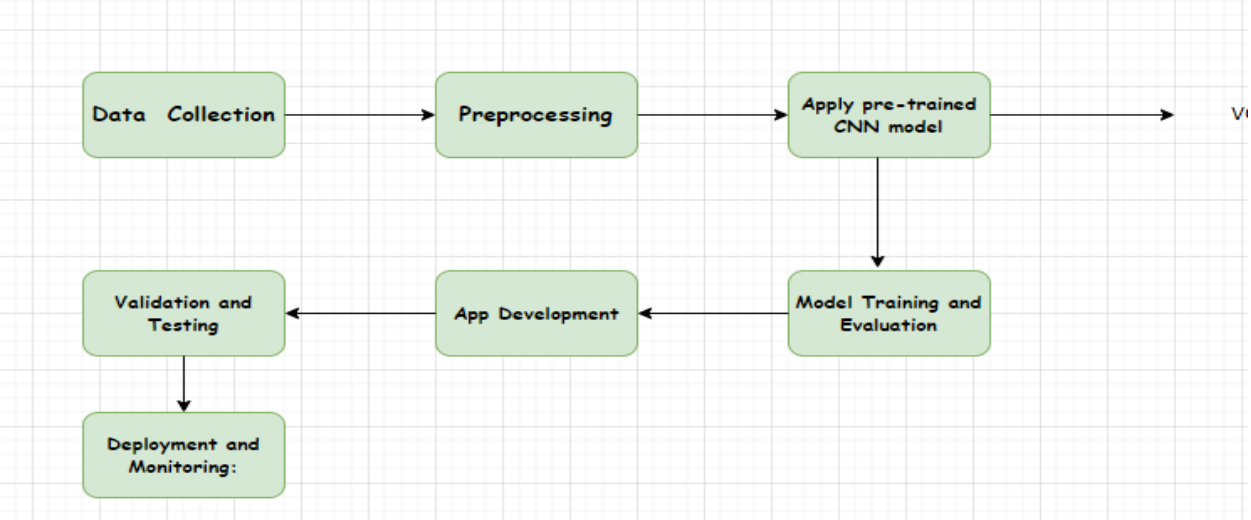


Figure 2: Proposed Model Architecture

i. **Data collection**:The dataset was collected from the kaggle website.And the dataset has permission to use it freely. The Melanoma Skin Cancer Dataset includes 10,000 images. The dataset contains 9600 images for training the model and 1000 images for testing.And the dataset has two classes Benign and Malignant.

ii.**Preprocessing:**. In this section, we preprocess the dataset using preprocessing techniques including Median filtering.Median filtering reduces noise while maintaining signal jumps. The extent of noise reduction is determined by the noise distribution. The larger the distribution tail, the better the filter performs in terms of noise reduction.

iii. **Pre-trained Model:**In our experiment ,we use transfer learning based model VGG16. We explore the VGG16 model in various ways. We used a pre-trained vgg16 model,finetune on ending layers of pretrained VGG16,finetune on pretrained VGG16.We got the best performance on transfer learning based VGG16 model.The train and testing accuracy is 96% and 94% respectively.

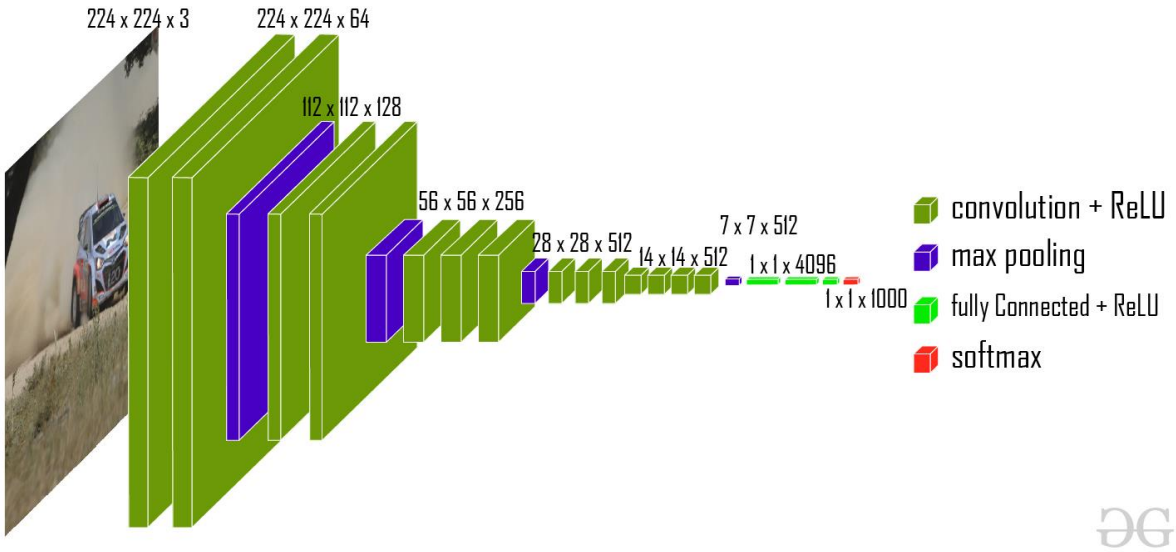
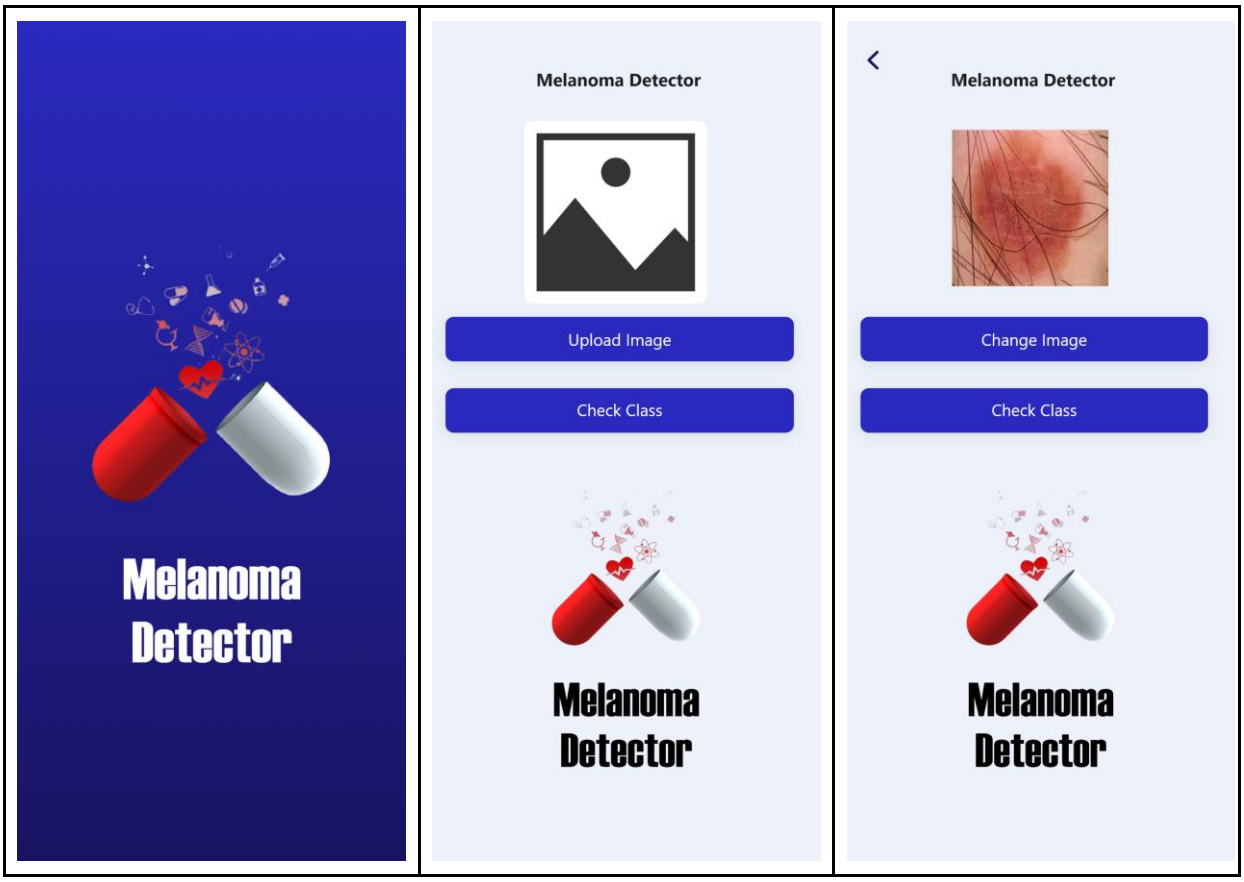


Figure 3: Represents the architecture of VGG16

(iv). **Model Training and Evaluation:**Using the acquired dataset, train the transfer learning model and evaluate its performance on a separate validation dataset. To refine the model's hyperparameters and increase its accuracy, iterative training and validation are required.

(v)**App development:** We want to make an app to detect Melanoma Cancer .Here in app development we use a pre-trained model VGG16 to predict the class that can be malignant or benign.


Melanoma Detector
Melanoma Detector
Upload Image
Check Class
Melanoma Detector
Melanoma Detector
Melanoma Detector
Change Image
Check Class
Melanoma Detector

(vi). **Validation & Testing:**In this section , we test our app with different datasets. Basically we will test the detected cancer with the original image to find accuracy.

(vii) **Deployment:** Sometimes we need to find the error of the app and fix it.

4. **Results:** As we already mentioned that here we use different types of vgg16 models .Now let's compare their performance.

Model Name	Training Accuracy(%)	Testing Accuracy(%)
a. finetune on pretrained VGG16	92	91
b. finetune on ending layers of pretrained VGG16	95	93
c. VGG16	**99**	**95**

Table 01: Represents the Result

a. Finetune on pretrained VGG16

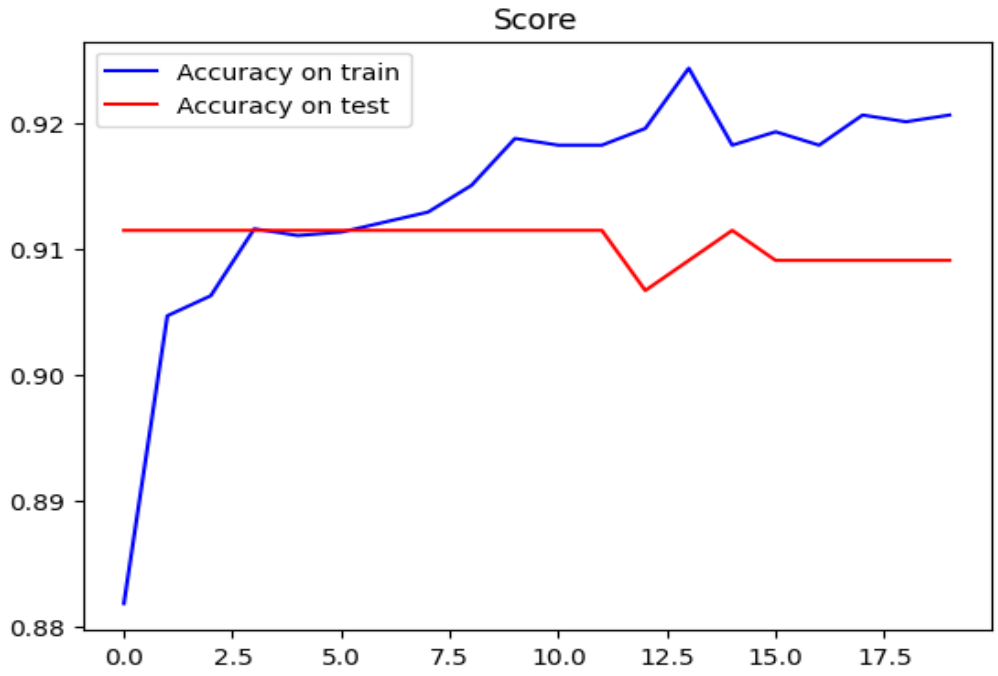


Figure 4

b. finetune on ending layers of pretrained VGG16

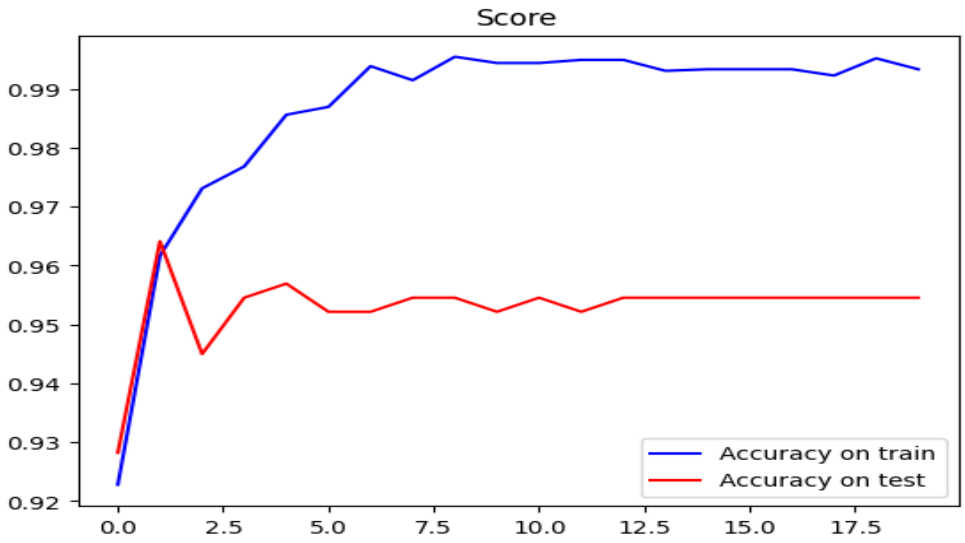


Figure 5

c. VGG16:

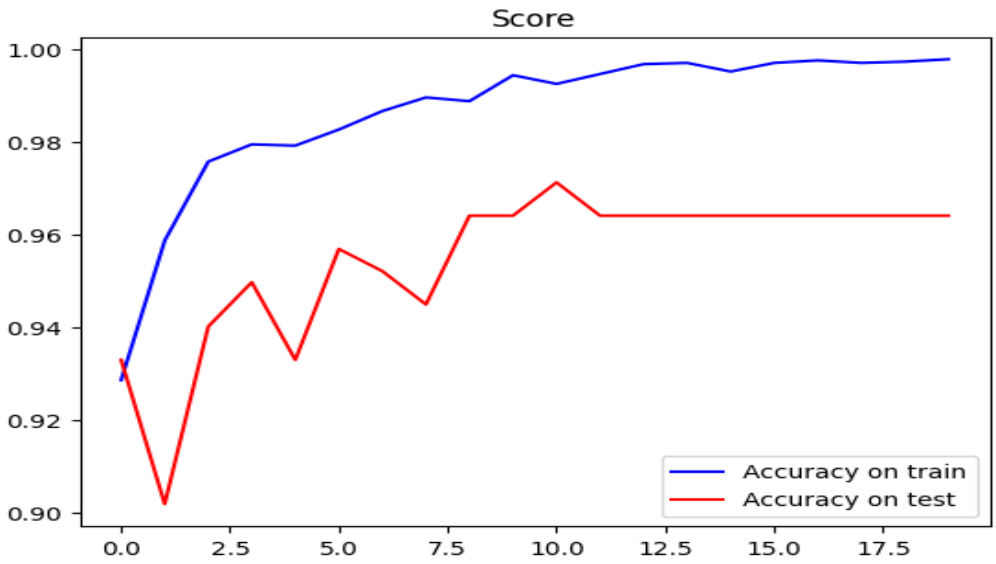


Figure 6

Overall we can see that, **Only VGG16 performs bette**r than any other VGG16 model.

5.Discussion:

Due to the VGG16 model's success in medical image classification tasks, it was selected. After several convolutional and pooling layers, fully connected layers are present. A melanoma-specific dataset can be used to refine the model so that it can learn to recognize specific patterns and traits that are linked to the disease, improving its ability to identify it.In this paper, we got best

performance using VGG16 model.And dataset was small .And we got best performance after preprocess the image.

The title of the software, "MelanomaDetector," accurately describes its main function and aim, which is to identify melanoma, a type of skin cancer. Users instantly understand from the app's name that it is intended specifically for the detection of melanoma.The development of an app dedicated to melanoma detection addresses a critical need in healthcare. Early detection of melanoma significantly improves prognosis and treatment outcomes.

6. Conclusion :

In conclusion, the "MelanomaDetector" app can be crucial for the healthcare industry. By giving consumers a convenient and accessible tool to monitor their skin health, it enables early diagnosis of melanoma, a kind of skin cancer that may be fatal.This app can increase accessibility to melanoma screening, supports healthcare professionals in decision-making, raises public awareness, and contributes to research efforts.

Overall, MelanomaDetector app can play a crucial role in promoting early detection, improving patient outcomes, and empowering individuals in the fight against melanoma cancer .

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