Deep Learning
Assignment 1

Assignment Gdrive Link:

https://drive.google.com/drive/folders/1tSd8r_u-5REvWu5RZuIBhbY593px6zlV?usp=sharing

Assignment Description:

Transfer Learning - Accuracy comparison of various pre-trained CNN Model for Chest CT Scan Image classification

1. The assignment is to train, predict diseases based on Chest CT Scan images with various pre-trained transfer learning models like InceptionV3.
2. The assignment is to try with different hyper parameters and fine tuning for each such models such that the accuracy of prediction increases.
3. The assignment is to compare each such model for accuracy and other evaluation metrics to find the best model that suits the problem.

Dataset and Base python file:

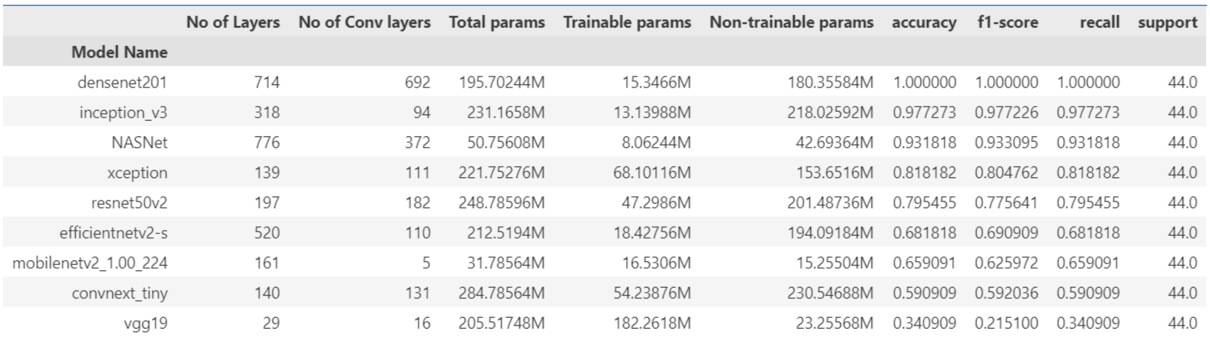
1. Dataset has different Chest CT Scan images that is put into different folders such as valid, test, train.
2. Dataset has images in different folders that specify what type of disease the image denotes such as `adenocarcinoma, large.cell.carcinoma, normal, squamous.cell.carcinoma`
3. Base Jupyter Python Notebook is shared which is using `InceptionV3 model to train, test and evaluate the model.`

Hyperparameters used:

By manually trying with different parameters, I found that **below parameters best suit this problem:**

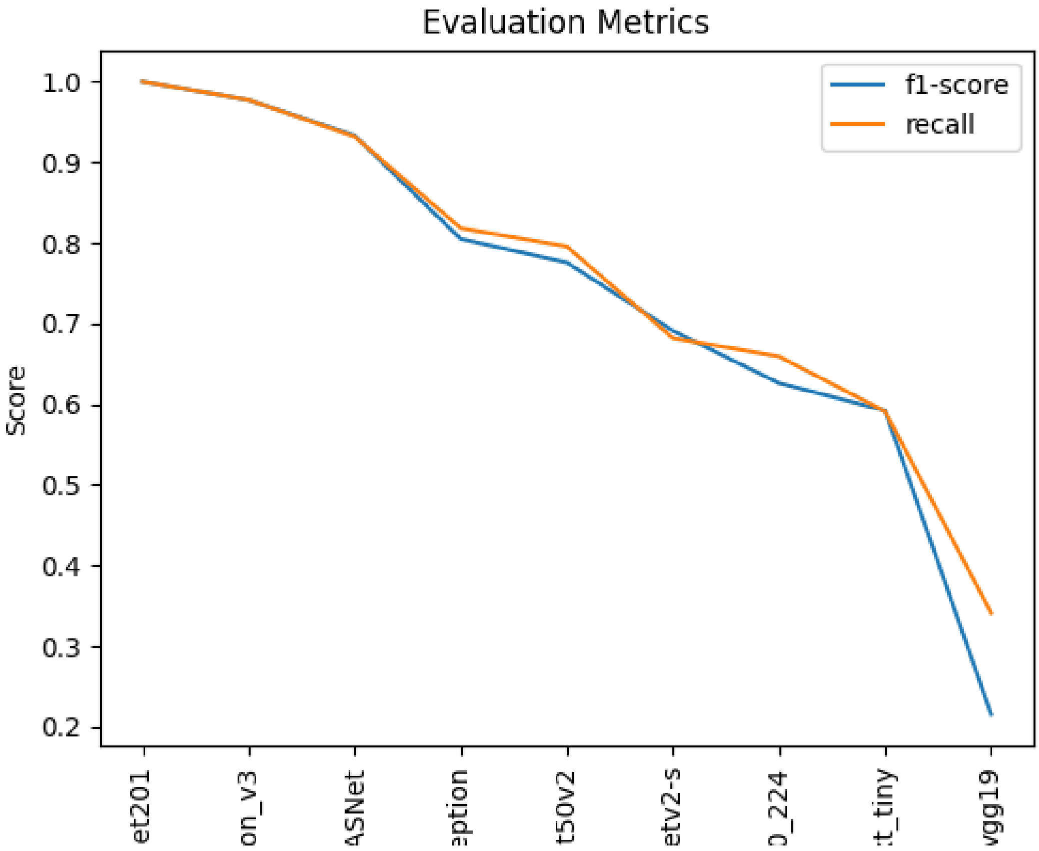
1. Use imagenet pretrained weights
2. Fine-tuning only last 10 layers
3. Iterate the dataset for 15 Epoch
4. Use Batch size as 22 which is half the size of full dataset.
5. Use accuracy function for evaluation along with loss function in model compile.
6. Add 3 extra dense layer for classification of new data.

Model Evaluation:

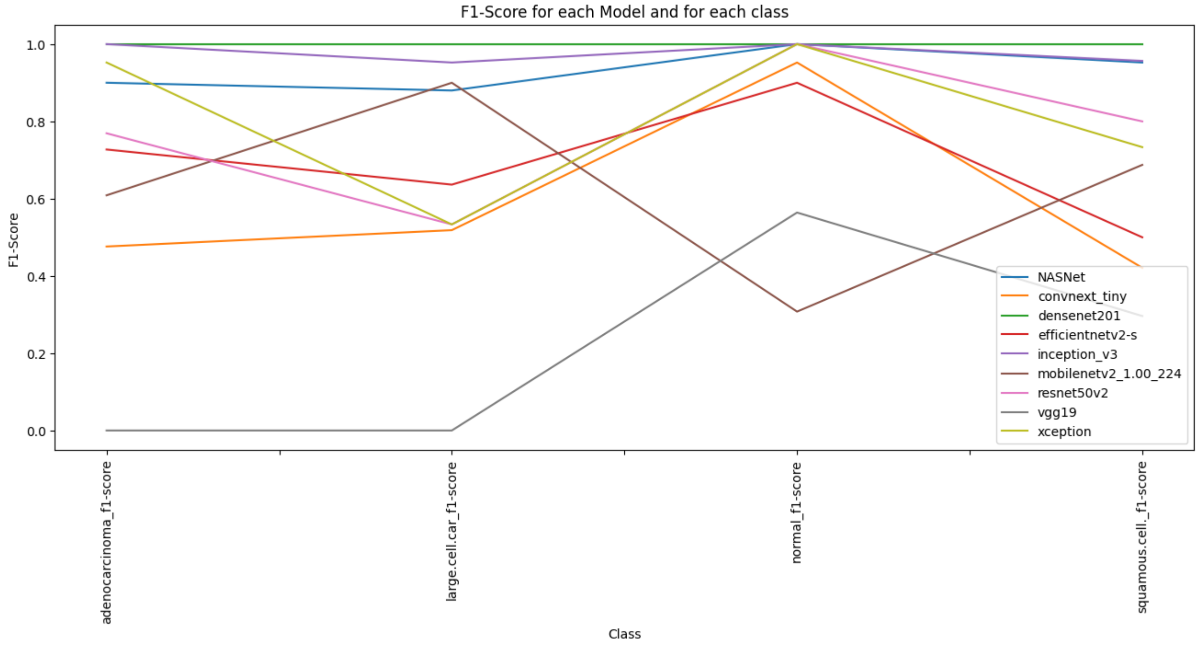


Model Name	No of Layers	No of Conv layers	Total params	Trainable params	Non-trainable params	accuracy	f1-score	recall	support
densenet201	714	692	195.70244M	15.3466M	180.35584M	1.000000	1.000000	1.000000	44.0
inception_v3	318	94	231.1658M	13.13988M	218.02592M	0.977273	0.977226	0.977273	44.0
NASNet	776	372	50.75608M	8.06244M	42.69364M	0.931818	0.933095	0.931818	44.0
xception	139	111	221.75276M	68.10116M	153.6516M	0.818182	0.804762	0.818182	44.0
resnet50v2	197	182	248.78596M	47.2986M	201.48736M	0.795455	0.775641	0.795455	44.0
efficientnetv2-s	520	110	212.5194M	18.42756M	194.09184M	0.681818	0.690909	0.681818	44.0
mobilenetv2_1.00_224	161	5	31.78564M	16.5306M	15.25504M	0.659091	0.625972	0.659091	44.0
convnext_tiny	140	131	284.78564M	54.23876M	230.54688M	0.590909	0.592036	0.590909	44.0
vgg19	29	16	205.51748M	182.2618M	23.25568M	0.340909	0.215100	0.340909	44.0

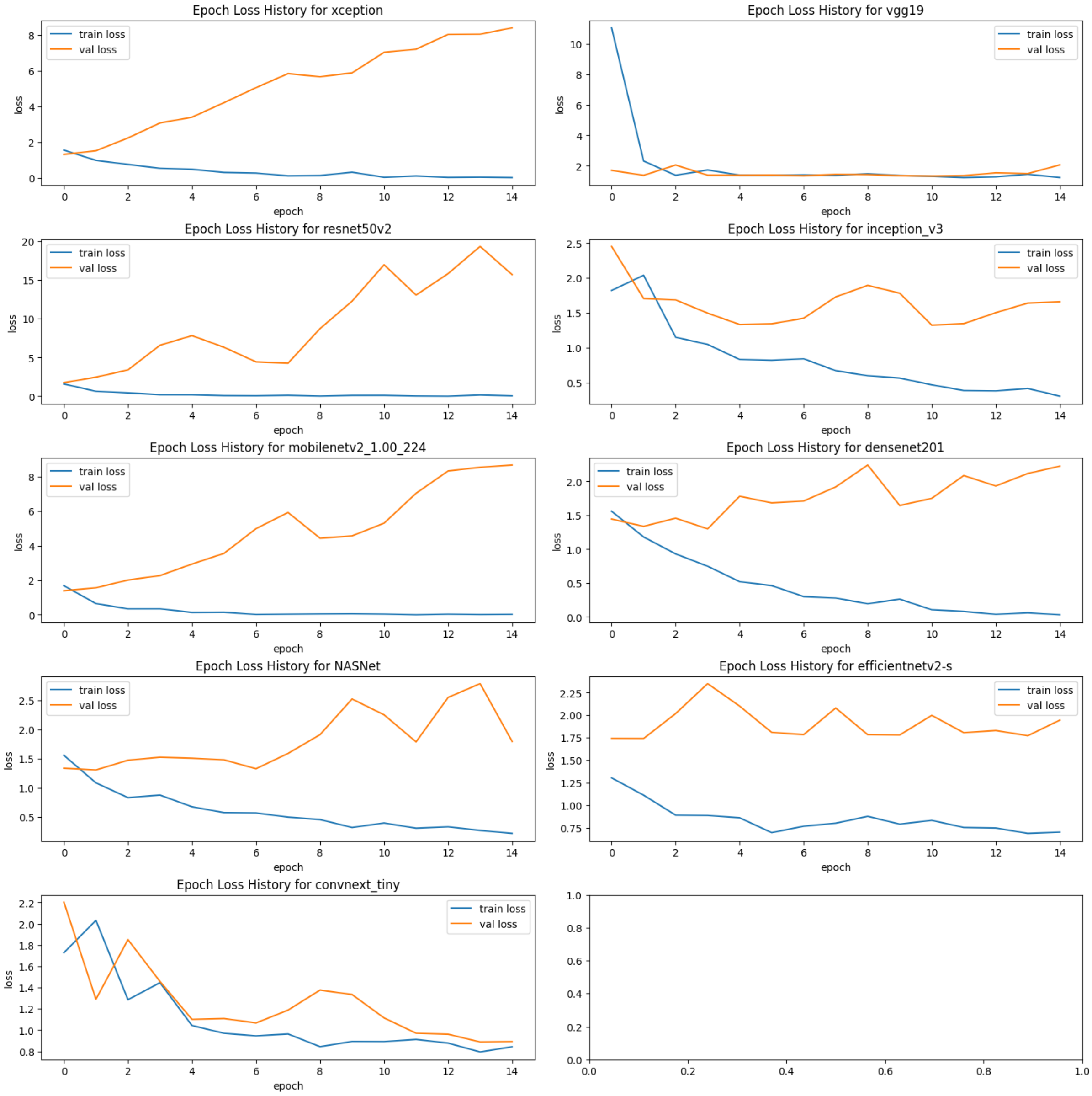
Evaluation Metrics Plot:



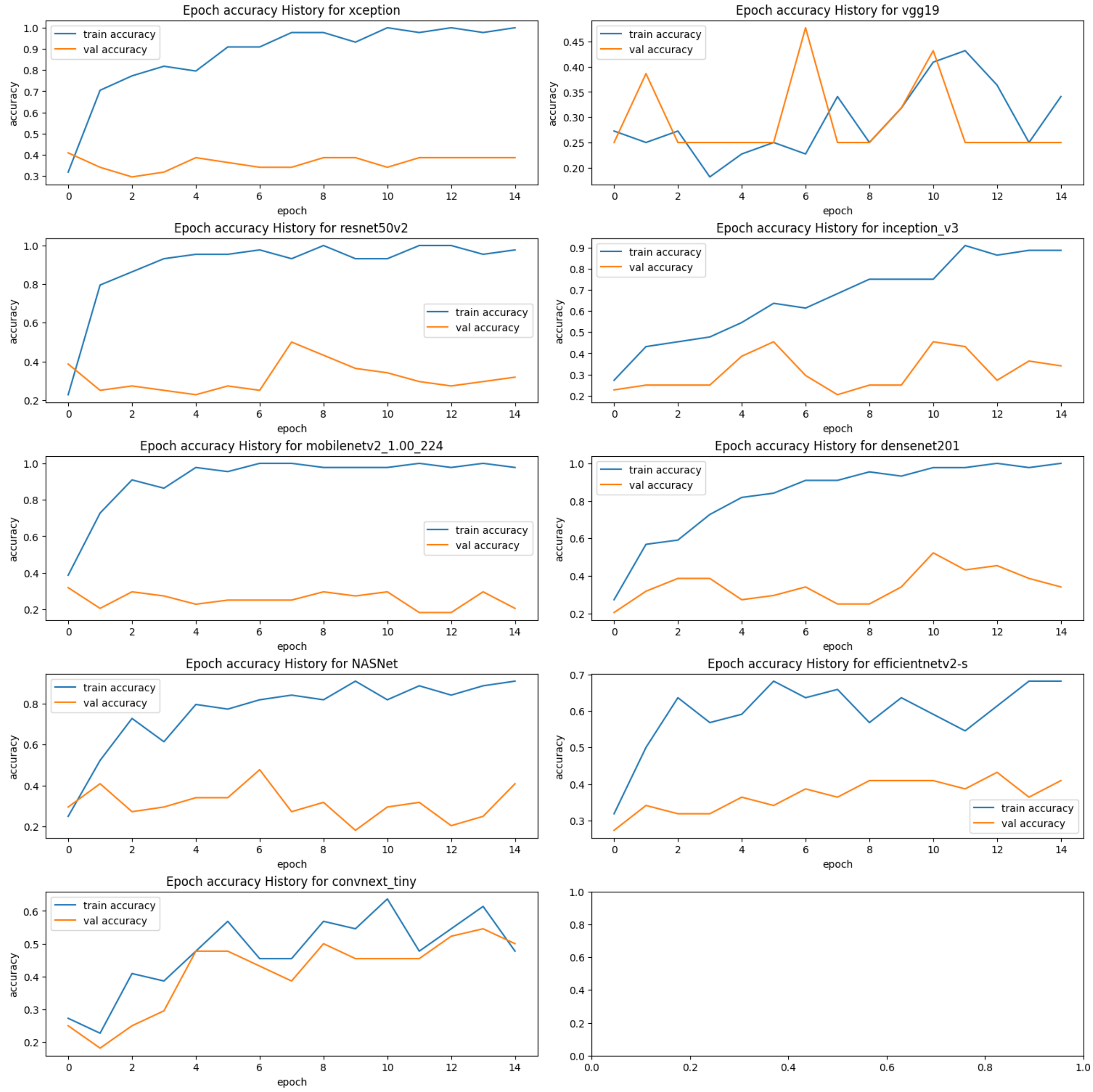
F1-Score for each class for each model:



Epoch - Loss History for each model:



Epoch - Accuracy History for each Model:



Epoch accuracy History for xception

Epoch accuracy History for vgg19

Epoch accuracy History for resnet50v2

Epoch accuracy History for inception_v3

Epoch accuracy History for mobilenetv2_1.00_224

Epoch accuracy History for densenet201

Epoch accuracy History for NASNet

Epoch accuracy History for efficientnetv2-s

Epoch accuracy History for convnext_tiny

Conclusion:

densenet201and inception_v3 model performs better than other models as their accuracy, f1-score and recall is high.

References:

- Dataset and Base ipynb file https://wilpbitspilaniacin0.sharepoint.com/:u:/r/sites/DeepLearningS2-23_SSZG529Regular/Shared%20Documents/General/TL_Full_Docs.zip?csf=1&web=1&e=iq7uXq

- Assignment Description 1 from Lecture Recording at 44:59 https://wilpbitspilaniacin0.sharepoint.com/:v:/r/sites/DeepLearningS2-23_SSZG529Regular/Shared%20Documents/General/Recordings/Deep%20Learning%20(S2-23_SSZG529)(Regular)-20240307_191148-Meeting%20Recording.mp4?csf=1&web=1&e=e2Cvx6&nav=eyJyZWZlcnJhbEluZm8iOnsicmVmZXJyYWxBcHAiOiJTdHJlYW1XZWJBcHAiLCJyZWZlcnJhbFZpZXciOiJTaGFyZURpYWxvZy1MaW5rIiwicmVmZXJyYWxBcHBQbGF0Zm9ybSI6IldlYiIsInJlZmVycmFsTW9kZSI6InZpZXcifSwicGxheWJhY2tPcHRpb25zIjp7InN0YXJ0VGltZUluU2Vjb25kcyI6MjcyOX19
- Assignment Description 2 from Lecture Recording at 42:20 https://wilpbitspilaniacin0.sharepoint.com/:v:/r/sites/DeepLearningS2-23_SSZG529Regular/Shared%20Documents/General/Recordings/Deep%20Learning%20(S2-23_SSZG529)(Regular)-20240324_180801-Meeting%20Recording.mp4?csf=1&web=1&e=wYVGSX&nav=eyJyZWZlcnJhbEluZm8iOnsicmVmZXJyYWxBcHAiOiJTdHJlYW1XZWJBcHAiLCJyZWZlcnJhbFZpZXciOiJTaGFyZURpYWxvZy1MaW5rIiwicmVmZXJyYWxBcHBQbGF0Zm9ybSI6IldlYiIsInJlZmVycmFsTW9kZSI6InZpZXcifSwicGxheWJhY2tPcHRpb25zIjp7InN0YXJ0VGltZUluU2Vjb25kcyI6MjU0MH19
- Reference Research Paper https://www.researchgate.net/figure/The-accuracy-comparison-of-pre-trained-CNN-models_tbl2_335717881
- Keras Applications https://keras.io/api/applications/
- Python Pandas Docs https://pandas.pydata.org/docs/reference/index.html#api
- Matplotlib Docs https://matplotlib.org/stable/api/index.html
- Tensorflow Keras Docs https://www.tensorflow.org/api_docs/python/tf/keras