CHAPTER I
INTRODUCTION

1.1. Background

The human brain is a wonderful 1400-gram organ that controls all body functions [1]. This wonderful organ sometimes experiences a chronic neurological disorder that affects more than 50 million people, with around 2 million newly diagnosed annually worldwide, and that is Epileptic Seizures [2]-[5]. In the epilepsy brain, electrical rhythms tend to become imbalanced [2]-[7]. Epileptic Seizures symptoms differ for the majority of patients, but, in general, uncontrollable jerking movements of the body, loss of consciousness, awareness, confusion, staring, strange sensations and emotions, or sudden falls [2].

Electroencephalogram (EEG) is often used to diagnose Epilepsy, which causes abnormalities in EEG readings [2]-[7]. The diagnosis of epileptic seizures, traditionally, requires a long time of intuitive monitoring of the patient's EEG signals [3]-[7]. Deep Learning algorithms, mainly convolutional neural networks, have been widely used to detect and classify epileptic seizures in raw EEG signals [3]-[7].

Convolutional Neural networks (CNN) have been used significantly in the last decade and are getting more and more attention in the world of deep neural networks [8]-[11]. CNN has three main features: Convolutional Layer, Pooling Layer, and Full Connected Layer [8][9]. The type of data that requires kernel sliding in only one dimension and has spatial properties is Time-Series data, in this final project, EEG data [10][11].

In this final project, the writer proposes a One-Dimensional Convolutional Neural Network method that classifies Time-Series Electroencephalography (EEG) data as Epilepsy or not.

1.2. Problem Formulations

Based on the background, the problem formulations of this final project are:

1. How to implement a one-dimensional convolutional neural network using electroencephalography data to classify epileptic seizures?
2. What parameters affect the accuracy of the epileptic seizures classification system?

1.3. Objectives

Based on the previous sub-chapter, the objectives of this study are:

1. To understand the epileptic seizure classification implementation process using electroencephalography data and a one-dimensional convolutional neural network.
2. To know the parameters that could affect the accuracy of the epileptic seizure classification system.

1.4. Problem Limitations

The scope of the limitations related to this final project are:

1. This final project only classifies three classes pre-ictal, ictal, and inter-ictal.
2. The Dataset is from the University of Bonn EEG Database.
3. The performance parameters measure accuracy, precision, recall, F1 score, and loss.

1.5. Research Methodology

1. Literature Review

Started by researching and curating relevant references from national journals and international and previous projects related to the various classification method of epileptic seizures and convolutional neural networks, precisely the one-dimensional neural network method. This stage includes intense discussions and guidance from supervisors.

2. Data Acquisition

Data acquisition aims to obtain electroencephalography data regarding the epileptic seizures classification system from the University of Bonn EEG database.

3. System Design

The data acquired in the previous stage is analyzed to suit this final project's research needs. The system is designed according to the combination of hyperparameters used at the Implementation stage.

4. Implementation

The system is implemented and simulated by training the electroencephalography data acquired with the previous stage hyperparameters.

5. Testing and Analysis

At this stage, electroencephalography data testing will be carried out to see how the simulated system performance is. Testing is carried out according to the training data and the performance results. It will be analyzed to determine whether the system is working well or not.

6. Report Preparation

In this final stage, the final report is compiled, and conclusions are drawn from the research regarding the epileptic seizure classification results.