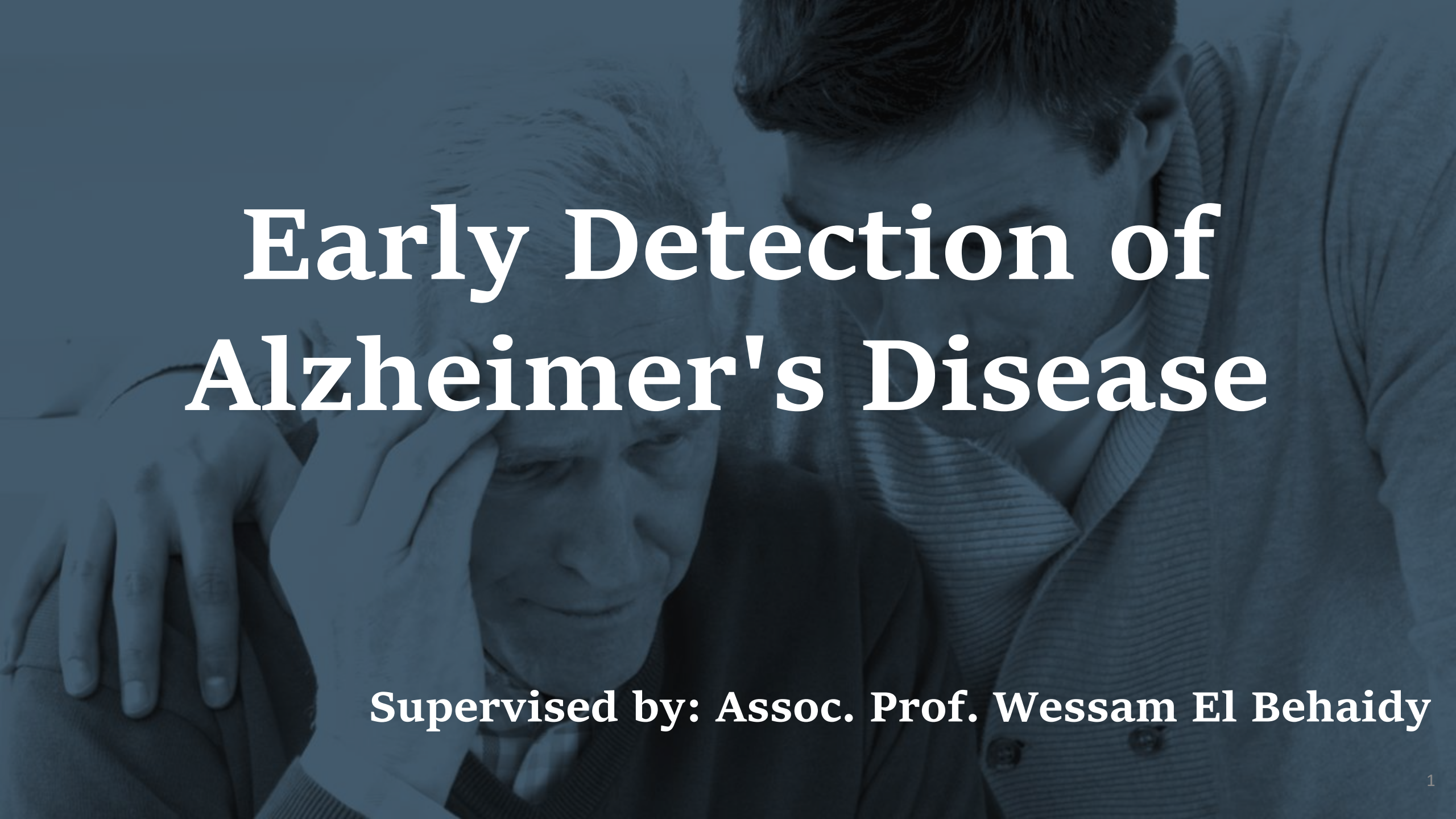

Early Detection of Alzheimer's Disease

Supervised by: Assoc. Prof. Wessam El Behaidy

TEAM MEMBERS

1. Esraa Mohamed Abd EL Gawad
2. Jilan Ahmed Shaaban Salem
3. Tasneem Abo Bakr Sharqawy
4. Aya Fergany Mahdy Mohamed
5. Omar Weal Taha Ahmed

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INTRODUCTION

In the entire world, Alzheimer's disease (AD) is the most frequent cause of dementia.

A progressive neurologic condition reduces brain size (brain atrophy) and kills brain cells, resulting in a slow deterioration of thinking, acting, and social skills that reduces a person's capacity for independence.

INTRODUCTION

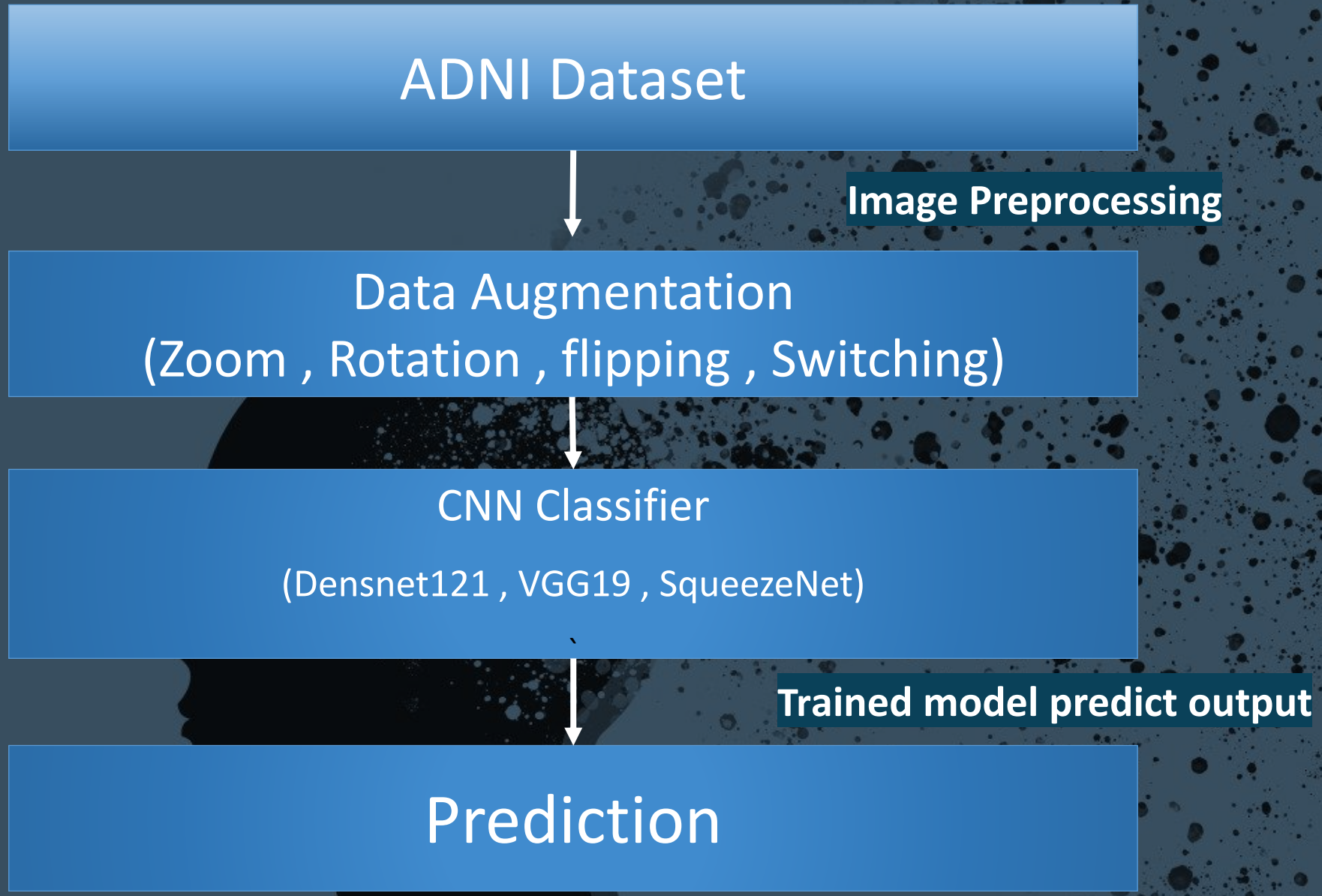
5.8 million people age 65 and older live with Alzheimer's disease (AD), which is difficult and incurable if it progresses to an advanced level. Eighty percent of them are 75 or older.

Out of the estimated 50 million persons with dementia worldwide

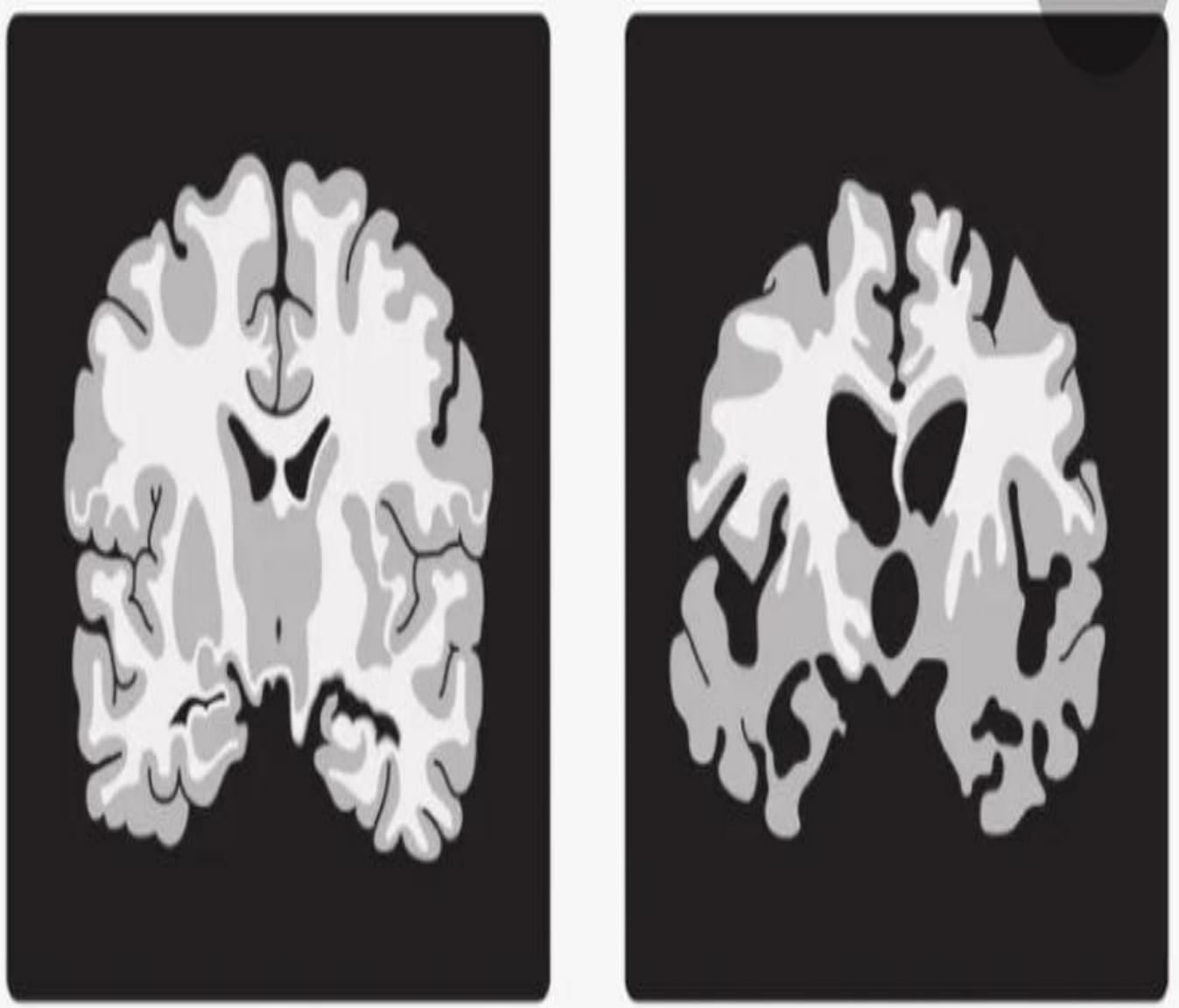
OBJECTIVE

- An early Alzheimer's diagnosis provides patients with a better chance of benefiting from treatment and that motivates us to make this study which used deep learning to classify Alzheimer's illness into multiple categories.

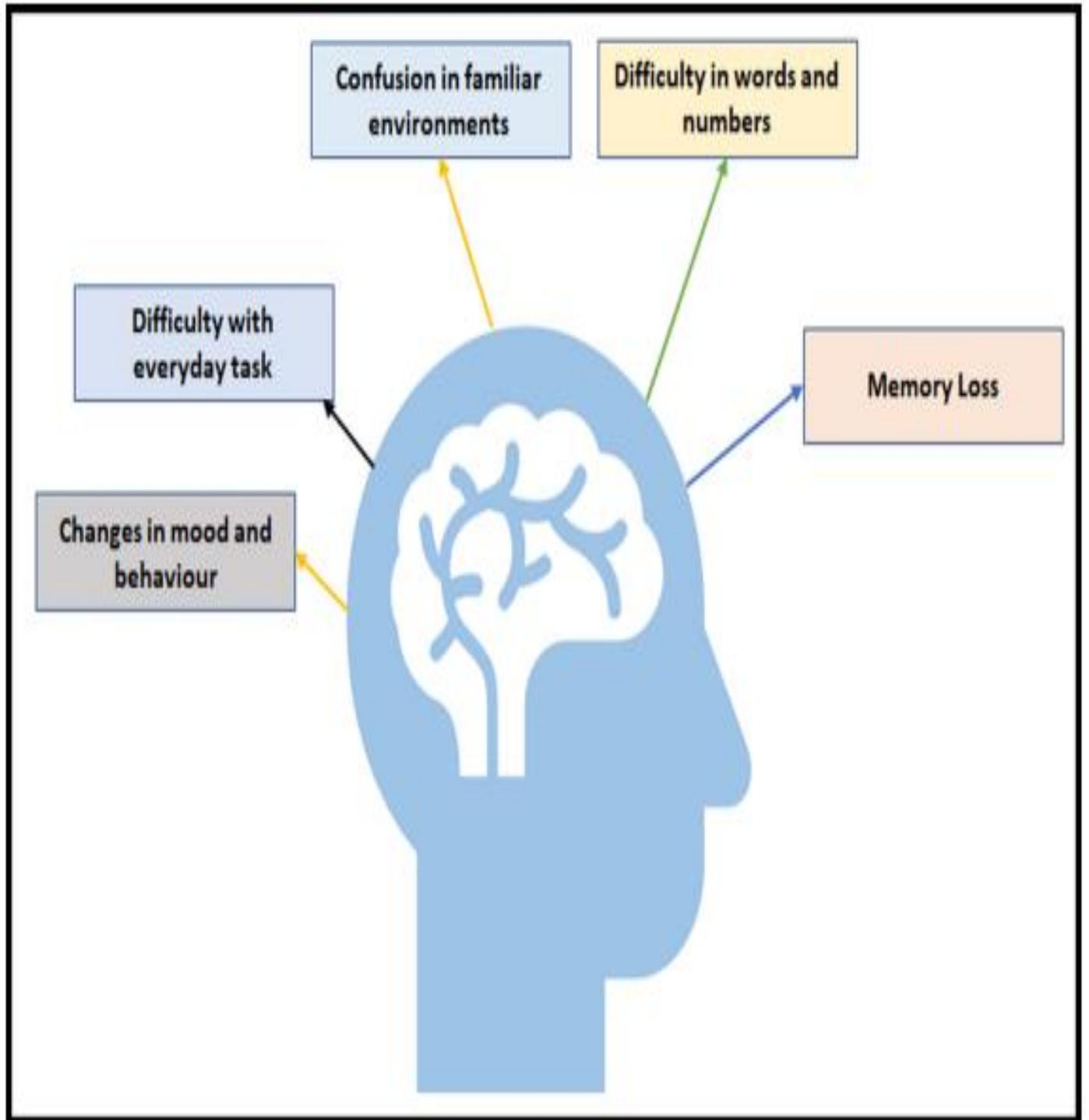
IMPLEMENTED MODEL DIAGRAM



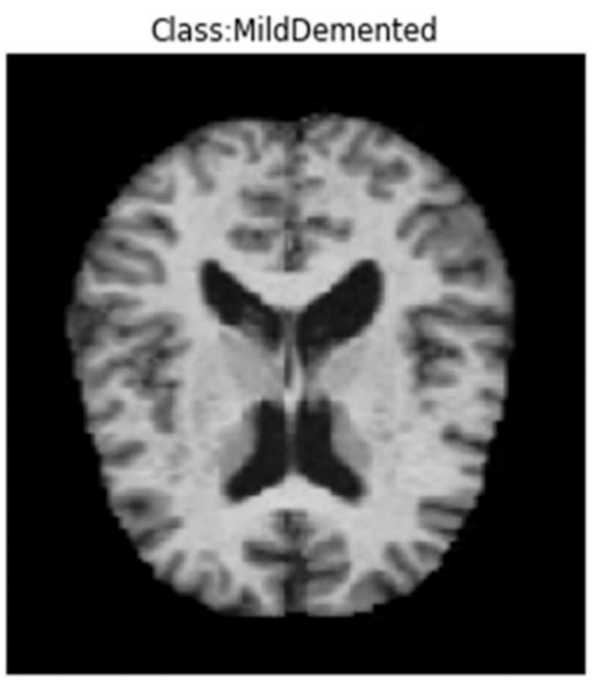
Comparison Between Normal Brain & Advanced Alzheimer’s .

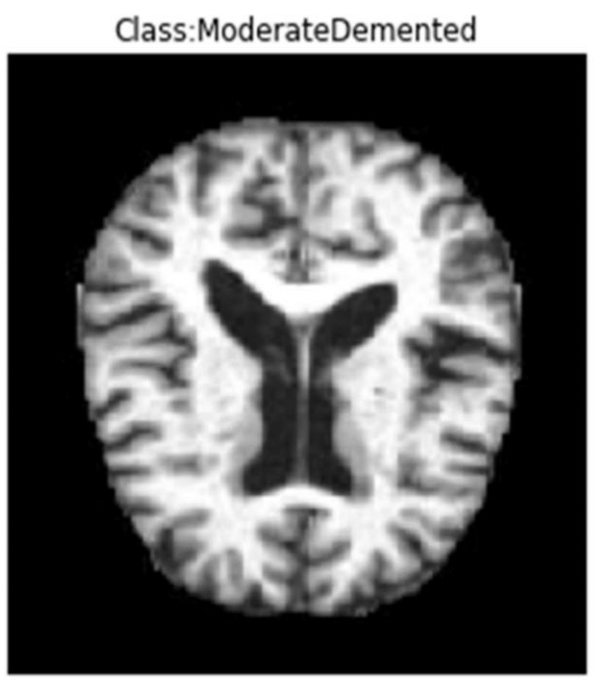


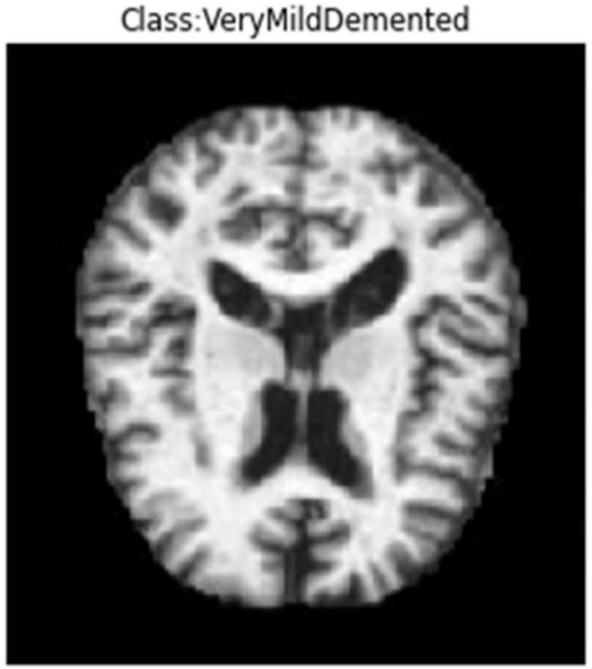
Symptoms of Alzheimer's Disease

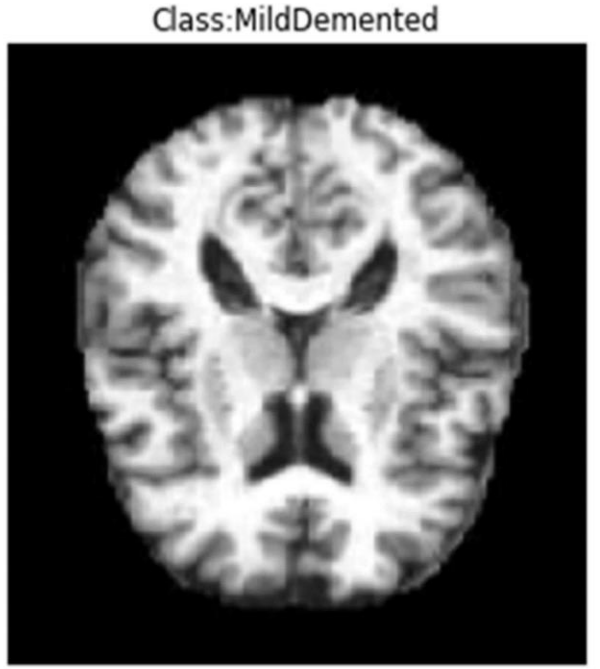


Comparison Between Different classes of infected brain in MRI.









❖ Dataset

ADNI

Original size for Alzheimer MRI (224,224).

- The Data is collected from several websites/hospitals/public repositories.
- The Dataset is consisting of Preprocessed MRI (Magnetic Resonance Imaging) .
- The Dataset has four classes of images.

❖ Dataset

The Dataset is consisting of total (6400) MRI images.

- Class - 1: Mild Demented (896 images)
- Class - 2: Moderate Demented (64 images)
- Class - 3: Non-Demented (3200 images)
- Class - 4: Very Mild Demented (2240 images)

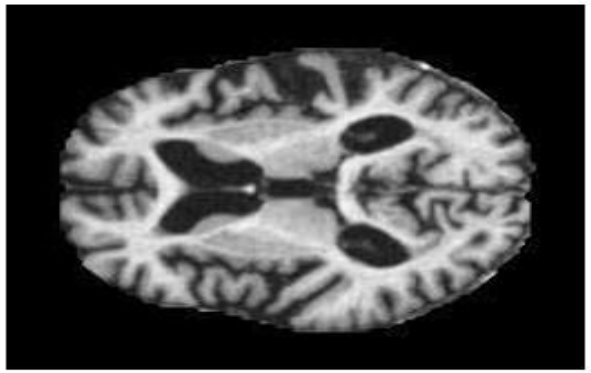
❖ Image Preprocessing

We applied Data Augmentations techniques such as zoom, rotation , flipping ,switching.

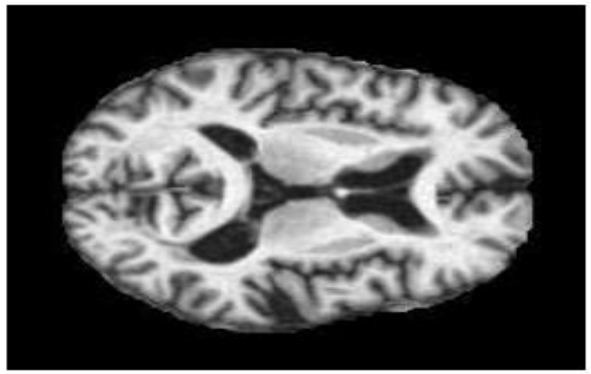
1. The factor parameter for rotation is between -0.15 ,0.15.
2. The factor parameter for zoom is between -0.3 , -0.1.

❖ Image Preprocessing

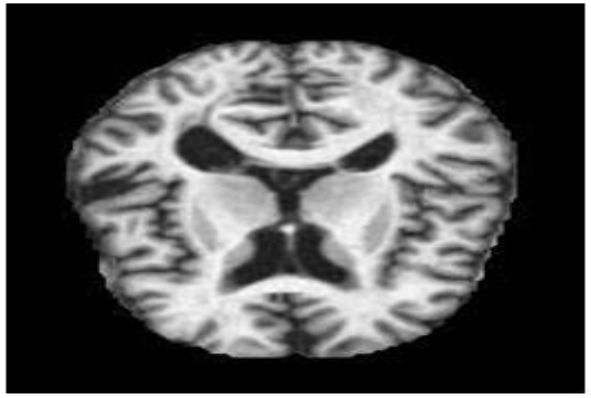
(A) Rotation



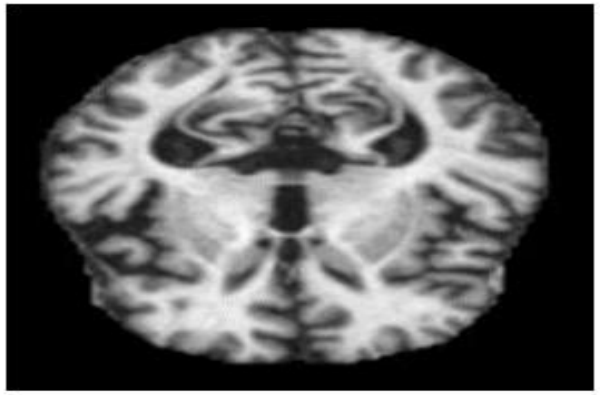
(B) Flipping



(C) Switching



(D) Zooming



❖ Applied Dataset

All the images are resized into 128 x 128 pixels.

The dataset after data augmentation consists of total (33,984) MRI images.

- Class - 1: Mild Demented (8960 images).
- Class - 2: Moderate Demented (6464 images).
- Class - 3: Non-Demented (9600 images).
- Class - 4: Very Mild Demented (8960 images).

RELATED WORK

Paper	Author	Algorithm& Accuracy
Early Detection of Alzheimer's Disease Using Non-invasive Near-Infrared Spectroscopy.(2019)	Khan (OASIS)	Adaboosting: 88.73% Artificial Neural Network:83.04%
Deep Learning Model for Prediction of Progressive Mild Cognitive Impairment to Alzheimer's Disease Using Structural MRI.(2022)	Bing Yan Lim (ADNI)	CNN:72.7% VGG16:80.66% RESNET:76.86%
Deep Learning Approach for Early Detection of Alzheimer's Disease. (2021)	Hadeer Helaly (ADNI)	CNN:93.61% Vgg19:97%
Deep Convolutional Neural Network based Classification of Alzheimer's Disease using MRI Data.(2021)	Ali Nawaz (OASIS , ADNI)	Deep CNN:73.75% GLCM:79.90%
Development and validation of an interpretable deep learning framework for Alzheimer's disease classification.(2020)	Shangran Qiu (ADNI, AIBL, NACC)	FCN-MLP WITH CNN:0.968 +/- 0.014

RELATED WORK

Paper	Author	Algorithm& Accuracy
Detecting Alzheimer's disease using machine learning methods.(2021)	Kia Dashtipour	BILSTEM:93.19%
Transfer learning using freeze features for Alzheimer neurological disorder detection using ADNI dataset.(2021)	Saeeda Naz1 (ADNI)	VGG16:99.14% VGG19:95.89%
MRI Segmentation and Classification of Human Brain Using Deep Learning for Diagnosis of Alzheimer's Disease: A Survey.(2020)	Yamanakkanvar (ADNI, AIBL, IBSR)	94.3%(CSF) DSC/JI:97.5%(WM) 94.8%(GM)
Early-Stage Alzheimer's Disease Prediction Using Machine Learning Models.(2022)	C. Kavitha (OASIS)	XGBOOST:85.92%
DEMNET: A Deep Learning Model for Early Diagnosis of Alzheimer Diseases and Dementia From MR Images.(2021)	Suriya Murugan (ADNI)	transfer learning:98.7% 3DCNN:97.52% 3DVIEW MODEL:95.11%

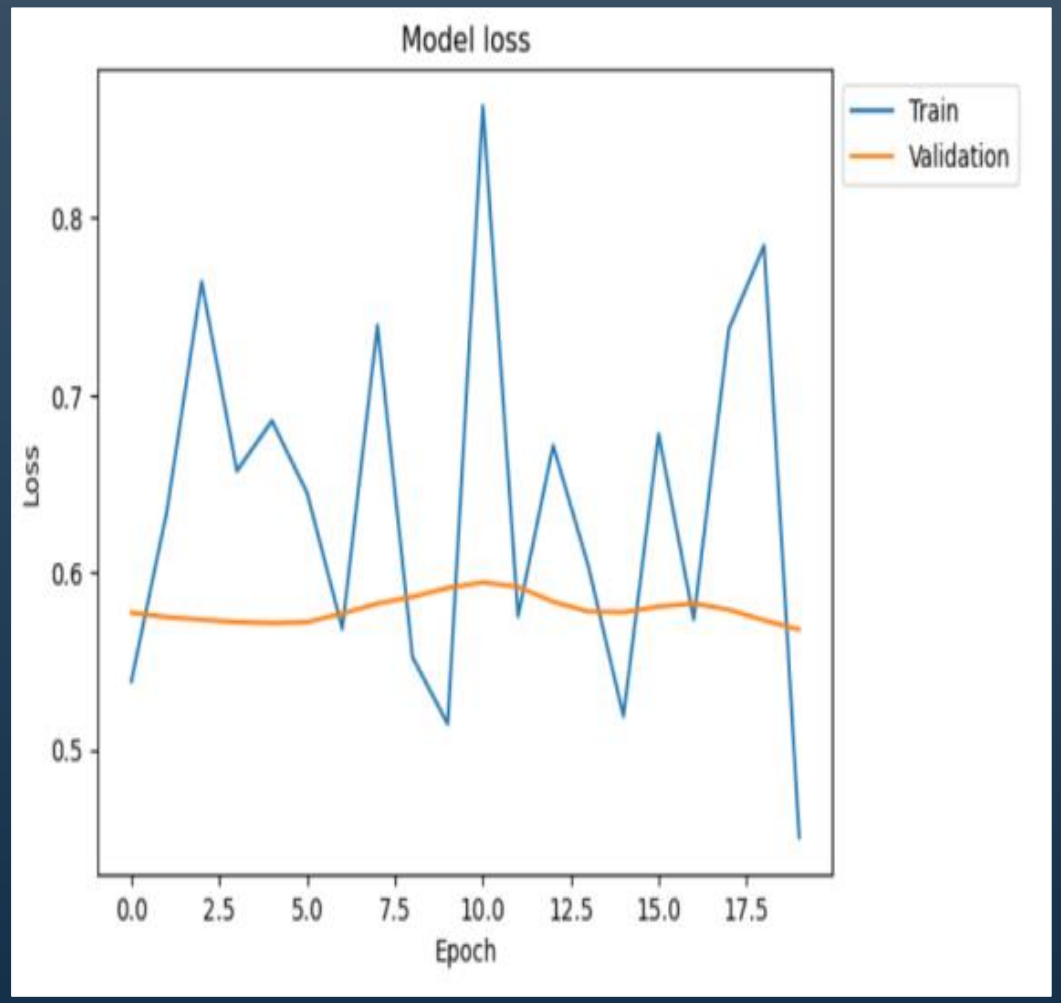
❖ CNN Classifier

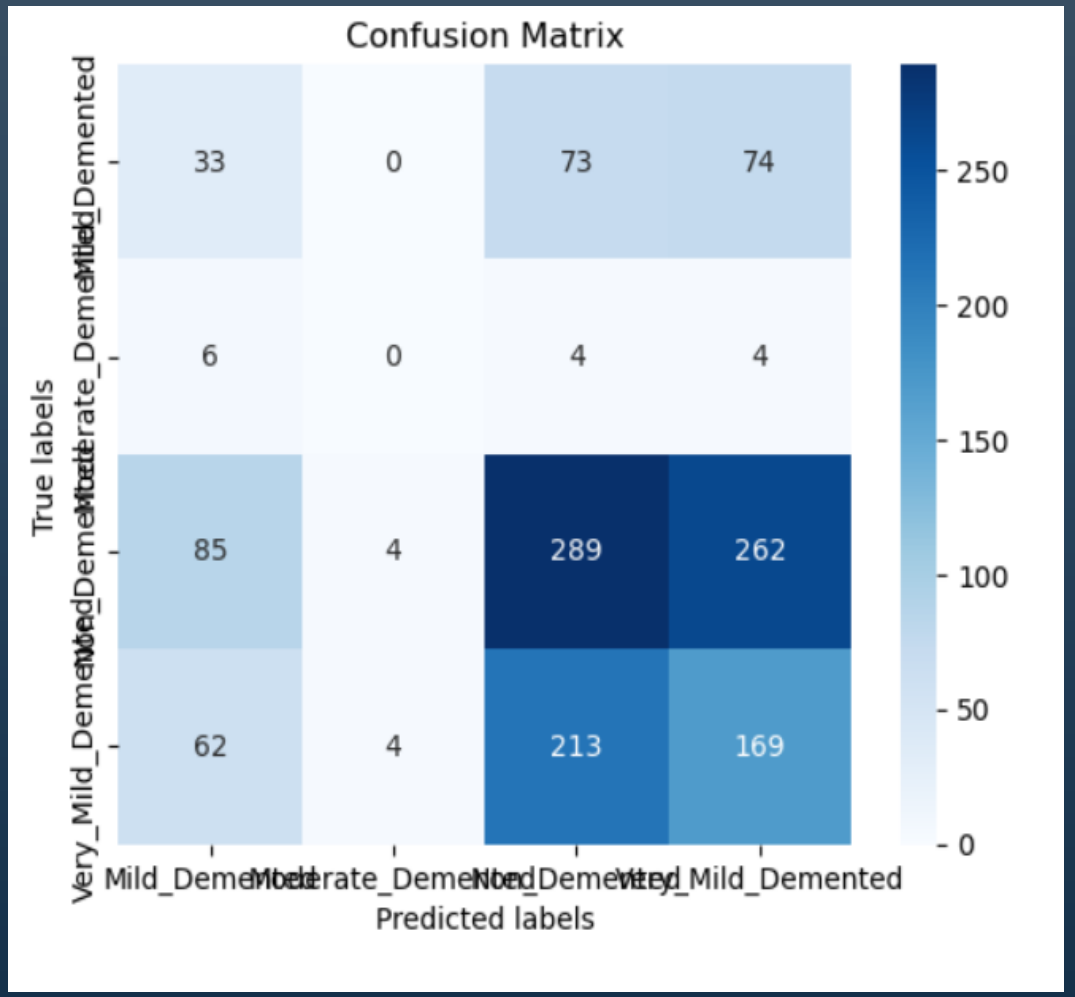
VGG19, **DenseNet121**, and **SqueezeNet** were the deep learning models we used.

1-DenseNet121

Parameter	Value	Reason
Input shape	128*128*3	Classification of image size.
Optimization Function	Adam	Most used optimizer in the literature.
Bath Size	16	After several trials we found that small batch sizes give better results.
Epochs	30	The maximum number we were able to reach while doing our test, without google colab blocking us .
Output Shape	Probability vector with 3 elements	/

Training and Validation Loss in DenseNet121& confusion matrix

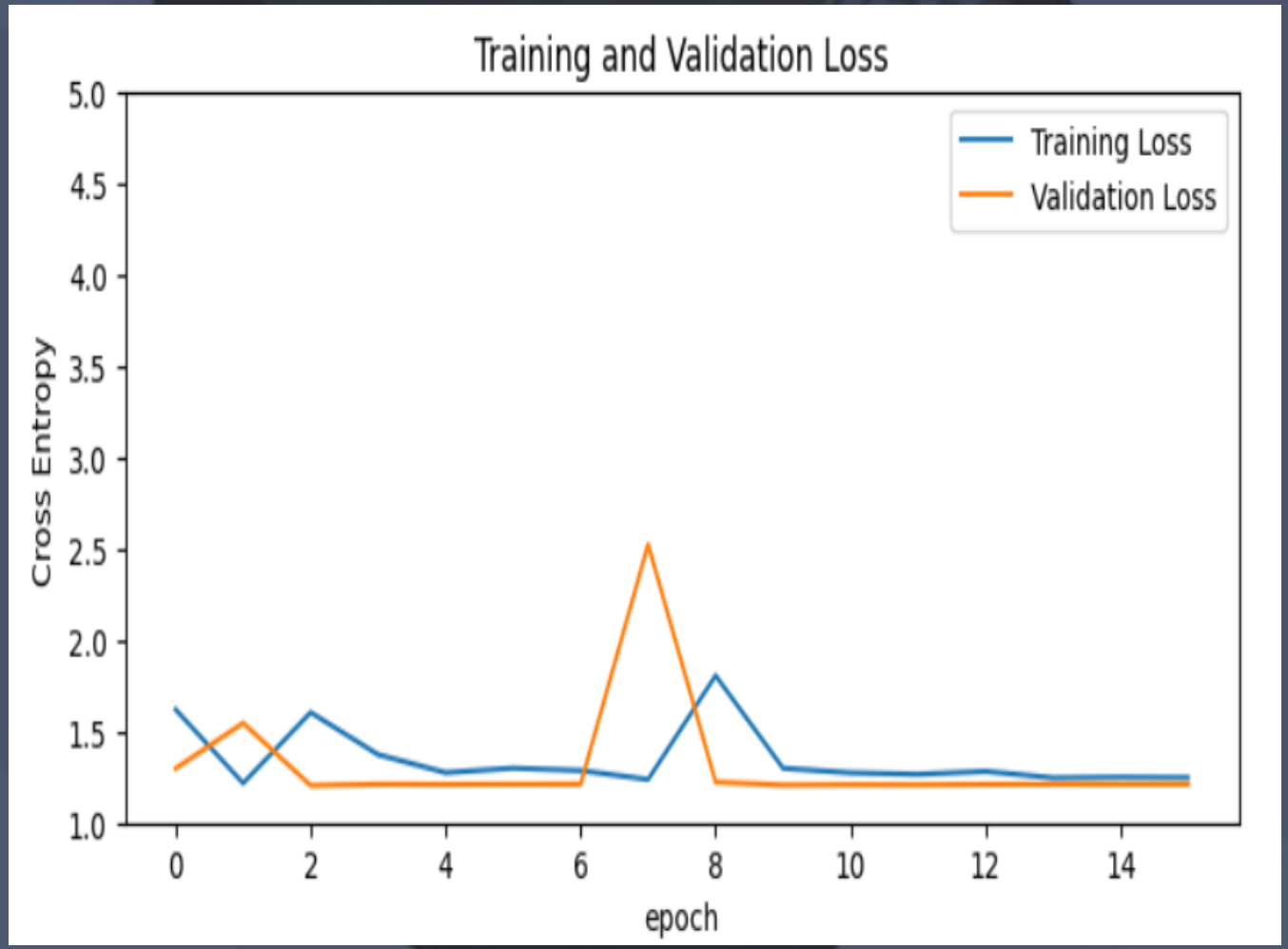




2-SqueezeNet

Parameter	Value	Reason
Input shape	224*224*3	Classification of image size.
Optimization Function	Adam	Most used optimizer in the literature.
Bath Size	128	After several trials we found that small batch sizes give better results.
Epochs	500	The maximum number we were able to reach while doing our test, without google colab blocking us .
Output Shape	Probability vector&elements	/

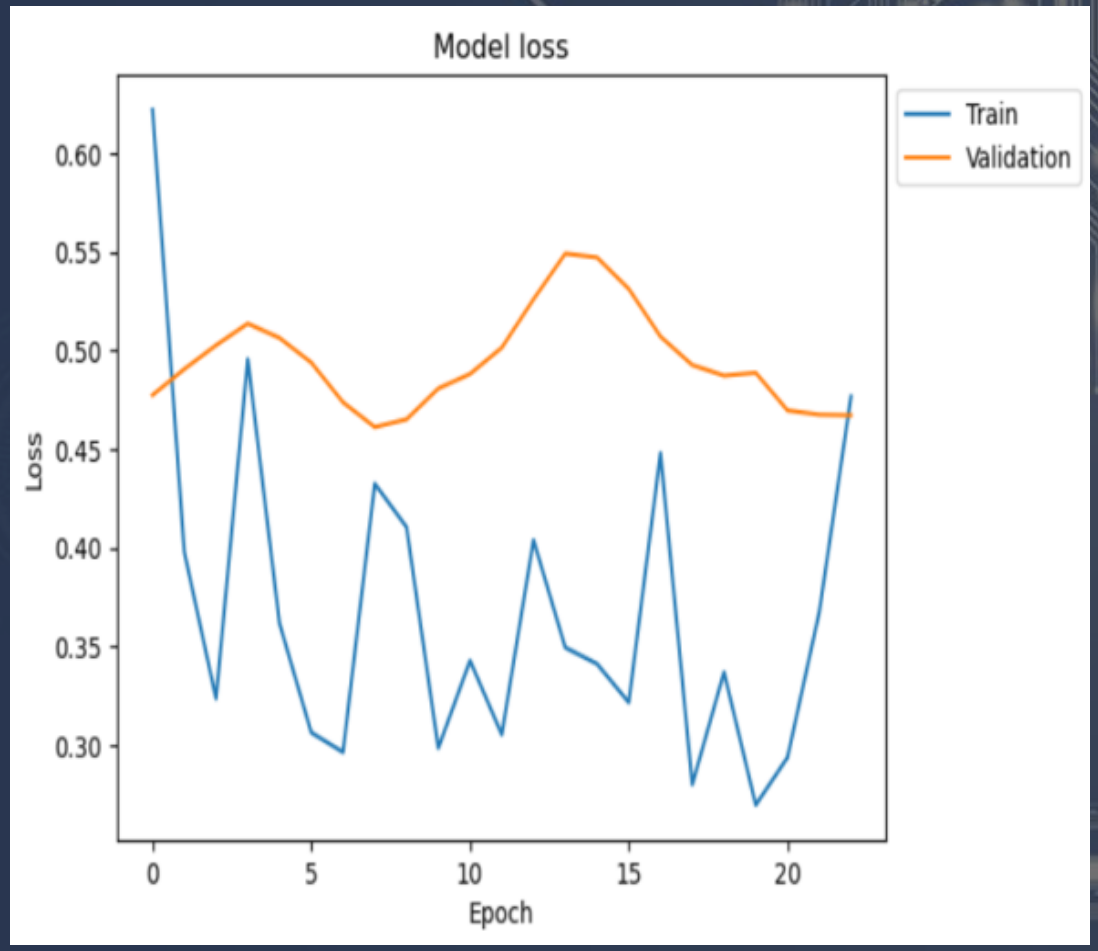
Training and Validation Loss for Squeeze-Net

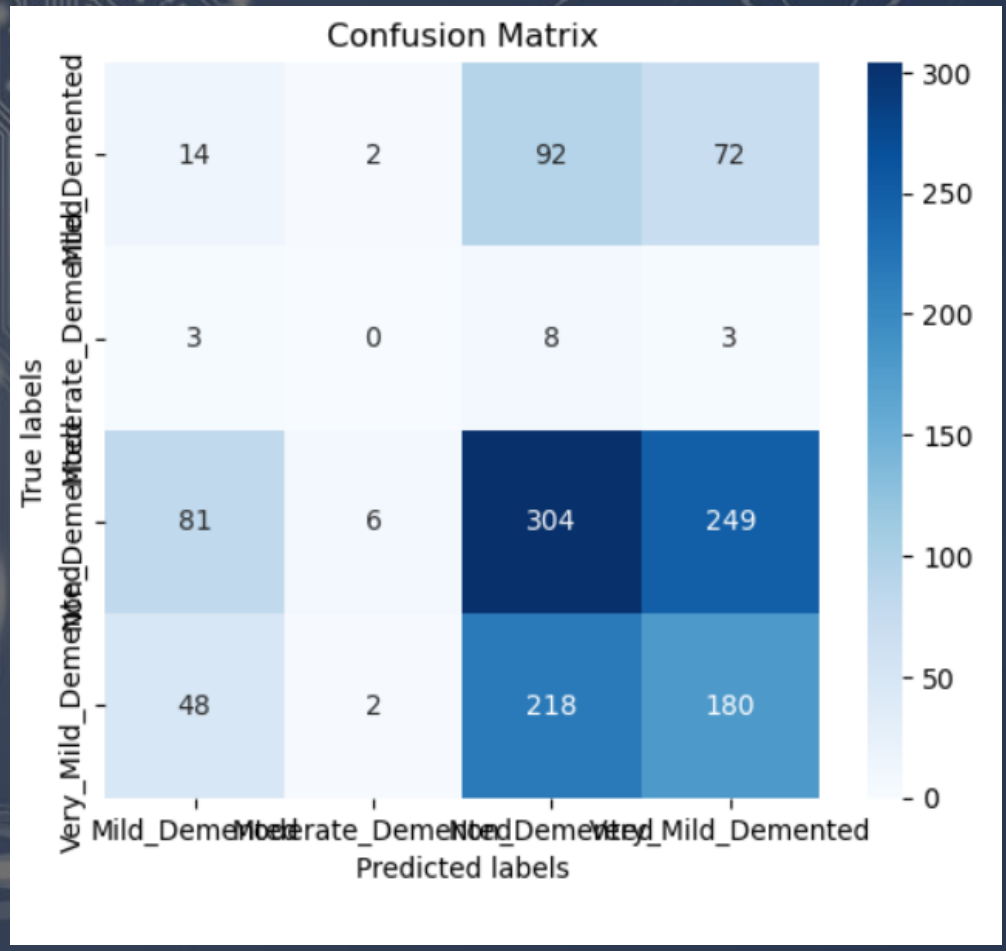


3-VGG19

Parameter	Value	Reason
Input shape	128*128*3	Classification of image size.
Optimization Function	Adam	Most used optimizer in the literature.
Bath Size	32	After several trials we found that small batch sizes give better results.
Epochs	50	The maximum number we were able to reach while doing our test, without google colab blocking us .
Output Shape	Probability vector with 3 elements	/

Training and Validation Loss in VGG19 & confusion matrix



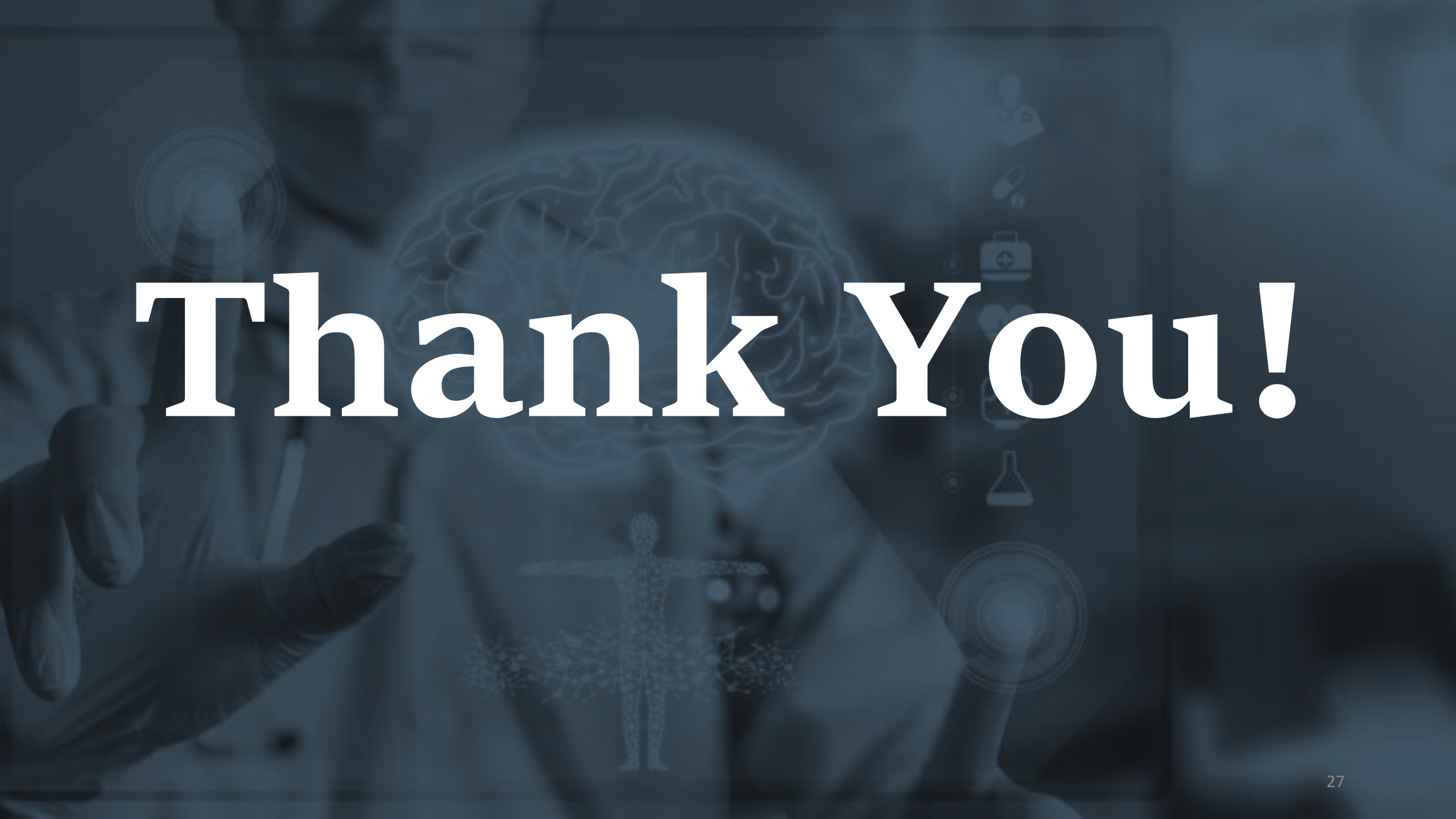


RESULTS COMPARISON

MODEL	ACCURACY	AUC	PRECISION	RECALL
Vgg19	0.83	0.96	0.85	0.80
DensNet-121	0.79	0.95	0.82	0.79
SqueezeNet	47.38	-	-	-

COMPARISON

OUR WORK	ANOTHER STUDY
VGG19: 83.0% Dataset: ADNI	CNN:72.7% VGG16:80.66% RESNET:76.86% Dataset: ADNI


Thank You!


Any
Questions??