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Investigation of Machine Learning methods for Alzheimer and Mental Health

In partial fulfilment of the requirements for the degree of

Bachelor of Science in Computer Science

Supervisor: Dr Iram Noreen

Department of Computer Sciences

Bahria University, Lahore Campus

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C e r t i f i c a t e



We accept the work contained in the report titled

Investigation of Machine Learning methods for Alzheimer and Mental Health

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as a confirmation to the required standard for the partial fulfilment of the degree of Bachelor of Science in Computer Science.

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January 5th , 2025

DECLARATION

We hereby declare that this project report is based on our original work except for citations and quotations which have been duly acknowledged. We also declare that it has not been previously and concurrently submitted for any other degree or award at Bahria University or other institutions.

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Investigation of Machine Learning methods for Alzheimer and Mental Health

ABSTRACT

Alzheimer's disease and its precursor, Mild Cognitive Impairment, are among the leading causes of dementia worldwide. Early detection of these conditions is crucial for effective intervention and management. This study explores the use of deep learning models, specifically Convolutional Neural Networks, for the classification of MRI scans into different stages of Alzheimer's disease, namely, MildDemented, ModerateDemented, NonDemented, and VeryMildDemented. The goal of this study was to test the influence of different settings, including the use of different optimizer techniques (Adam, SGD, ADAMW) and training methods (early stopping, dropout), on the model's classification accuracy for these categories.

This study comprises training CNNs with different architectures, including the dense layers and dropout approach. It prevents overfitting and improves generalization. The dataset contained MRI scans, which were augmented to provide a rich training set that enhances the model's ability to learn complex features of the brain images. The ADAM optimizer proved the best for overall classification accuracy, particularly when combined with early stopping and dropout to balance training efficiency and model generalization.

A total of 11 versions of the model were tested, and among them, Version 10 (trained for 50 epochs using the ADAM optimizer, 2 dense layers, and 0.5 dropout) achieved the highest accuracy of 90% with a specificity of 0.92, demonstrating the best performance. This model shows strong potential for real-world diagnostic applications in early-stage Alzheimer’s detection.

TABLE OF CONTENTS

DECLARATION 2

ACKNOWLEDGEMENTS 3

ABSTRACT 4

TABLE OF CONTENTS 5

LIST OF TABLES 10

LIST OF FIGURES 11

CHAPTER 1 14

INTRODUCTION 14

1.2 Problem Statements 15

1.3 Aims and Objectives 15

1.4 Scope of Project 15

CHAPTER 2 17

LITERATURE REVIEW (and/or SRS) 17

CHAPTER 3 23

DESIGN AND METHODOLOGY 23

3.1 Data Collection 23

3.2 Model Training Setup 23

3.3 Preprocessing 23

3.4 Model Training 24

3.5 Model Export 24

3.6 Evaluation and Validation 24

3.7 Performance Comparison 24

CHAPTER 4 26

DATA AND EXPERIMENTS (and/or IMPLMENTATION) 26

4.1 Version 1: Baseline 2-Layer Model with 40 Epochs and Default Settings 29

Key Observation 31

4.2 Version 2: 40 Epochs with Early Stopping and Adam Optimizer, 3-Layers 31

Key Observation 34

4.3 Version 3: 40 Epochs with Early Stopping and SGD Optimizer 34

Key Observation 37

4.4 Version 4: 40 Epochs with AdamW Optimizer and with Early Stopping 37

Key Observation 41

4.5 Version 5: 60 Epochs with SGD Optimizer and Early Stopping 41

Key Observation 44

4.6 Version 6: 80 Epochs with SGD Optimizer with Early Stopping 45

Key Observation 48

4.7 Version 7: Training & Validation Accuracy with 40 Epochs (Early Stopping, ADAM Optimizer 3-Layer Model with 2 Dense Layers and 0.2 Dropout) 48

Key Observation 52

4.8 Version 8: Training & Validation Accuracy with 40 Epochs (Early Stopping, ADAM Optimizer 3-Layer Model with 1 Dense Layers and 0.2 Dropout) 53

Key Observation 56

4.9 Version 9: Training & Validation Accuracy with 40 Epochs (Early Stopping, ADAM Optimizer 3-Layer Model with 2 Dense Layers) 56

Key Observation 59

4.10 Version 10: Training & Validation Accuracy of Testing Phase with 50 Epochs (Early Stopping, ADAM Optimizer 3-Layer Model with 2 Dense Layers and 0.5 Dropout) 60

Key Observation 64

CHAPTER 5 65

RESULTS AND DISCUSSIONS 65

5.1 Key Points from Classification Report (40 Epochs – Version 1) 65

5.2 Key Points from Classification Report (40 Epochs with Early Stopping & with 3 Layer Adam Optimizer Model – Version 2) 66

5.3 Key Points from Classification Report (40 Epochs Early Stopping with SGD Optimizer 3 Layer Model – Version 3) 68

5.4 Obervations from Classification Report (40 Epochs – Early Stopping with ADAMW Optimizer 3 Layer Model – Version 4) 70

5.6 Obervations from Classification Report (60 Epochs – Early Stopping with SGD Optimizer 3 Layer Model – Version 6) 72

5.7 Obervations from Classification Report (80 Epochs – Early Stopping with SGD Optimizer 3 Layer Model – Version 6) 73

5.8 Version 7: Obervations from Classification Report with 40 Epochs (Early Stopping, ADAM Optimizer 3-Layer Model with 2 Dense Layers and 0.2 Dropout) 75

5.9 Version 8: Classification Report with 40 Epochs (Early Stopping, ADAM Optimizer 3-Layer Model with 1 Dense Layer and 0.2 Dropout) 77

5.10 Version 9: Classification Report with 40 Epochs (Early Stopping, ADAM Optimizer 3-Layer Model with 2 Dense Layers) 79

5.11 Version 10: Classification Report with 50 Epochs of Testing Phase(Early Stopping, ADAM Optimizer 3-Layer Model with 2 Dense Layers & 0.5 Dropout) 81

5.12 Specificity Report 84

5.13 Observations from ROC Curve and AUC Score – 40 Epochs (Early Stopping & Adam Optimizer 2-Layer Model) – Version 1 87

5.14 Observations from ROC Curve and AUC Score – 40 Epochs (Early Stopping & SGD Optimizer 3-Layer Model) – Version 2 88

5.15 Observations from ROC Curve and AUC Score – 40 Epochs (Early Stopping & ADAMW Optimizer 3-Layer Model) – Version 3 89

5.16 Observations from ROC Curve and AUC Score – 40 Epochs (Early Stopping & ADAM Optimizer 3-Layer Model) – Version 4 90

5.17 Observations from ROC Curve and AUC Score – 60 Epochs (Early Stopping & SGD Optimizer 3-Layer Model) – Version 5 91

5.18 Observations from ROC Curve and AUC Score – 80 Epochs (Early Stopping & SGD Optimizer 3-Layer Model) – Version 6 92

5.20 Version 7: ROC Curve Plot AUC Score with 40 Epochs (Early Stopping, ADAM Optimizer 3-Layer Model with 2 Dense Layers and 0.2 Dropout) 93

5.21 Version 8: ROC Curve Plot AUC Score with 40 Epochs (Early Stopping, ADAM Optimizer 3-Layer Model with 1 Dense Layer and 0.2 Dropout) 94

5.22 Version 9: ROC Curve Plot AUC Score with 40 Epochs (Early Stopping, ADAM Optimizer 3-Layer Model with 2 Dense Layers) 95

CHAPTER 6 96

CONCLUSION AND RECOMMENDATIONS **96**

REFERENCES **98**

APPENDICES **101**

LIST OF TABLES

TABLE	TITLE	PAGE
Table 2.1: State of Art Method		21
Table 2.2: Dataset Description		22
Table 5.1: Classification Report with 40 Epochs – Version 1		66
Table 5.2: Classification Report with 40 Epochs (with Early Stopping & with 3 Layer Adam Optimizer Model) - Version 2		68
Table 5.3: Classification Report with 40 Epochs (Early Stopping with SGD Optimizer 3 Layer Model) - Version 3		70
Table 5.4: Classification Report with 40 Epochs (Early Stopping & ADAMW Optimizer 3 Layer Model) - Version 4		71
Table 5.6: Classification Report with 60 Epochs (Early Stopping & SGD Optimizer 3 Layer Model) - Version 5		73
Table 5.7: Classification Report with 80 Epochs (Early Stopping & SGD Optimizer 3 Layer Model) - Version 6		75
Table 5.8: Classification Report with 40 Epochs (Early Stopping, ADAM Optimizer 3 Layer Model with 2 Dense Layers and 0.2 Dropout) - Version 7		77
Table 5.9: Classification Report with 40 Epochs (Early Stopping, ADAM Optimizer 3 Layer Model with 1 Dense Layers and 0.2 Dropout) - Version 8		79
Table 5.10: Classification Report with 40 Epochs (Early Stopping, ADAM Optimizer 3 Layer Model with 2 Dense Layers) - Version 9		81
Table 5.11: Classification Report with 50 Epochs (Early Stopping, ADAM Optimizer 3 Layer Model with 2 Dense Layers & 0.5 Dropout) - Version 10		82
Table 5.12: Accuracies Comparison of all Versions		83
Table 5.13: Performance Comparison of all versions		86

LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 2.1:	Brain scan image for diagnosis of Alzheimer Ahamed et al.'s (2020)	19
Figure 3.1:	Disease diagnosis using Machine Learning	25
Figure 4.1:	Classes Distribution in Original Dataset	26
Figure 4.2 :	Classes Distribution in Augmented Dataset	27
Figure 4.3 :	Sample Images from Original Dataset [26]	28
Figure 4.4 :	Training & Validation Accuracy and loss with 40 Epochs (Initial Version 1)	29
Figure 4.5 :	Confusion Matrix of 40 Epochs – Initial Version 1	30
Figure 4.6:	Training & Validation Accuracy and loss with 40 Epochs (Early Stopping with 3 Layers Adam Optimizer Model) - Version 2	32
Figure 4.16 :	Confusion Matrix of 40 Epochs (With Early Stopping & with 2 Layer Adam Optimizer Model) – Version 2	34
Figure 4.6::	Training & Validation Accuracy with 40 Epochs (Early Stopping with SGD Optimizer 3 Layer Model) - Version 3	35
Figure 4.17:	Confusion Matrix of 40 Epochs (Early Stopping with SGD Optimizer 3 Layer Model) – Version 3	37
Figure 4.7:	Training & Validation Accuracy with 40 Epochs (Early Stopping & ADAMW Optimizer 3 Layer Model) - Version 4	38
Figure 4.18:	Confusion Matrix of 40 Epochs (with Early Stopping & ADAMW Optimizer 3 Layer Model) – Version 4	40
Figure 4.9 :	Training & Validation Accuracy with 60 Epochs (Early Stopping & SGD Optimizer 3 Layer Model) - Version	42
Figure 4.20:	Confusion Matrix with 60 Epochs (Early Stopping & SGD Optimizer 3 Layer Model) – Version 5	44
Figure 4.10:	Training & Validation Accuracy with 80 Epochs (Early Stopping & SGD Optimizer 3 Layer Model) - Version 6	46
Figure 4.21:	Confusion Matrix with 80 Epochs (Early Stopping & SGD Optimizer 3 Layer Model) – Version 6	48
Figure 4.11:	Training & Validation Accuracy with 40 Epochs (Early Stopping, ADAM Optimizer 3 Layer Model with 2 Dense Layers and 0.2	

Dropout) - Version 7
50

Figure 4.22: Confusion Matrix with 40 Epochs (Early Stopping , ADAM Optimizer 3 Layer Model with 2 Dense Layers and 0.2 Dropout) – Version 7
52

Figure 4.12: Training & Validation Accuracy with 40 Epochs (Early Stopping, ADAM Optimizer 3 Layer Model with 1 Dense Layers and 0.2 Dropout) - Version 8
54

Figure 4.23: Confusion Matrix with 40 Epochs (Early Stopping , ADAM Optimizer 3 Layer Model with 1 Dense Layers and 0.2 Dropout) – Version 8
55

Figure 4.13: Training & Validation Accuracy with 40 Epochs (Early Stopping, ADAM Optimizer 3 Layer Model with 2 Dense Layers) - Version 9
57

Figure 4.24: Confusion Matrix with 40 Epochs (Early Stopping , ADAM Optimizer 3 Layer Model with 2 Dense Layers) – Version 9
59

Figure 4.14: Training & Validation Accuracy with 50 Epochs (Early Stopping, ADAM Optimizer 3 Layer Model with 2 Dense Layers) - Version 10
62

Figure 4.25: Confusion Matrix with 50 Epochs (Early Stopping , ADAM Optimizer 3 Layer Model with 2 Dense Layers & 0.5 Dropout) – Version 10
64

Figure 5.1: ROC Curve Plot and AUC Score with 40 Epochs (Early Stopping & Adam Optimizer 2 Layer Model) – Version 1
87

Figure 5.2: ROC Curve Plot and AUC Score with 40 Epochs (Early Stopping & SGD Optimizer 3 Layer Model) - Version 2
88

Figure 5.4: ROC Curve Plot and AUC Score with 40 Epochs (Early Stopping & ADAMW Optimizer 3 Layer Model) - Version 3
89

Figure 5.5: ROC Curve Plot AUC Score with 40 Epochs (Early Stopping & ADAM Optimizer 3 Layer Model) - Version 4
90

Figure 5.6: ROC Curve Plot AUC Score with 60 Epochs (Early Stopping & SGD Optimizer 3 Layer Model) - Version 5
91

Figure 5.7: ROC Curve Plot AUC Score with 80 Epochs (Early Stopping & SGD Optimizer 3 Layer Model) - Version 6
92

Figure 5.8: ROC Curve Plot AUC Score with 40 Epochs (Early Stopping, ADAM Optimizer 3 Layer Model with 2 Dense Layers and 0.2 Dropout) - Version 7
93

Figure 5.9: ROC Curve Plot AUC Score with 40 Epochs (Early Stopping, ADAM Optimizer 3 Layer Model with 1 Dense Layers and 0.2 Dropout) - Version 8 94

Figure 5.10: ROC Curve Plot AUC Score with 40 Epochs (Early Stopping, ADAM Optimizer 3 Layer Model with 2 Dense Layers) - Version 9 95