Generalized Non-Specific Seizure Based on EEG Signal Using Artificial Neural Network Method

1st Nita Dwi Maryati
School of Electrical Engineering
Telkom University
Bandung, Indonesia
nitadwim@
student.telkomuniversity.ac.id

2nd Raditiana Patmasari
School of Electrical Engineering
Telkom University
Bandung, Indonesia
raditiana@telkomuniversity.ac.id

3rd Sugondo Hadiyoso
School of Applied Science
Telkom University
Bandung, Indonesia
sugondo@telkomuniversity.ac.id

***Abstract*— Epilepsy is a seizure that occurs in the human brain. To find out, this research is to detect one of the signals in epilepsy patients, Generalized Non-Specific Seizure (GNSZ) recorded by using Electroencephalography (EEG). The dataset is a GNSZ signal taken from Temple University EEG Corpus. In this study, Hjorth Descriptor Method was used a feature extraction to process signals in time domain, where the output of this method is represented using three parameters, activity, mobility, complexity, and Artificial Neural Network (ANN) as a classification. In this study, the results of feature extraction from the GNSZ signal on the recording of EEG signals are compared with the characteristics of the normal signal. The results of this research has got 95,83% accuracy by using activity and complexity parameters. Other results obtained are GNSZ signals recognized as normal or vice versa.**

Keywords—Epilepsy, GNSZ, Hjorth Descriptor, ANN.

I. Introduction

Epilepsy is an event caused by abnormal neuron activity that causes general brain disorders [1]. Disorders that occur in the brain can be seen on the Electroencephalography (EEG) record, which is then used to see seizure events such as epilepsy that occur in the brain [2]. Types of signals that exist in epilepsy patients, one of which is Generalized Non-Specific Seizure. Seen from its seizure focal, a surge can be said to be a signal of Generalized Non-specific seizure if there is not much evidence that explains the classification of the type of seizure included in the general type of Seizure [3]. In this study, the aim was to detect the Generalized Non-Specific Seizure signal using the Hjorth descriptor method as feature extraction represented in three activities, mobility, complexity parameters.

II. METHOD

In this study using a dataset taken from the Temple University EEG Corpus. The dataset used is a 256 Hz sampling frequency GNSZ signal with a different record time. This recording is done using Electroencephalography (EEG) recorded over a period of several hours or even in one day for patients. The recording data format is Europan data format (.edf).

A. Preprocessing

The first process is loaded in the dataset to change the (.edf) data format to (.mat) for the next processing. The signal is cut according to the start and stop time length of the recording. With this, the length of each signal data is different, according to the start and stop time of the signal recording signal itself. After cutting, then through the normalization process to divide the total value of the signal with the maximum value of the signal. Feature extraction uses the Hjorth Descriptor method with output parameters in the form of activity, mobility, complexity. The following figure 2.1 is a GNSZ signal that has been cut according to start and stop recording and Figure 2.2 is a signal of a normal person as a comparison.

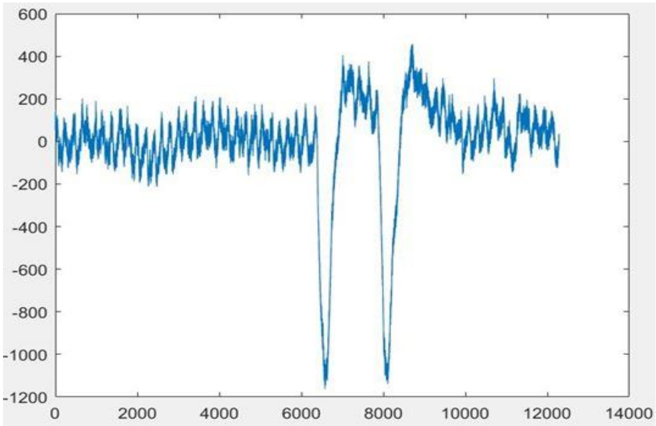

Figure 2.1 GNSZ signal that has been cut.

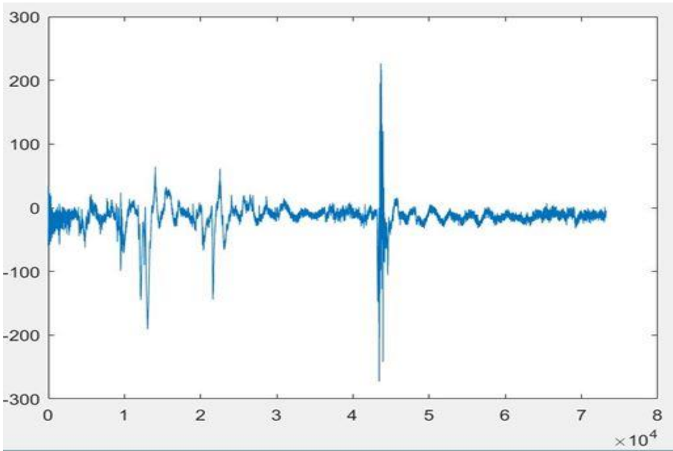

Figure 2.2 normal people signal.

B. Hjorth Descriptor

For processing the EEG signal uses the Hjorth descriptor method as the character extraction that works on the time domain [4]. The Signal is representative of this method is in the form of three parameters, activity, mobility and complexity [5].

a. Activity

Average signal power and is the signal variance of the time fuction.

$$Activity = varience = var(y(t)) \quad (2.1)$$

b. Mobility

The square root of the ratio a variance of the first derivative of the signals the shape of the signal similar to a sine.

$$Mobility = M_x = \sqrt{\frac{var(y'(t))}{var(y(t))}} \quad (2.2)$$

c. Complexity

Shows the shape of the signal similar to a sine wave.

$$Complexity = \frac{mobility(y'(t))}{mobility(y(t))} \quad (2.3)$$

C. *Artificial Neural Network*

ANN model is used to provide network capabilities to recognize a pattern. This ANN model formed when the training data and test data have been established. Following the architecture of backpropagation can be seen in the picture below.

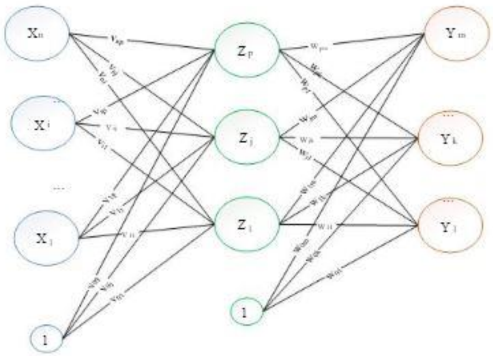

Figure 2.3 Backpropagation Architecture [6].

The picture above is Backpropagation architecture with one hidden layer (unit Z (z_1 ... z_P)). Output unit (unit Y (Y_1 ... Y_P)) and for hidden units that have a bias. the bias weight of the output unit is expressed by w_{0k}. the weight bias in the z_j hidden layer is expressed as V_{0j}. V_{ij} is the line weight from X_i unit to z_j hidden layer. While w_{Jk} is the weight of the line from z_j to the output unit Y_k [7].

III. RESULT AND DISCUSSION

In this research, using parameters that are tested individually with 60 GNSZ, and12 Normal as training dataset and 60 GNSZ, and12 normal as evaluation dataset.

Table 1. Highest accuracy for three parameters.

Parameter	Neuron	Epoch	Accuracy
Activity	20	100	95,83 %
Mobility	20	100	61,11%
Complexity	20	100	95,83%

IV. CONCLUSION

Based on the results of the testing that has been done on the classification, it can be concluded that the Hjorth descriptor method using ANN Backpropagation classification has been able to detect GNSZ signals, while the system has not fully worked optimally where there are still errors in detecting the GNSZ signal or not. The highest accuracy is 95,83% using activity and complexity parameters obtained by using the feature extraction method of Hjorth Descriptor and ANN classification.

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