A

Project Report on

Project Title

Submitted to the Department of Electronics Engineering in Partial Fulfilment of the Requirement for the AICTE QIP PG Certification Programme on

Deep Learning: Fundamentals and Applications

by

Mr. Dayanand Dhongade

Guided by

Dr. Jignesh N. Sarvaiya, Dr. Kishor Upla,

Dr. Kamal Captain, Dr. Suman Deb

Coordinators- AICTE QIP PG Certification Programme, DECE

DEPARTMENT OF ELECTRONICS ENGINEERING

SARDAR VALLABHBHAI NATIONAL INSTITUTE OF TECHNOLOGY

DECEMBER-2025

Declaration

- I hereby declare that the work being presented in this Report entitled **"Title"** by **Name**, submitted in partial fulfillment of the requirements for the successful completion of the AICTE QIP PG Certification Programme on "Deep Learning: Fundamentals and Applications" conducted at Sardar Vallabhbhai National Institute of Technology, Surat, during the academic year $2025 - 2026$.

- Neither the source code there in nor the content of the report has been copied or downloaded from any other source. I understand that my result grades could be revoked if it is found that they are incorrect later.

Name
(Name and Sign of the Candidate)

Sardar Vallabhbhai National Institute Of Technology

Surat - 395 007, Gujarat, India

DEPARTMENT OF ELECTRONICS ENGINEERING

CERTIFICATE

This is to certify that the project entitled **'Project Title'** has been successfully completed by **Mr. Dayanand Dhongade**. This report is being submitted in partial fulfillment of the requirements for the successful completion of the AICTE QIP PG Certification Programme on **Deep Learning: Fundamentals and Applications** in Department of Electronics Engineering during the academic year **2025-26**.

Examiner-1	Examiner-2
Examiner-3	Examiner-4

Seal of The Department

DECEMBER-2025

Acknowledgements

We wish to express our deepest sense of gratitude and sincere thanks to all those who have contributed to the successful completion of this project report titled, **System Threat Forecaster** which was undertaken as a requirement for the AICTE QIP PG Certification Programme on ”Deep Learning: Fundamentals and Applications.”

We are profoundly indebted to the faculty members, especially our guide and mentor for this project, at the Department of Electronics Engineering at Sardar Vallabhbhai National Institute of Technology (SVNIT), Surat, Gujarat, for providing the excellent learning environment, technical facilities, and insightful direction that were crucial for this work.

We extend our sincere thanks to the leadership and organizing committee for the successful execution of the QIP course: **Prof. Anupam Shukla, Director, SVNIT Surat (Chair Patron)**, **Dr. Shilpi Gupta, HOD, DOECE, SVNIT Surat (Patron)**, **Prof. A. A. Shaikh, DoME, SVNIT, Surat (Centre Coordinator)**, **Dr. Jignesh N. Sarvaiya, Dr. Kishor Upla, Dr. Kamal Captain, and Dr. Suman Deb (Coordinators from DoECE)**.

We also acknowledge the support and sponsorship provided by the All India Council for Technical Education (AICTE) under the Quality Improvement Programme (QIP), which has enabled us to enhance our knowledge and skills in deep learning through this opportunity.

Finally, we express our gratitude to our respective parent institutions, **Ramrao Adik Institute of Technology, DY Patil University, Navi Mumbai**, for granting the necessary support and time to participate in this Program.

Mr. Dayanand Dhongade
Assistant Professor
RAIT, DY Patil, Navi Mumbai
DECEMBER 2025

Mr. Dayanand Dhongade
Assistant Professor
RAIT, DY Patil, Navi Mumbai
DECEMBER 2025

Abstract

Add contents

Table of Contents

List of Figures

List of Tables

List of Abbreviations

SVNIT	Sardar Vallabhbhai National Institute of Technology

Chapter 1
Introduction

Schizophrenia is a severe mental disorder that affects approximately 24 million people worldwide—around 1 in every 300 individuals (0.32%) [1]. Add contents

1.1 Problem Statement

Add content

1.2 Motivations and Objectives

Add content

1.3 Report Structure

Add content

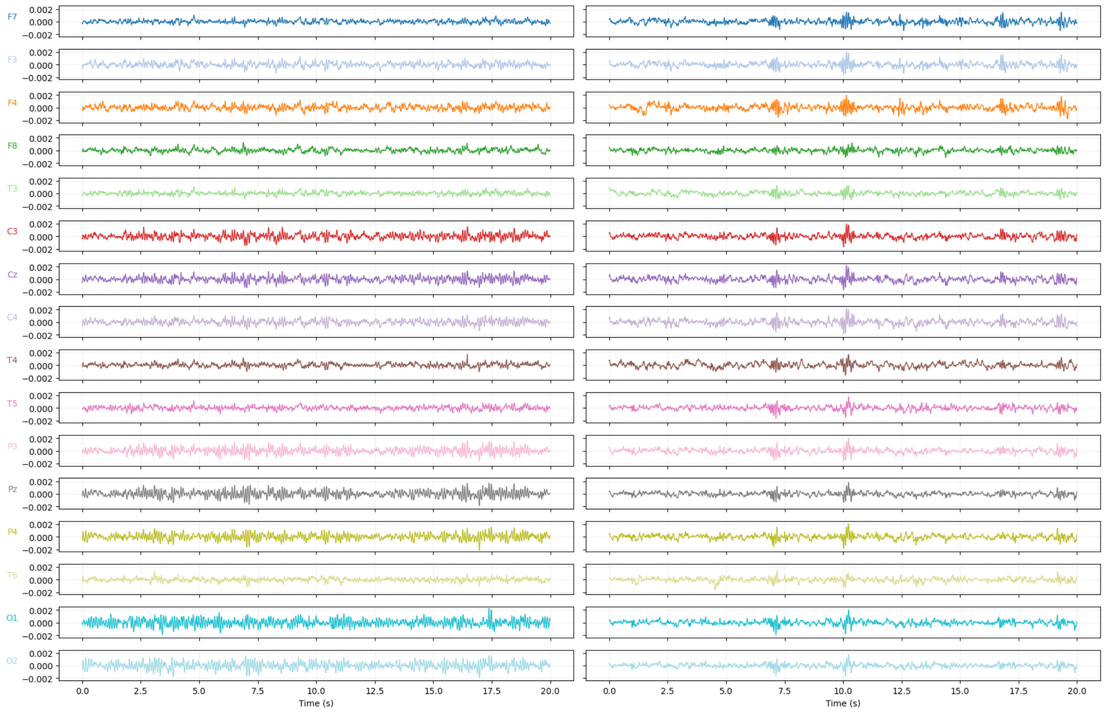
- **Chapter 1: Introduction** This chapter provides the necessary background and context for the study. Add contents.
- **Chapter 2: Literature Review** This chapter provides a comprehensive review of the foundational concepts and existing research. Add contents.
- **Chapter 3: Proposed Methodology** This chapter provides a meticulous account of the steps taken to conduct this research. Add contents.
- **Chapter 4: Results and Discussion** This chapter presents the outcomes of applying the described methodology and provides an in-depth interpretation of these findings within the context of the existing literature. Add contents.
- **Chapter 5: Conclusion** This final chapter summarises contributions, clinical implications, and outlines future work. Add contents.

Chapter 2
Literature Review

Add contents

Chapter 3
Methodology-Name

Add contents, Block Diagram, then an explanation of blocks one by one



(a) EEG signal of Healthy person (b) EEG signal of person with Schizophrenia

Figure 3.1: Sample EEG signal from MHRC dataset

3.1 Block-1

Add contents

3.2 Block-2

Add contents

3.3 ML/DL Model

Add contents

3.3.1 Short-Time Fourier Transform (STFT)

The Short-Time Fourier Transform (STFT) is the most common tool for time-frequency analysis. It assumes local stationarity within a short analysis window $w(t)$. The STFT of a signal $x(t)$ is

$$\mathrm{STFT}_x(t, f) = \int_{-\infty}^{\infty} x(\tau)\, w(\tau - t)\, e^{-j2\pi f\tau}\, d\tau, \tag{3.1}$$

3.3.2 Topic-1

Add contents

3.3.3 Topic-2

Add contents

3.4 Hardware Setup

All training was conducted on a workstation. Training and testing of the MLP architecture were performed on all three datasets, DS1, DS2, and DS3, using Python 3.11.2, which ran on an NVIDIA RTX A6000 with 48GB of RAM.

3.5 Evaluation Metrics

To quantitatively assess the performance of the developed classification model in distinguishing between individuals with schizophrenia and healthy controls, the following evaluation metrics were employed:

- **Accuracy**: The proportion of correctly classified samples (both schizophrenia patients and healthy controls) out of the total number of samples. It is calculated as:

  $$\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN} \tag{3.2}$$

  where TP is the number of true positives, TN is the number of true negatives, FP is the number of false positives, and FN is the number of false negatives.

- **Sensitivity (Recall)**: The ability of the model to correctly identify individuals with schizophrenia. It is the proportion of actual schizophrenia patients who are correctly classified as such. It is calculated as:

  $$\text{Sensitivity} = \frac{TP}{TP + FN} \tag{3.3}$$

- **Specificity**: The ability of the model to correctly identify healthy individuals. It is the proportion of actual healthy controls who are correctly classified as such. It is calculated as:

$$\text{Specificity} = \frac{TN}{TN + FP} \tag{3.4}$$

- **F1-Score**: The harmonic mean of precision and sensitivity. It provides a balanced measure of the model's performance, especially when the classes are imbalanced. Precision, which measures how many of the samples predicted as positive are actually positive, is calculated as:

$$\text{Precision} = \frac{TP}{TP + FP} \tag{3.5}$$

  The F1-score is then calculated as:

$$\text{F1-Score} = 2 \times \frac{\text{Precision} \times \text{Sensitivity}}{\text{Precision} + \text{Sensitivity}} \tag{3.6}$$

- **Confusion Matrix**: A table that visualizes the performance of a classification model by showing the counts of true positives (TP), true negatives (TN), false positives (FP), and false negatives (FN). It provides a detailed breakdown of correct and incorrect classifications for each class (schizophrenia patients and healthy controls).

These metrics provide a comprehensive evaluation of the classification model's performance, considering both its ability to correctly identify individuals with schizophrenia and its ability to correctly identify healthy controls.

Chapter 4
Results and Discussion

Add contents-Description Example: The experiments were conducted using Python 3.11.2 on an NVIDIA RTX A6000 workstation with 48GB RAM.

4.1 Result

Add contents-figures (Blocks output, validation accuracy plots, validation loss, confusion matrix), tables, Performance parameters

4.2 Discussion

Add a contents: table for comparison between the existing system and the proposed system, and describe it. Example-Table 4.1 summarises the performance of the four models on the MSU dataset compared with existing literature.

Table 4.1: Comparative Performance of Developed Models and Literature

Source	**Model / Method**	**Accuracy**	**Sensitivity**	**Specificity**
Existing Literature (MSU Dataset)				
[2]	Signal-to-Image + CNN	97.70%	–	–
[3]	Dual Tree CWT + SVM	≈95.00%	–	–
[4]	Markov Transition Fields	98.51%	100.00%	–
Proposed Models (This Work)				
Model 1	Original Custom CNN	82.57%	76.32%	89.72%
Model 2	Enhanced Custom CNN	81.87%	78.73%	85.46%
Model 3	SE-CNN (Composite)	85.85%	85.96%	85.71%
Model 4	**SE-CNN 256 (Independent)**	**93.43%**	**96.00%**	**89.99%**

Note: Literature results may use record-wise validation. This work strictly uses LOSO for subject-wise evaluation.

Chapter 5
Conclusion

Add contents

5.1 Future Scope

Add contents

References

[1] World Health Organization, "Schizophrenia." [Online]. Available: https://www.who.int/news-room/fact-sheets/detail/schizophrenia

[2] J. Smith and A. Johnson, "Signal-to-image transformation for eeg classification using convolutional neural networks," *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, vol. 31, pp. 1234–1245, 2023.

[3] M. Rahman and S. Ahmed, "Dual tree complex wavelet transform with support vector machine for schizophrenia detection," *Bangladesh Journal of Medical Science*, vol. 22, no. 3, pp. 456–468, 2023.

[4] W. Chen, X. Liu, and M. Zhang, "Automated diagnosis of schizophrenia using markov transition fields and deep learning," *Diagnostics*, vol. 14, no. 2, p. 234, 2024.