Skin Cancer Diagnosis
using Deep Learning

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Introduction

Using Deep Learning technology to classify patients' dermatoscopic images to diagnose and distinguish skin cancer from other types of non-malignant skin lesions....

objective

Distinguish skin cancer lesions from other types of skin lesions with high accuracy and precision.

Classification Approach

- We used binary classification (**2 classes**) to distinguish between Skin Cancer and Non-Cancer lesions.
- We also used another multi-class classification (**7 classes**) different skin lesions from each others including skin cancer lesions.

METHODOLOGY

01 Preprocessing

Rescaling , Resizing, Zoom and Rotating

02 Image Augmentation

Batch Normalization , Pool Size , Filters

03 Convoluted NN

Using different CNN architectures to classify skin lesions.

04 Transfer Learning

Using different pretrained models with Complex MLP

Image Preprocessing

Rescaling

Zoom

Resize

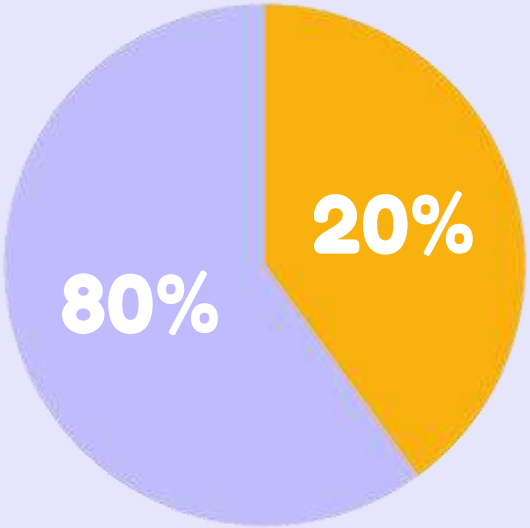
Data Description

From Kaggle

10016 data instances
(dermatoscopic images)

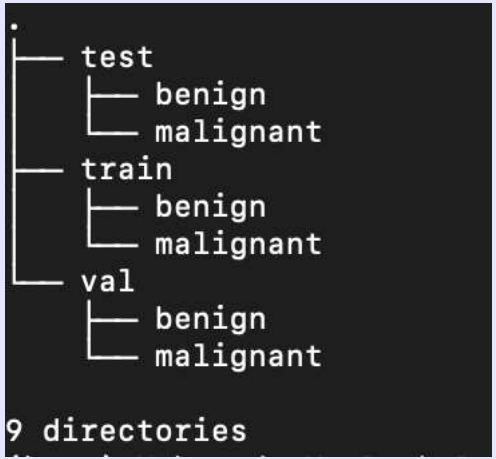
Tools and Libraries

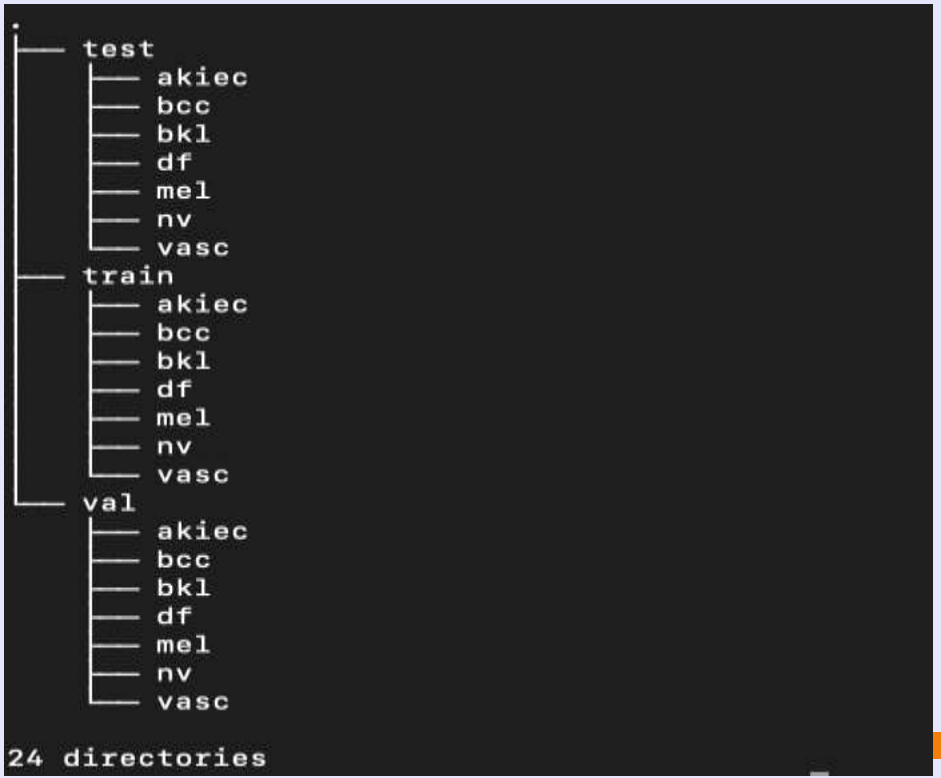
Data Division



- Training Data Set
- Validation And Test Data Set

Folders Structure





Pipeline

Image Data Generator And Image Augmentation

Lazy Image Loading

Training and Validation

Different Models

1

2

3

4

5

Transfer Learning

Data Split

- (6490) images Train
- (180) images Validation
- (1002) images Test belonging to 2 classes.

Test (NN, CNN)

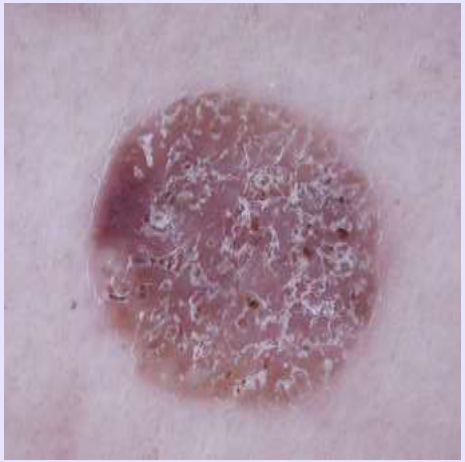
Utilized different sizes of NN and CNN networks

Image Samples(Cancerous)

Mel (Melanoma)	Bcc (Basal Cell Carcinoma)	Akiec (Actinic Keratosis)

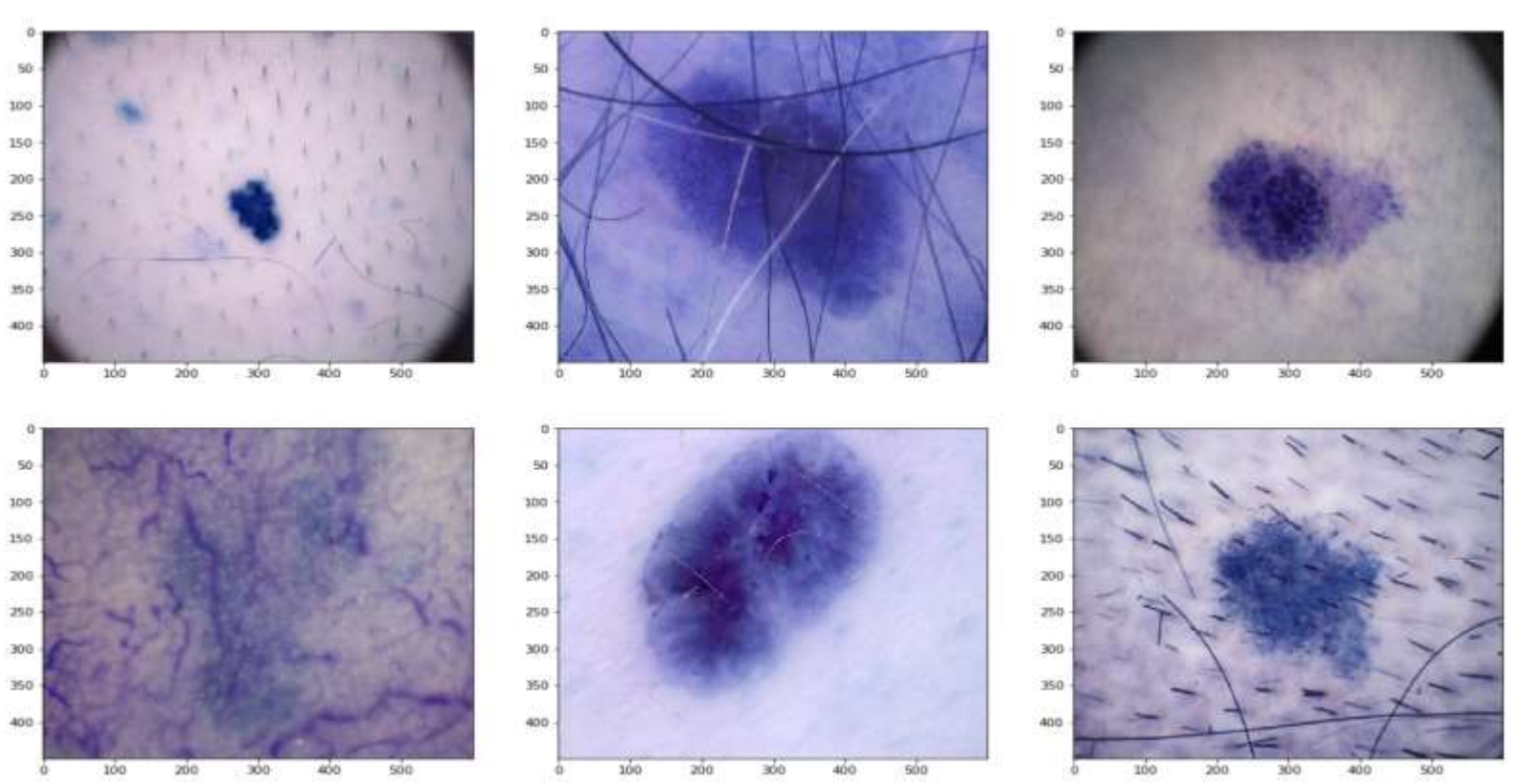
Image Samples(Non-Cancerous)



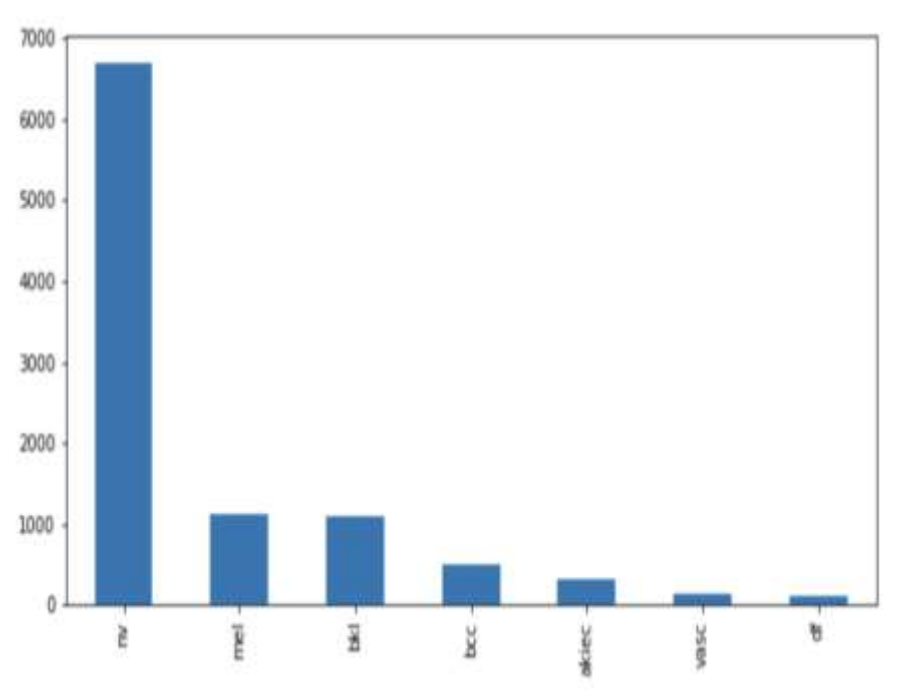
Df (Dermatofibrom)	nv (Melanocyte nevi)	Vasc (Non-Cancer Vascular Lesions)	Bkl (Sebohrreic keratosis)

Image Samples

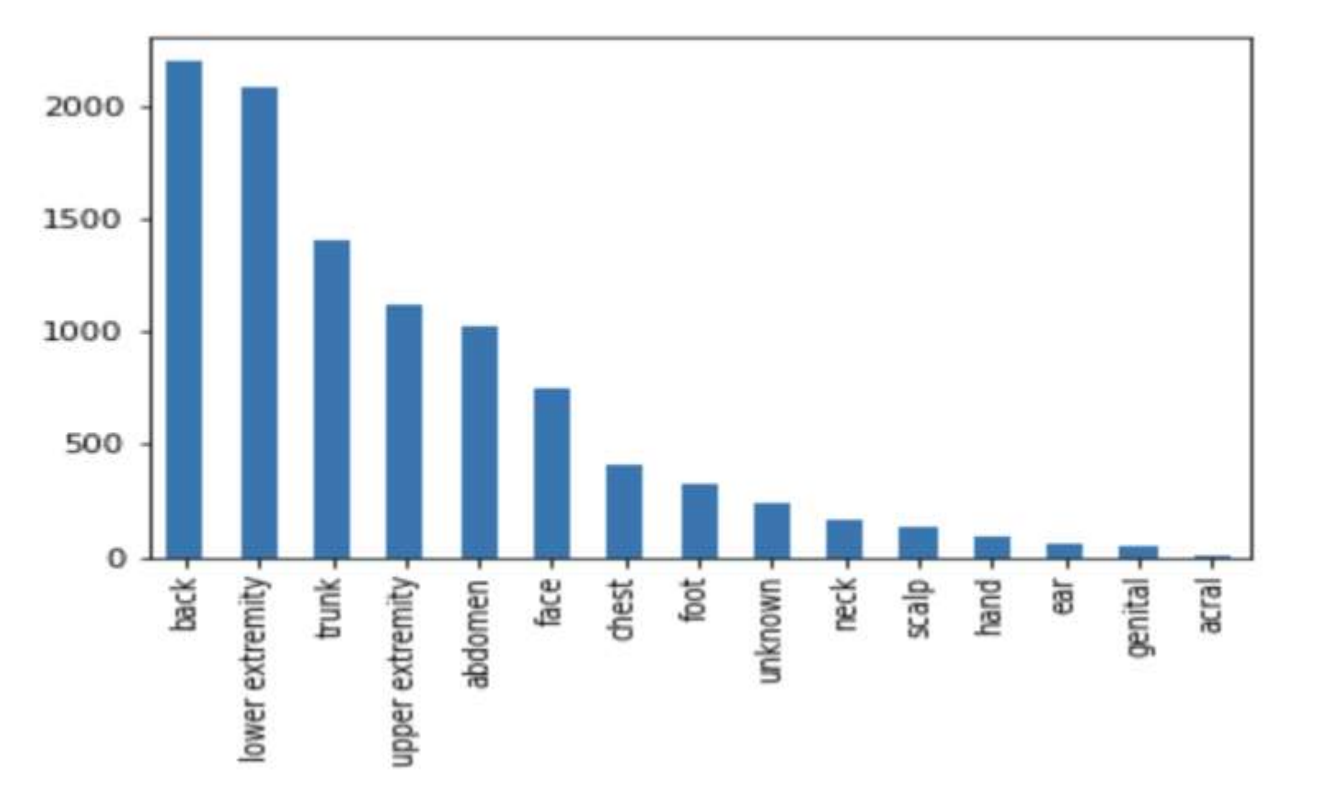


Types of Skin Diseases

Skin Diseases	Pathology
nv (Melanocyte nevi)	Non-Cancerous
Bkl (Sebohrreic keratosis)	Non-Cancerous
Df (Dermatofibrom)	Benign Tumors (Non Cancerous)
Vasc (Non-Cancer Vascular Lesions)	Non-Cancerous Pyogenic Granulomas
Bcc (Basal Cell Carcinoma)	Cancerous
Mel (Melanoma)	Cancerous (Malignant)
Akiec (Actinic Keratosis)	Cancerous



Skin Lesion Localizations



Models Performance

Classification Models (7 Classes)

Models Name	Accuracy Train	Accuracy Validation
Baseline (AdaBoost)	0.65	0.66
Kneighbors Model	0.66	0.66
XGBClassifier	0.67	0.69

Best Model	Accuracy Test
XGBClassifier	0.66

Classification Models (2 Classes)

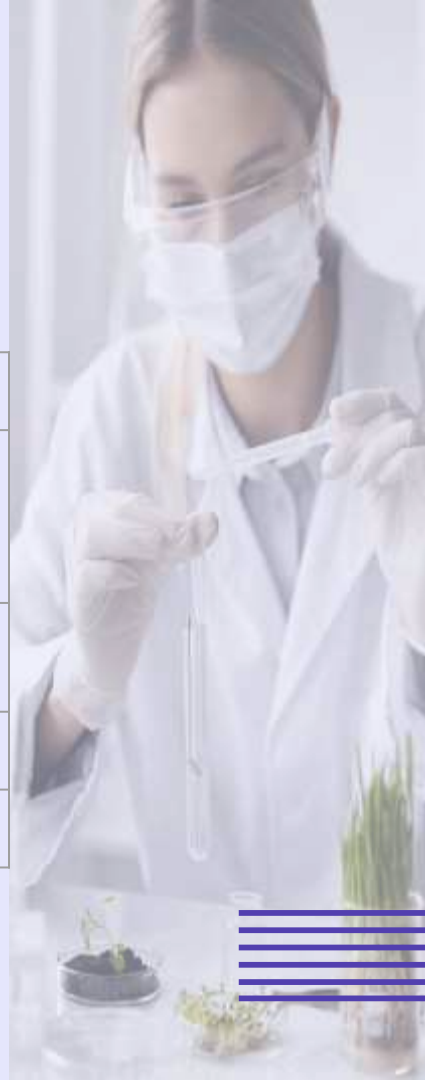
Models Name	Accuracy Train	Accuracy Validation
Baseline (AdaBoost)	0.80	0.792
Kneighbors Model	0.63	0.67
XGBClassifier	0.8	0.797

Best Model	Accuracy Test
XGBClassifier	0.81

Neural net (NN) Vs Convoluted Neural net (CNN) (7 Classes)

Type	NN		CNN	
Accuracy	Accuracy Train	Accuracy Validation	Accuracy Train	Accuracy Validation
Simple	0.64	0.66	0.66	0.69
Medium	0.66	0.69	0.66	0.69
Complex	0.66	0.69	0.67	0.69

Best Model	Accuracy Test
Complex (CNN)	0.69



Neural net (NN) Vs Convoluted Neural net (CNN) (2 Classes)

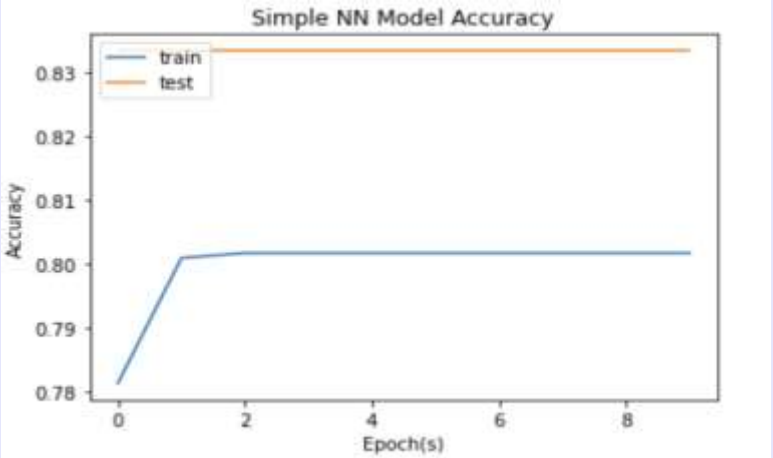
Type	NN		CNN	
Accuracy	Accuracy Train	Accuracy Validation	Accuracy Train	Accuracy Validation
Simple	0.80	0.83	0.80	0.83
Medium	0.80	0.83	0.79	0.83
Complex	0.80	0.83	0.80	0.83

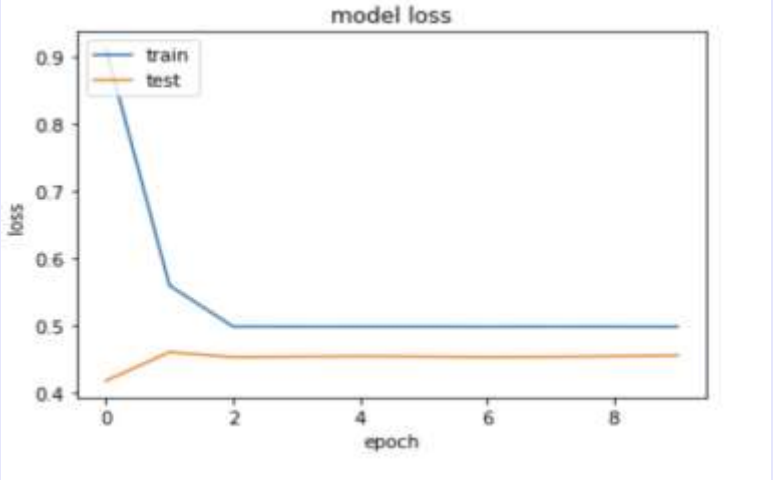
Best Model	Accuracy Test
Complex (CNN)	0.79

Simple NN Model

This Char Between Accuracy And Epoch (s)

This Char Between Loss And Epoch

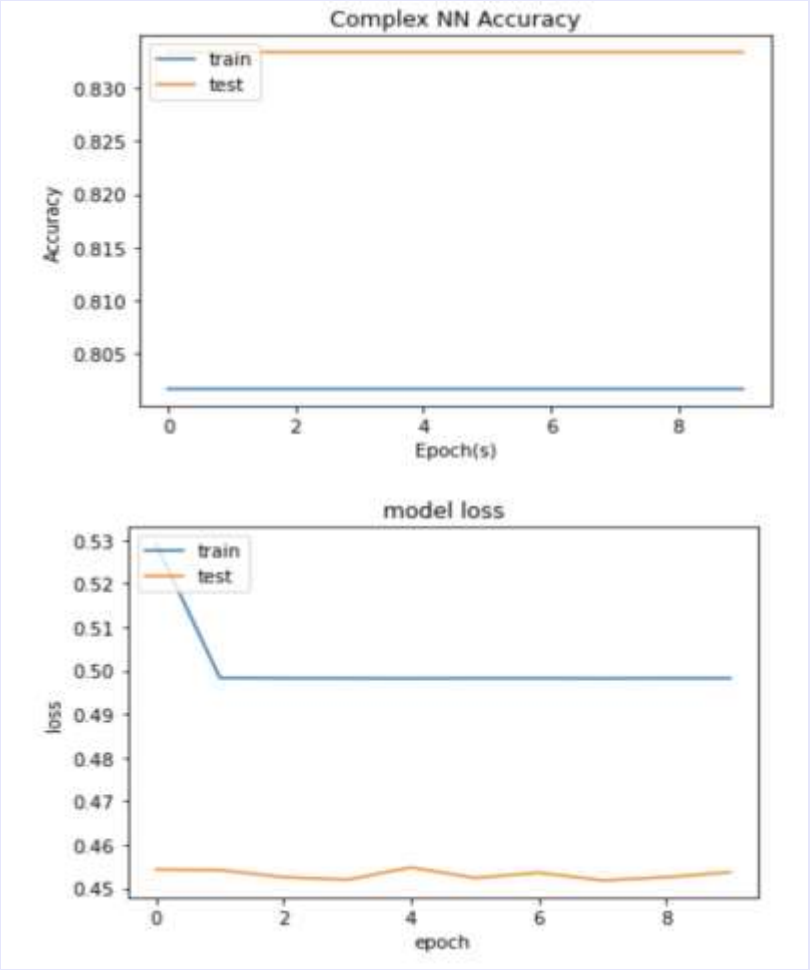




Medium NN Model

This Char Between Accuracy And Epoch (s)

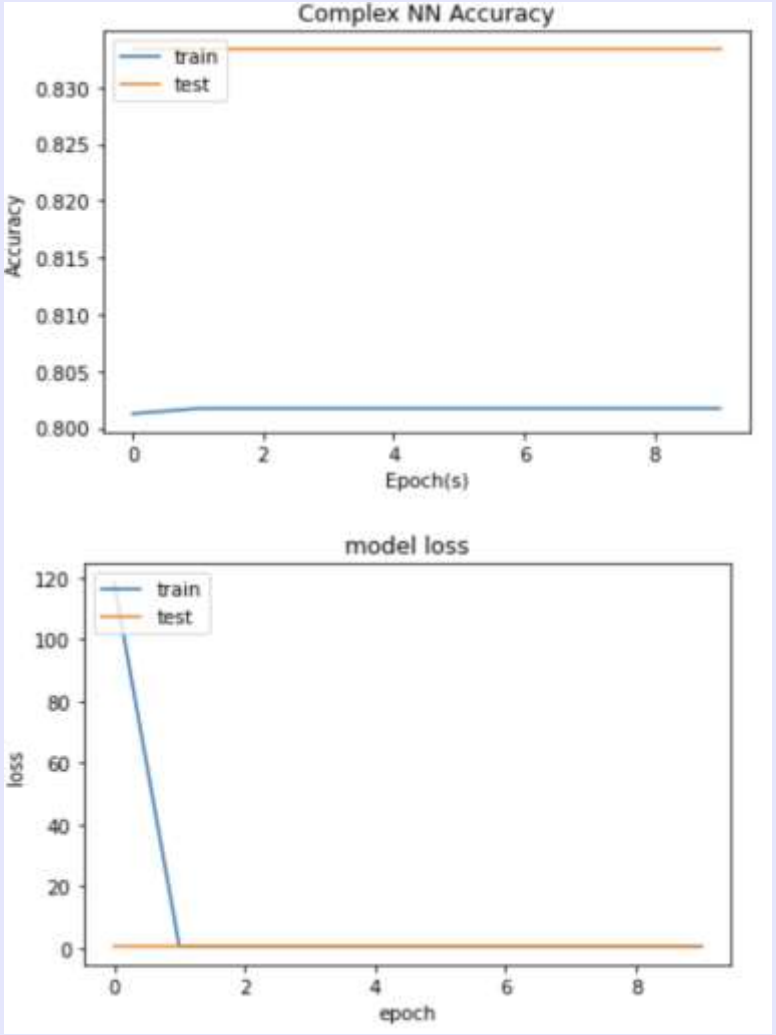
This Char Between Loss And Epoch



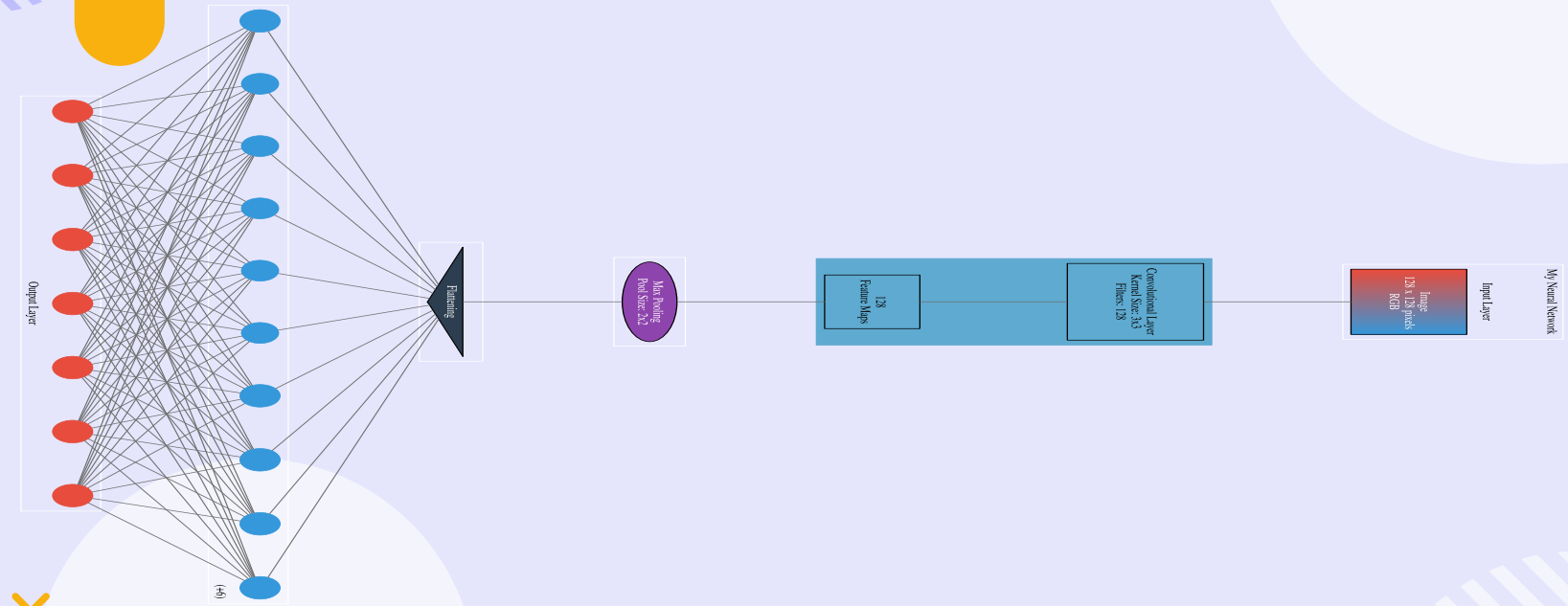
Complex NN Model

This Char Between Accuracy And Epoch (s)

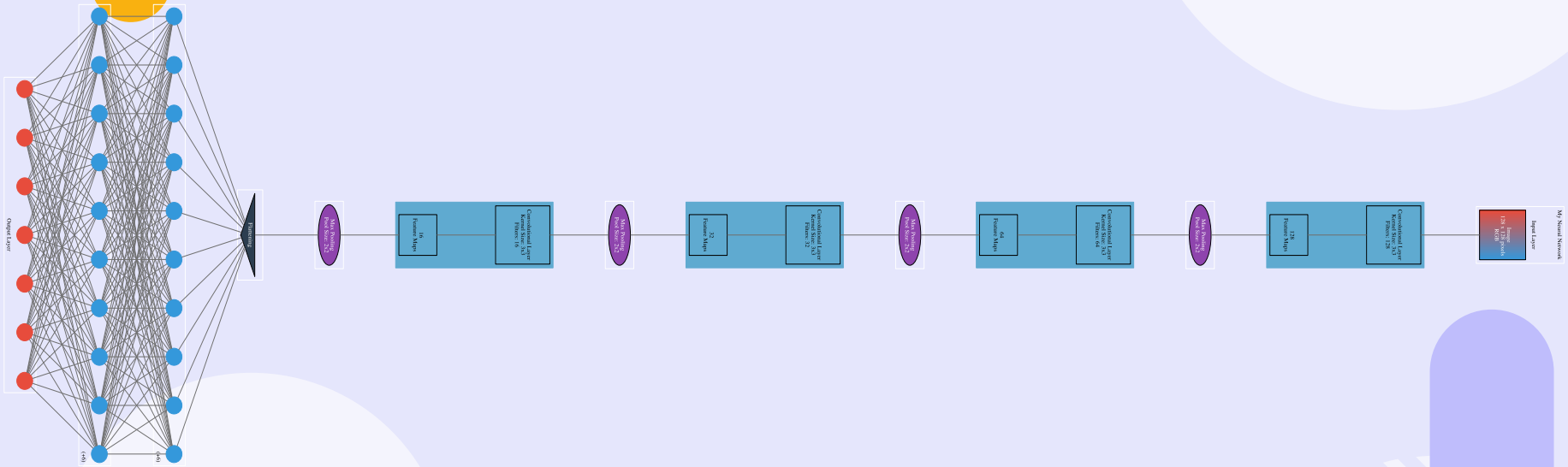
This Char Between Loss And Epoch



Visualizing Simple Convoluted NN (CNN Model)



Visualizing Complex Convoluted NN (CNN Model)



Transfer Learning (7 Classes)

Pretrained	Accuracy Train	Accuracy Validation
ResNet152	0.663	0.693
EfficientNet	0.660	0. 690
VGG16	0.661	0. 691
VGG19	0.661	0. 692
DenseNet	0.661	0.693

Best Transfer Learning Model	Accuracy Test
ResNet152	0.65

Transfer Learning (2 Classes)

Pretrained	Accuracy Train	Accuracy Validation
ResNet152	0.8014	0.833
EfficientNet	0.8014	0.833
VGG16	0.8000	0.833
VGG19	0.8000	0.833
DenseNet	0.8014	0.833

Best Transfer Learning Model	Accuracy Test
ResNet152	0.80

Solutions for increasing Accuracy

- Using Batch Normalization Layer
- Using different optimizers with different learning rates
- Increased initial optimizer learning rate 0.05
- Using ReduceLROnPlateau by factor of 0.2
- Change in batch size

Overfit solutions

Using L1-L2 kernel Regularizers

Using EarlyStopping Callback

Dropout Layers (%50, 30%, 20%)

Future Work

This project could be extended further to diagnose skin cancer lesions at early stages to guide precision treatment as early as possible through feeding more high-resolution images and utilizing dimensionality reduction techniques in the deep learning pipeline.

THANKS For Listening