Mid-progress Phase for DSAI 305 Project

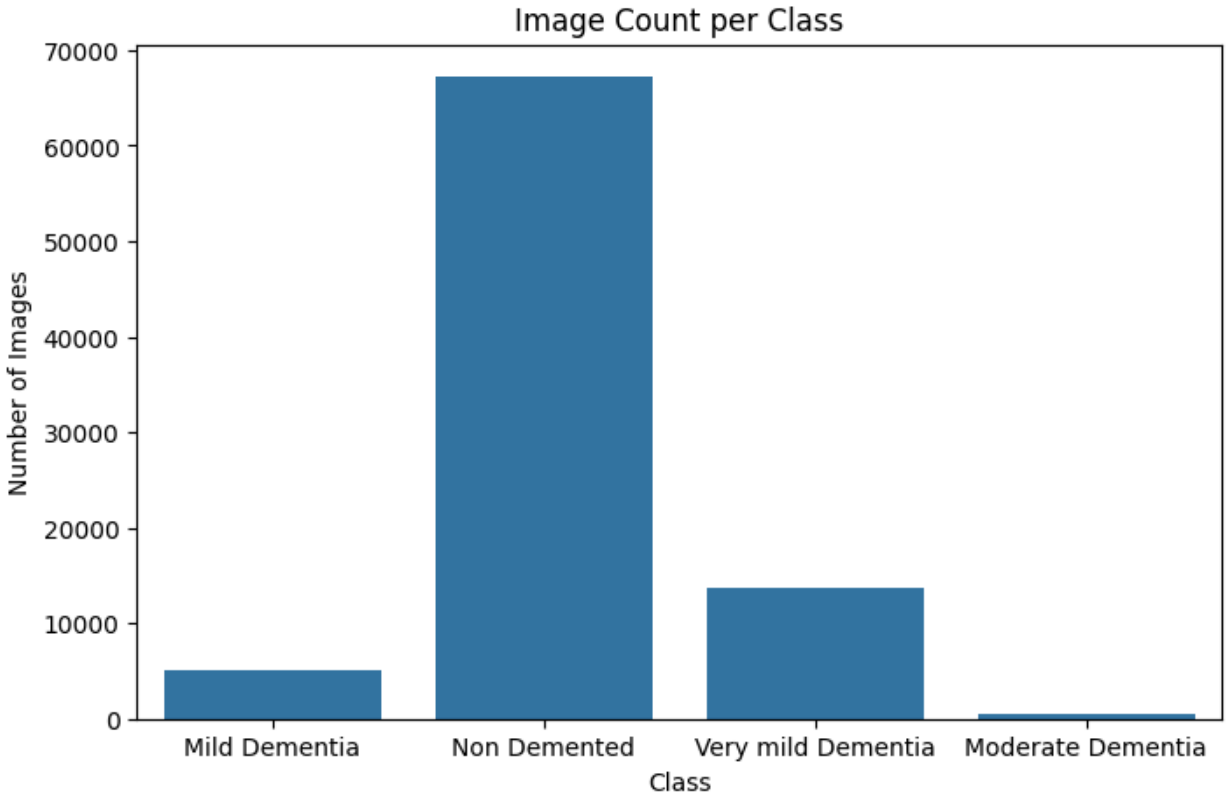
First: EDA Techniques results

First of all: Exploring the number of classes and classes names

```
Classes found: ['Mild Dementia', 'Non Demented', 'Very mild Dementia',
'Moderate Dementia']
```

Exploring the numbers of images per each class and visualizing them

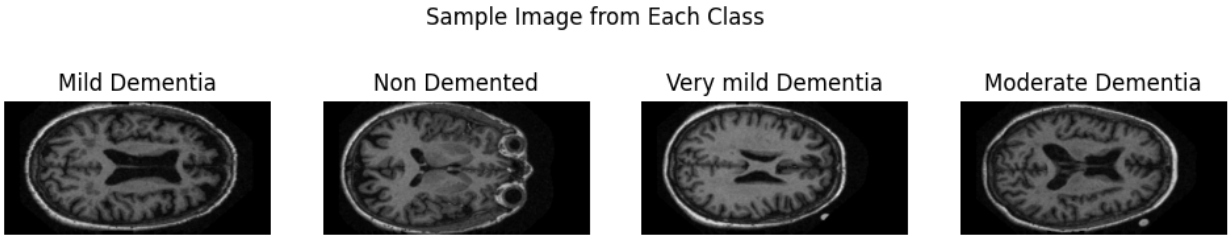
```
Mild Dementia: 5002 images
Non Demented: 67222 images
Very mild Dementia: 13725 images
Moderate Dementia: 488 images
Total Images: 86437
```



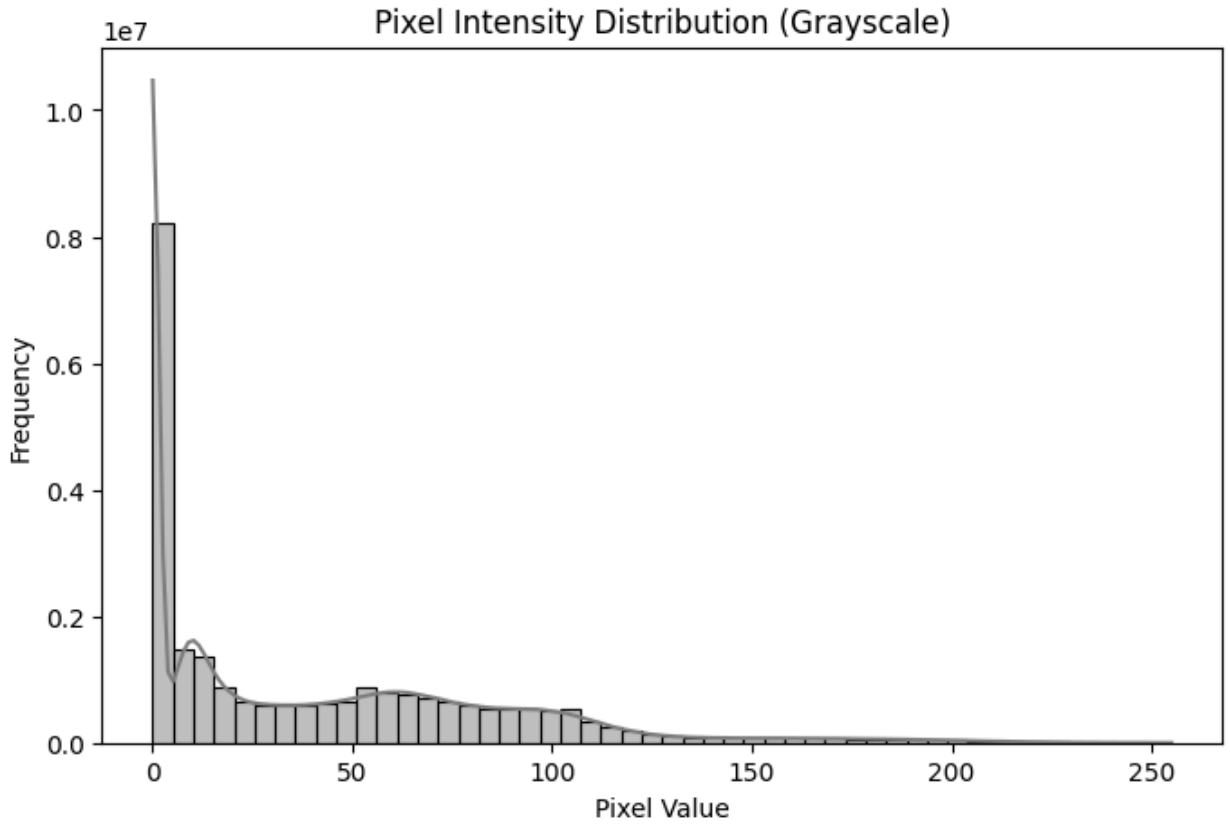
Exploring images height, width statistics

```
Image Height - Mean: 248.0, Min: 248, Max: 248
Image Width  - Mean: 496.0, Min: 496, Max: 496
Channels: [3]
```

Display a sample image for each class



Visualizing pixels values distribution after converting the images into grayscale

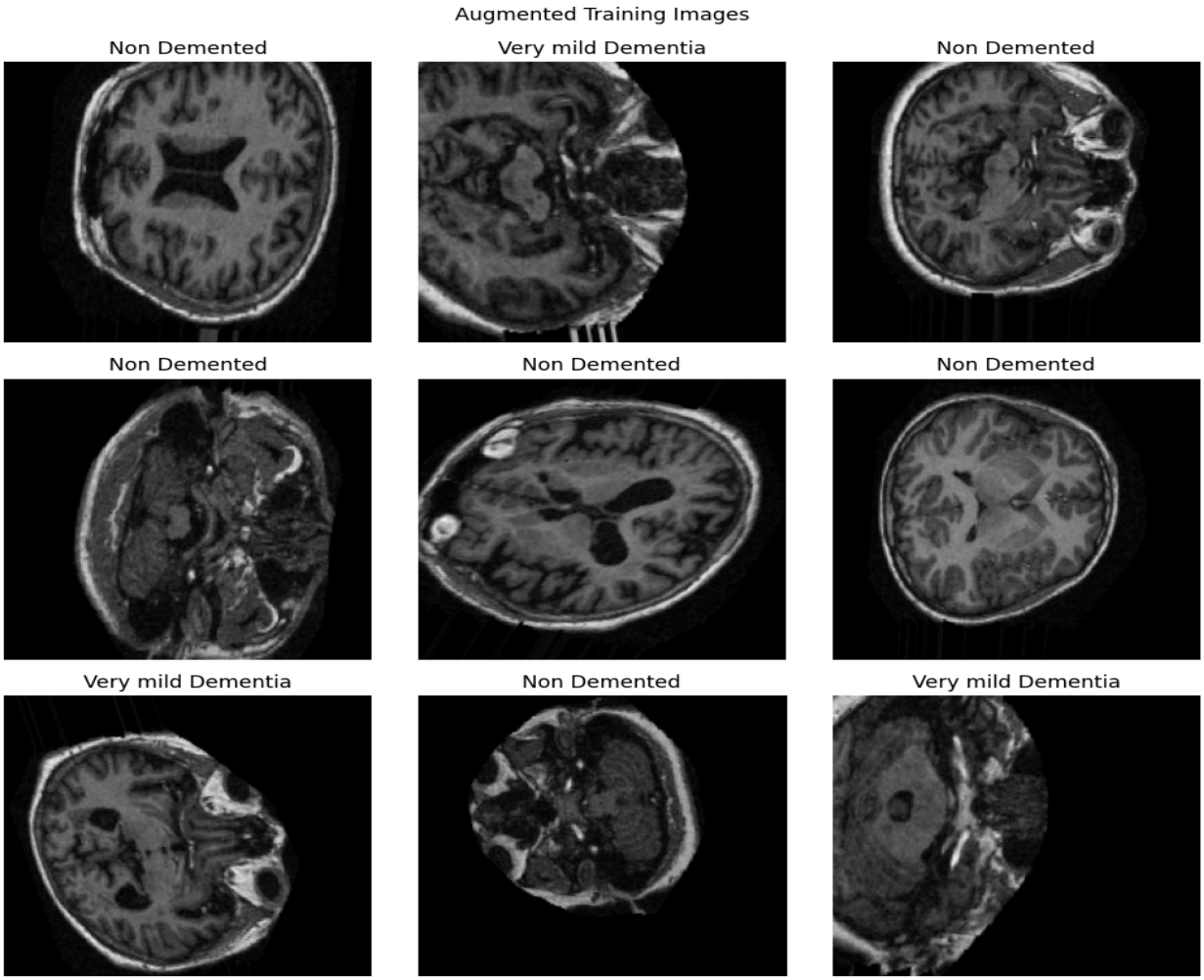


Checking for duplicates or corrupted images

```
Found 0 duplicate images
Found 0 corrupted images
```

Second: Images preprocessing results

Robust preprocessing has been done through efficient data augmentation, pixel normalization and image resizing.



Third: Feature extraction and Model implementation

VGG16 is used as a feature extractor and the classifier is a 100 neurons neural network and a softmax activation function as well as using RELU, ADAM optimizer, a regularization rate of 0.0006, and 10 epochs.

The model's architecture:

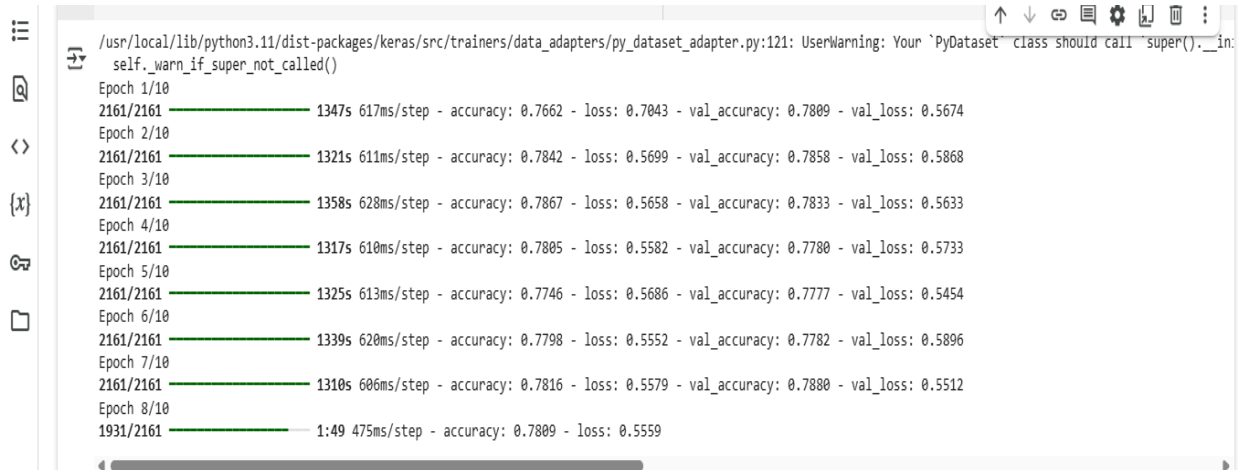
```
Downloading data from https://storage.googleapis.com/tensorflow/keras-applications/vgg16/
58889256/58889256 ━━━━━━━━━━━━━━━━━━━━ 0s 0us/step
Model: "functional"
```

Layer (type)	Output Shape	Param #
input_layer (InputLayer)	(None, 224, 224, 3)	0
block1_conv1 (Conv2D)	(None, 224, 224, 64)	1,792
block1_conv2 (Conv2D)	(None, 224, 224, 64)	36,928
block1_pool (MaxPooling2D)	(None, 112, 112, 64)	0
block2_conv1 (Conv2D)	(None, 112, 112, 128)	73,856
block2_conv2 (Conv2D)	(None, 112, 112, 128)	147,584
block2_pool (MaxPooling2D)	(None, 56, 56, 128)	0
block3_conv1 (Conv2D)	(None, 56, 56, 256)	295,168
block3_conv2 (Conv2D)	(None, 56, 56, 256)	590,080
block3_conv3 (Conv2D)	(None, 56, 56, 256)	590,080
block3_pool (MaxPooling2D)	(None, 28, 28, 256)	0
block4_conv1 (Conv2D)	(None, 28, 28, 512)	1,180,160
block4_conv2 (Conv2D)	(None, 28, 28, 512)	2,359,808
block4_conv3 (Conv2D)	(None, 28, 28, 512)	2,359,808
block4_pool (MaxPooling2D)	(None, 14, 14, 512)	0
block5_conv1 (Conv2D)	(None, 14, 14, 512)	2,359,808
block5_conv2 (Conv2D)	(None, 14, 14, 512)	2,359,808
block5_conv3 (Conv2D)	(None, 14, 14, 512)	2,359,808
block5_pool (MaxPooling2D)	(None, 7, 7, 512)	0
flatten (Flatten)	(None, 25088)	0

Model results

```
# Early stopping
early_stop = EarlyStopping(monitor='val_loss', patience=3,
restore_best_weights=True)

# Train the model
history = model.fit(
    train_generator,
    validation_data=test_generator,
    epochs=10,
    callbacks=[early_stop]
)
```



The model has achieved an accuracy of 78% and then stopped due to the applied early stopping.

The project challenges:

1. The large size dataset has been a great challenge as the data includes about 80,000 images of brain MRI scans.

2. Using an imbalanced dataset as the model may get biased towards majority classes.

3. Choosing the right models and architecture.

4. Hardware limitations.

5. Preprocessing complexity.