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Classification of skin cancer using Convolutional Neural Network

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Abstract: Humans are prone to skin cancer, which is one of the most common forms of cancer. The Cause of skin cancer is the uncontrollable mutation in DNA that could occur due to many reasons. An important factor in increasing the chance of success is identifying the cancer in the early stages. Now a days, computer aided diagnosis applications are used almost at every field. It is majorly used areas in health sector. Data from sick people is stored in computers to create biomedical datasets.. The goal of our Project is to obtain an effective and sustainable way for early diagnosis of skin cancer by classifying our dataset images as benign or malignant. The dataset used in the project consists of 660 test images along with 2437 training images.

Keywords: Skin Cancer Detection, Artificial Intelligence, Healthcare, Image processing, Convolutional Neural Networks, VGG16, InceptionV3, Deep Learning, MobileNetV2, EfficientNet.

INTRODUCTION

As per the World Health Organization reports, cancer has been constantly reported as one of the leading causes of death around the world, and according to some studies, In the United States, only more than two people die of skin cancer every hour. Due to Mutations in human DNA, many malignant cancer types has been seen in the human body. Sunlight has been proven as one of the leading factors for the increase in skin cancer cases and
By protecting from the Sun, you can reduce the risk of skin cancer, where the most common causes include UV radiation, unhealthy lifestyle & smoking [1]. The count of skin cancer cases is expected to keep rising with the rapid depletion of the ozone. The help of medical experts and a significant number of the necessary equipment are vital for the timely and accurate diagnosis of the cancer present in the skin. Dermoscopy which is an assistant diagnosis and non-invasive method is used to examine skin with pigmented skin lesions and determine the probability of skin cancer. The correct diagnosis for skin cancer has been proven very difficult even when it is performed by experienced oncologists or dermatologists. The fact that skin cancer takes numerous forms makes this task a challenge. In practice, it can show symptoms in the form of inflammation and the main difficult part is to diagnose the symptom is malignant or benign [2].

Skin cancer can also be present in other forms whose detection is very difficult with just a naked eye, like rashes or skin color change and blemishes[9]-[12]. As a result, a more precise and dependable detection approach is required. The use of Computer-Aided Diagnosis is being done by hospitals and other stakeholders because of its ability to detect and screen skin cancer using various Dermoscopic images in its early stages. These methods take into account the processing of images by examining different properties such as shape, color, and texture to check whether it is benign or malignant [3]. It is crucial to rule out the type of skin cancer as it eases the challenge to identify the best treatment possible. Getting rid of false positive and false negative scenarios is of high priority in this area, and diminishing the proportion of errors much as possible. Researchers are trying their best to find different Convolutional Neural Networks when detecting and classifying different types of skin cancer to improve the accuracy as much as they can [8].

ALGORITHMS USED:

• **Inception-v3**: It came after InceptionV1, which has 24 Million parameters. This network adds batch normalisation to the auxiliary layers in the auxiliary network and tweaks the optimiser, loss function, and loss function inceptionv3.

• **VGG16**: Visual Geometry Group (VGG) created VGG-16, which has thirteen convolutional and three connected layers, incorporating the ReLU form of AlexNet with more layers. VGG16 uses smaller size filters (2*2, 3*3).

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• **Deep CNN Model**: The proposed model is tested on dataset from ISIC. It compares the data with the two models, adjusting hyperparameters and layer numbers as necessary to get maximum accuracy.

• **MobileNetV2**: MobileNetV2 is very similar to the original MobileNet, except that it uses inverted residual blocks with bottlenecking features. It has a drastically lower parameter count than the original MobileNet. MobileNets support any input size greater than 32 x 32, with larger image sizes offering better performance.

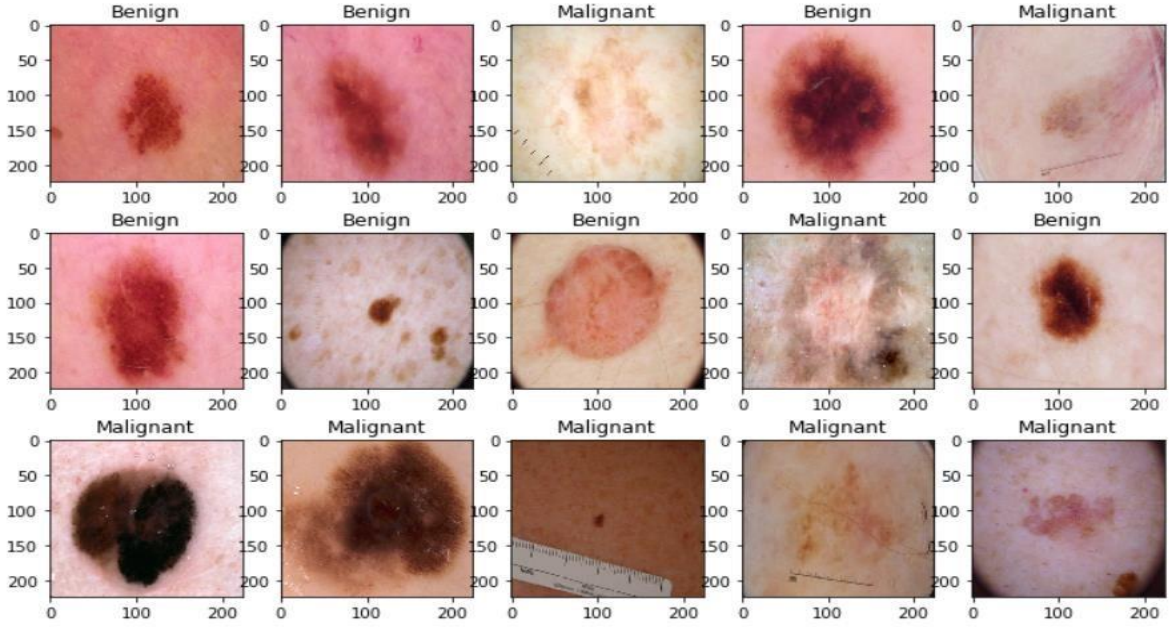
• **EfficientNet B2**: Efficientnet-B2 is trained for classification in the standard manner (note that FC denotes the fully connected final layer). In testing, the image is broken up into patches that are fed to the feature extractor.

Table 1 : Computer Specifications

Processor used	Intel i5-8300H processor
Graphic card	Nvdia GeForce GTX 1050Ti
RAM	12 GB DDR4 2400MHz

Table 2 : Software Used

Operating System	Windows 10 64 bit
Programming Language	Python 3.x
IDE	Jupyter Notebook
Neural Network Library	Keras, scikit learn
Python Library	Numpy



DATASET

Skin Cancer: Malignant vs Benign : The dataset used in this Project contains a balanced dataset of images which is divided as benign skin moles and malignant skin moles.
The dataset consists of two folders f benign and malignant with each containing about 1800 pictures (224x244) of the two types of moles.

All the rights of the DataSet used in the Project are bound to the ISIC-Archive rights (https://www.isic-archive.com/#!/topWithHeader/onlyHeaderTop/gallery?filter=%5B%5D)

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LITERATURE REVIEW

One of the most common types of cancer today is skin cancer, which was one of the most active types in the last decade. The skin is the largest organ of our body, making it likely that skin cancer will be one of the most widespread types of cancer. The American Cancer Society provides statistics that show only 1% of all skin cancer cases are melanoma skin cancer. Out of all skin cancer cases, only 1% of them are nonmelanoma skin cancer, which includes nonmelanoma skin cancer, although they have a higher mortality rate than other types of skin cancer. Biopsy is one of the most common method used by doctors for Skin cancer detection. In this procedure, Doctor removes a skin sample from the affected skin lesion for examination to determine whether that lesion is cancerous or not. However, this process has many drawbacks like it is slow, time consuming and very painful. In order to simplify and speed up the process many non invasive techniques were proposed to examine the Skin Cancer whether it is melanoma or non-melanoma. Skin cancer detection generally involves first acquiring an image, then processing it, segmenting and extracting the desired features from it, and finally classifying the image.
Yessi Jusman, Indah Monisa, Dhimas Dharmawan and Kunnu Purwanto in 2021 presented a Multilayer Perceptron, which was a customized CNN along with VGG16 for classification of skin cancer. Based on their analysis of the HAM10000 dataset, they concluded that VGG16 are significantly faster than Multilayer Perceptrons.

Nour Aburaed, Mina Al-Saad, Watiq Mansoor, Alavikunhu Panthakkan and Saad Ali Aminin 2020 strategized a way to classify skin cancer classification and used VGG16 and VGG19 for the implementation.

Onur Köse, Feyza YILMAZ and Ahmet DEMİR in 2019 compared the accuracy rate of ResNet-101 architecture with Inception-v3 architecture and found out that latter has shown more prominance than the former.

Mater Hussen Mahnashi, Mohammed Olaythah Alraddadi, Abdul Hakeem M Saeed, Soliman Ayed Alsaiari, Abdur Rehman Mahmood 6, Muhammad Ramzan, Hikmat Ullah Khan, Shumaila Akram and Mehwish Dildar preseted a detailed review of skin cancer detection techniques using deep learning and analyzed the research findings and concluded that CNNs are gives best results as compared to ANNs and KNNs for image classification.

1. CONVOLUTIONAL NEURAL NETWORK FOR SKIN CANCER DETECTION

CNN (Convolutional Neural Network) is a kind of deep neural network technology. It works with multilayer perceptron. A network which is completely connected may cause overfitting of data. CNN outperforms any hierarchical structure that is available out there. CNNs only requires small portion of data in image classification throughout the process. An image is taken as an input in CNN then resepective weights are assigned to each of them.
CNN architectures contains many layers which help transform different weights as according to input images. Layer in CNN typically include pooling, convolutional, dense, connected and drop-out layer. Out of all the layer in the CNN model the most important is the convolutional layer

Layer (type)	Output Shape	Param #
conv2d_1 (Conv2D)	(None, 224, 224, 64)	1792
conv2d_2 (Conv2D)	(None, 222, 222, 64)	36928
max_pooling2d_1 (MaxPooling2	(None, 111, 111, 64)	0
conv2d_3 (Conv2D)	(None, 111, 111, 64)	36928
conv2d_4 (Conv2D)	(None, 109, 109, 64)	36928
max_pooling2d_2 (MaxPooling2	(None, 54, 54, 64)	0
dropout_1 (Dropout)	(None, 54, 54, 64)	0
flatten_1 (Flatten)	(None, 186624)	0
dense_1 (Dense)	(None, 512)	95552000
dropout_2 (Dropout)	(None, 512)	0
dense_2 (Dense)	(None, 256)	131328
dropout_3 (Dropout)	(None, 256)	0
dense_3 (Dense)	(None, 2)	514

Total params: 95,796,418
Trainable params: 95,796,418
Non-trainable params: 0

Figure 1: Convolutional Neural Network for Skin Cancer Detection

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2. PROPOSED METHOD

Aim of the project is to acquire a capable course of action to diagnose skin cancer as early as possible in its initial stages, images are lebelled as benign according to the existance of benign cells. Skin cancer can lead to the death of an individual without proper treatment. The purpose of the project is to espy skin cancer in the initial stage and increase the possibility of a successful procedure and treatment. In the medical field, diagnosis with the help of computer applications is used and various datasets which are biomedical in nature are constructed from the data collected. And to increase accuracy of our current model while comparing accuracies with other well known deep learning algorithms namely Inception-V3, VGG16, MobileNetV2, EfficientNet B2.

METHODOLOGY:

1. Importing all the Essential Libraries
2. Loading images of benign and malignant skin cancers
3. Labelling the data using categorical labels.
4. Normalise the data
5. Split the data into Training & Testing dataset
6. Training the CNN model
7. Train the model on cross validation set 8. The model is tested for accuracy.

3. COMPARISON BETWEEN DIFFERENT SKIN CANCER DETECTION TECHNIQUES

CLASSIFICATION METHODS	RESULT
1. Deep CNN	87.27% accuracy
2. VGG16	83.78% accuracy
3. InceptionV3	85.00% accuracy
4. MobileNetV2	77.12% accuracy
5. EfficientNet B2	79.69% accuracy

Table 3: Comparative Study of different Skin Cancer Detection Techniques

4. RESULTS AND DISCUSSIONS

In this project the Deep CNN model which was proposed and was trained using the dataset has an accuracy of 87.2 percent. And the accracy of VGG16 is 83.78 , InceptionV3 is 85%, MobileNetV2 is 77.12 and EfficientNet B2 is 79.69% for the same dataset. The accuracy of the proposed model is more than other models as it is more optimised for the current dataset.

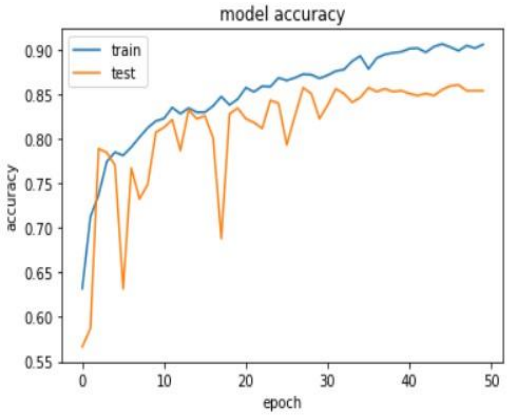

Figure 2 : Training & Testing accuracy

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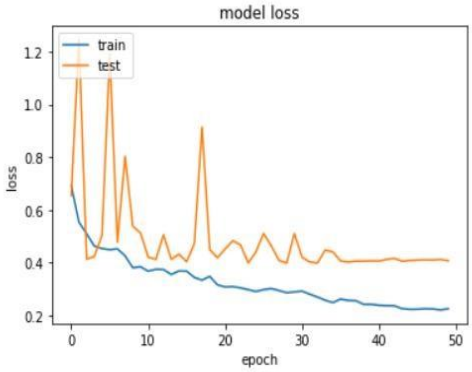

Figure 3 : Training & Testing model loss

5. CONCLUSION

The aim of the project is to maximize the accuracy of the classification of skin cancer using the proposed Deep CNN Model. The accuracy of the model is 87.2% where the accuracy could depend upon mulitple factors like cleaning the data, categorize the data, selection of parameters, the size of the dataset, the numbers of epochs and many more factors.

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