DEEP LEARNING ASSIGNMENT REPORT

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1. PROBLEM STATEMENT:

- Design and implement a self-supervised learning algorithm
- Extract relevant features from medical images in an unsupervised manner.

2. METHODOLOGY:

I developed a Unet model for the assignment. Unet model is known to handle medical images data while storing and taking care of the extra details present in these images.

Firstly, the covid19 images data has been extracted using the path where it is saved and data pre-processing is done. This includes converting the lists of images into array of correct dimensions and shape so that it can accurately fit the model.

After data pre-processing, the model has been created. Creation of the model includes creating the layers of the model like the maxpool layer, dense layers, convo layers, etc for the processing t=of the image data.

Encoder and decoder are an important part of Unet model. Since encoders handles the extraction of critical features through a series of the convolutional layers which are earlier built. The layers efficiently and progressively reduces the spatial dimension of the image data, while preserving the necessary information present in the data.

Similarly, the decoder block help to correctly interpret the extracted features and up samples the data. It increases the spatial dimensions of the image with the help of the transpose convolutional layers.

Once the model is ready, it is then compiled. After the compilation, the model is trained on the number of epochs and the training data.

After model training and reaching to a certain accuracy rate, the test image data is then passed for the prediction.

After the prediction is completed, the output images are printed against the real images and the mask images.

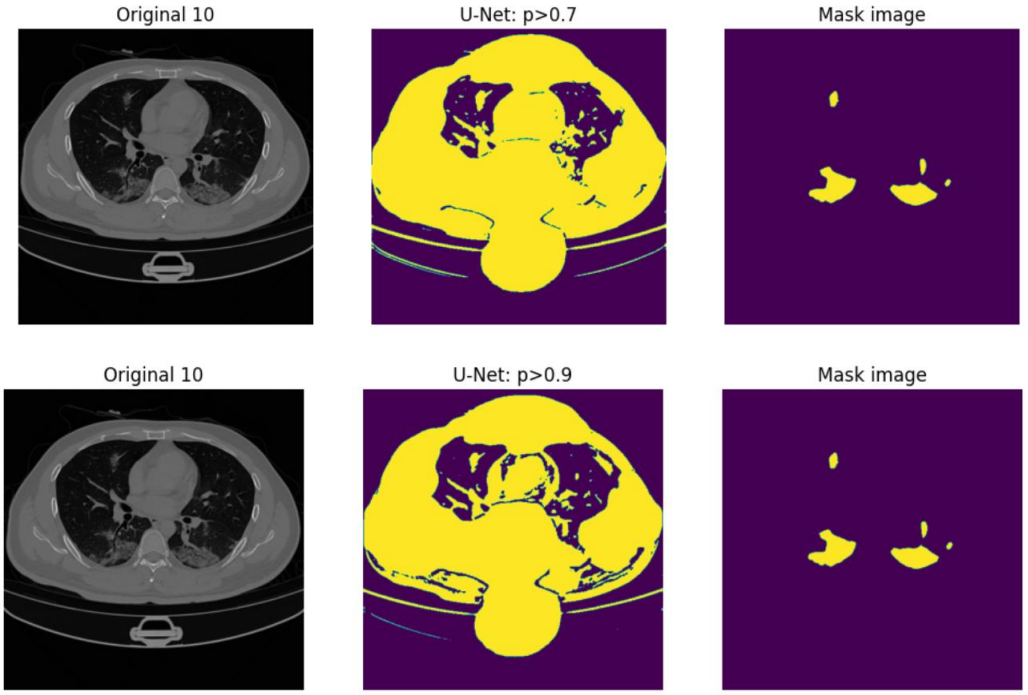
3. MODEL ARCHITETURE

- **Convolutional Block:** this block takes the input and performs two 3*3 convolutional operations on the images.
- **Batch Normalization:** it is applied in each convolutional layer for god training stability and prevent internal covariate shift.
- **Encoder Block:** it takes the input tensors and number of filters as its arguments. It starts the processing by taking the inputs from the outputs of the convolutional layer which preserves the features of the images.
- **MaxPooling layer:** the max pooling layer is a part of encoder. It applies a 2*2 max pooling layer which down samples the features of the images.

- **Convo2d Layer:** this layer is a pert of decoder block. It is a 2*2 transpose convolution layer which helps in up sampling the features of the image data.
- **Convo block:** a convo block layer is then used to concatenate or merge the encoder's output.

4. RESULT:

- Accuracy rate achieved: 56.12%
- Plotted the output with the real images and the mask images and the output image with p>0.7 could accurately segment the affected parts of the lungs from the unaffected parts.



5. CHALLENGES:

There were various challenges faced during the working of the assignment:

1. Accuracy rate is directly affected by the number of training image data.
2. Model complexity made it harder for the training. Sometimes it even failed and crashed.
3. Self-supervised learning model like simCLR, Boyld, Barlow twins GAN's etc are challeneging to implement due to their ongoing research. However, simCLR was tried to implement, but resources (computing power of the device) were not efficient.
4. Scalability was a challenge as the Unet model did not support all the images that were available to train and predict. It needs fine tuning and a little complex model so as to avoid under fitting at the same time.
5. Powerful TPU is required for good scalability and efficiency.
6. Organ segmentation and classification posed a challenge as the resultant image which recieved as the output of the Unet model was not being classified on the classification algorithm due to limited data.

7. More number of epoch training resulted in diminishing the accuracy of the model.

REFERENCES:

1. https://www.kaggle.com/datasets/maedemaftouni/covid19-ct-scan-lesion-segmentation-dataset
2. Keras documentations