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# Manual Remodelling of AF4 and O2 Electrodes in Schizophrenia

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**abstract**

Manual Remodelling of AF4 and O2 Electrodes in Schizophrenia. This study aims to: a) Know the EEG signals in the brain in humans, b) find out how manual rearrangements of the AF4 electrode and O2 electrode in schizophrenic patients and c) find out how the interpolation method compares at the AF4 and O2 electrodes in schizophrenic patients.Rearrangement of AF4 and O2 electrode manuals in schizophrenic patients, there are various ways, namely (a) graph of results of analysis, (b) enlarge graph, (c) create intervals and intersection points, (d) fitting in matlab and (e) analysis.There is a difference between the interpolation method of Newton degree 4th polynomial with the Lagrange degree 4th polynomial interpolation method which is the percent error by using Newton degree 4th when the graph is at the beginning until it is at the top is still stable with the mean value of error 14.118 % as well as the polynomial error with using Lagrange degree 4 is much better than Newton's 4th order with an average percent error of 4.69 %. While there is an equation between Newton degree 1 interpolation method with interpolation method of Lagrange degree 1 polynomial on electrode O2 value of error 0%.

**Keywords:**
Reinforcement; Schizophrenia; Interpolation

## INTRODUCTION

The brain is an organ that is very easy to adapt even though the neurons in the brain die do not undergo regeneration, the adaptive ability or plasticity of the brain in certain situations parts of the brain can take over the function of parts of the brain. The brain is a sensitive part of our body, which controls various bodily activities. This activity consists of various sensations and control of muscle activity to move, talk, see, and make (face) expressions (Harpale & Bairagi, 2015). The brain is the most important organ in the human body. Without the brain, humans cannot live and develop. This is proven by the function of the brain that is very sacred to the body. In this case the brain functions as a regulatory center for activity or movement, cognition, being able to make plans, be able to solve problems, provide judgment, stimulate creativity in humans, control feelings, control sexual-related behavior and also be able to speak in general (Kumbara, et al, 2015).

Therefore, the brain is the controller of the body. If someone has a healthy brain, it will encourage physical health. But on the contrary, if a person's brain is in an unhealthy condition, then that is the cause of all problems in our body.

In connection with this presentation, how important is the function of the brain in humans in their various roles both in interpreting the stimulus coming from outside (external) and from inside the body (internal), the stimulus that arises from sensory interaction with the surrounding environment, as part of its function as a translator of the brain is the recipient of the data and provides a reciprocal response to the stimulus.

As we all know, that fit in studying the design and structure of the brain is physiological and cognitive science, but in the Qur'an it has touched on the structure and function of the brain globally. Allah SWT says which reads:

كَلَّا لَئِن لَّمۡ يَنتَهِ لَنَسۡفَعَۢا بِٱلنَّاصِيَةِ ١٥

نَاصِيَةٖ كَٰذِبَةٍ خَاطِئَةٖ ١٦

Meaning:

> "You know, really if he does not stop (doing so) We will undoubtedly pull the crown. (that is) the crown of the one who denounces ungodly. "(QS. Al-Alaq verses 15-16).

The brain certainly will not be far from the name of reason, according to Al-Qur'an review, reason is hujjah or in other words is a gift of Allah SWT with human reason different from other creatures. Reason is also a tool that can convey the truth and at the same time as a proof and differentiator between the haq and the false, as well as what is found can be ascertained the truth. Speaking of the brain and reason, the Qur'an has a broad scope about the brain and reason, as in the following verse:

إِنَّ فِي خَلۡقِ ٱلسَّمَٰوَٰتِ وَٱلۡأَرۡضِ وَٱخۡتِلَٰفِ ٱلَّيۡلِ وَٱلنَّهَارِ لَأٓيَٰتٖ لِّأُوْلِي ٱلۡأَلۡبَٰبِ

That means

> "Indeed, in the creation of heaven and earth, and the alternation of night and day there are signs for intelligent people" (Q.S. Ali Imran verse 190).

Based on this, of course the brain has the most primary responsibility for all actions and reactions that have been made by the body, or as the central nervous system. Simply put, the nervous system is a communication network that controls every thought, emotion, impression, memory, and movement in the body. The nervous system works like a telephone line that allows the brain to be able to communicate with every part of the body through electrical signals. Thus the brain works using the electrical system, which produces small electrical signals in a regular pattern and is channeled through a network of nerve cells called neurons. The form of electrical activity can be seen and recorded using a device called an Electroensephalogram (EEG).

Electroencephalography (EEG) is an activity to record the spontaneous electrical activity of the brain during a certain period. EEG uses the electrical activity of neurons in the brain. The instrument used to record an EEG is called an electroencephalogram (Naibaho, 2015).

By using an Electroensephalogram (EEG) as an instrument to capture brain signals that can find out what is the effect of the stimulus received by a person to the reaction to brain activity through the EEG produced.

EEG signal measurement is done by placing electrodes on the scalp by following the specified electrode laying standards (Musthafa, et al, 2016).

The term Schizophrenia comes from the new Latin schizo which means "split" and phrenia which means "mind". This emphasizes that a person's mind is divided from reality, and that the individual is part of a chaotic and frightening world. Schizophrenia involves the breakup of an individual personality from reality and not the appearance of several personalities in one individual (King, 2010).

According to Arif (2006) argues that Schizophrenia is included in one of the severe mental disorders. Schizophrenia is a disorder with a series of symptoms which include disturbances in the context of thinking, forms of thought, perception, affect, sense of self, motivation, behavior, and interpersonal touch (Halgin & Susan, 2010).

Schizophrenics suffer from abnormal language production. The language abnormality is not only in terms of phonology, but also from changes in grammar and syntax. Thus causing his words to be very difficult to understand by those around him.

Schizophrenia is a pervasive disease that affects a broad range of psychological processes including cognitive, affect, and behavior. The following are the characteristics of schizophrenia according to (Nevid, 2003) as follows:

1) Interference in thoughts and speech

2) Disturbances in the form of thoughts

3) Lack of concentration

4) Impaired eye movements

5) Deficiencies in event-related potentials

6) Impaired perception

7) Emotional disorders

According to Endarmoko (2006), it is another word for reconstruction. In line with Mulyo (2014) stated that Reconstruction is a return as before.

According to Cooper, Nettler, Mahmoud, & Effendi (2002) Reconstruction is a process that does not end, but that does not mean giving birth to new legal rules in other words reconstruction is re-understanding, re-understanding and may not always be understood in depth by ordinary people. Reconstruction is the return of something to its original place. Preparation or depiction of existing materials and rearranged as they were or the original event (Marbun, 1996).

Based on this understanding, it can be concluded that the reconstruction has another term, namely reconstruction, which can be interpreted as a way to restore any situation whether it is an event, place, picture or so on to get the exact same result as the original.

Newton's interpolation method is used to find the intermediate points of n points. The general form of equations of Newton's order interpolation method n (Sahid, 2005) is as follows:

$f_n(x) = b0 + b1(x - x_0) + b2(x - x_0)(x - x1 + ... + bnx - x0x - x1...(x - xn - 1)$ (1)

The Lagrange interpolation method is used to find the intermediate points of n points. The general form of equations of Newton's order interpolation method n (Sahid, 2005) is as follows:

$P_n(x) = \sum_{i=0}^{n} a_i L_i(x) = a_0 L_0(x) + a_1 L_1(x) + \cdots + a_n L_n(x)$ (2)

which in this case

$$a_i = y_i, i = 1, 2, 3, \ldots, n$$

To calculate the percent error of both methods using the percent error formula (Rosmanita, 2017) is as follows:

$$\% \, eror = \frac{(Results\ Value\ - Default\ Value)}{Default\ Value} x\ 100\ \% \quad (3)$$

## METHODS

This research is a type of research with a qualitative method using a literature review approach and a quantitative method by using interpolation methods related to manual rebuilding. The stages are used in reconstructing by finding points manually and fitting data. The steps used in the manual re-electrode are stated in the groove as follows:

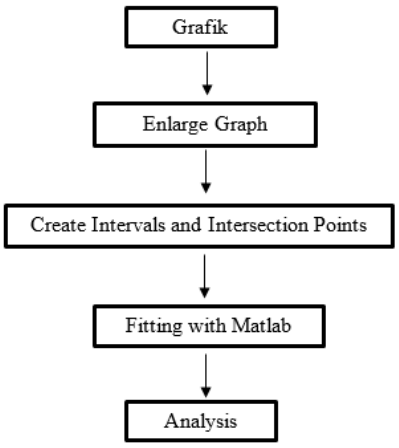


**Figure 1 Electrodes Manual Reconstruction in Schizophrenics**

Caption:

Chart

The graph is the result of spectral analysis obtained by Yudiansyah Akbar, et al (2016) who have various electrode results on the graph.

Enlarge Graph

Enlarge the graph is to do a screenshot first of the graph then done manually magnification.

Create Intervals and Intersection Points

Make intervals of the x-axis and y-axis to get the data that is suitable and accurate, there is no mistake in placing the intersection. Then the data intersection of the axis to be used as data for making points on matlab stored in the form of Microsoft Excel.

Fittings on matlab

In the process of fitting the matlab file that has been saved in the form of Microsoft Excel, a call is made using the matlab application to produce a plot point on the graph.

Analysis

At this stage the results of the fitting of the AF4 electrodes and O2 electrodes in schizophrenics to be used as a comparison material and do the interpolation method on the data.

Data collection techniques are the most important step in writing, because the main goal in research is to get data (Nasehuddien and Benefits, 2015). To obtain data completeness that is in accordance with the focus of the study, the data collection techniques are used through interviews and literature studies. This research is a type of research with a qualitative method using a literature review approach and a quantitative method by using interpolation methods related to manual reengineering. The stages are used in reconstructing by finding points manually and fitting data.

The interpolation method is the process of finding and calculating the value of a function whose graph passes a given set of points. These points may be the result of an experiment in an experiment, or obtained from a known function. Interpolation functions are usually selected from a group of specific functions, one of which is the most widely used polynomial function (Sahid, 2005).

## RESULT AND DISCUSSION

At this stage the graphs made by researchers from Akbar, Y., Handayani, N., Arif, I., Khotimah, SN, & Haryanto, F. (2016) which states that the recording results are data that have been done by previous researchers with the sampling frequency (fs) of recording is 128 Hz, so recording for 3 minutes (t) produces as many as 23040 data. As mentioned, the mathematical model that researchers use by using the Welch periodogram method, so that it can explore the content of EEG signals in the time domain and frequency domain simultaneously. EEG signals generated in the time domain will be difficult to analyze, but conversely if an observation or analysis in the frequency domain is made it will appear more clearly to have information content than in the time domain. By utilizing a welch periodogram which will be used to dig up information in the frequency domain. Analysis of the information content of EEG signals in the frequency domain is known as spectral analysis. The resulting graph is the following picture:

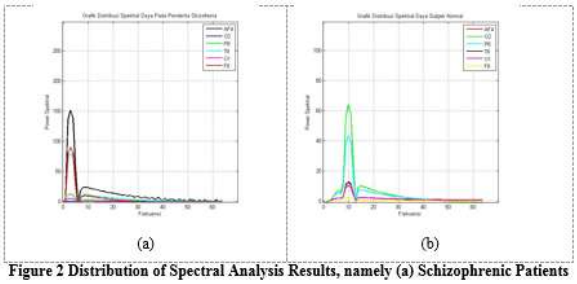


**Figure 2 Distribution of Spectral Analysis Results, namely (a) Schizophrenic Patients and (b) Normal People**

From various available electrodes, electrodes taken for further analysis and extraction are electrodes that have the highest and lowest spectral values, namely AF4 electrodes and O2 electrodes seen from spectral power in Schizophrenics. As for the results of a manual reset on the AF4 electrode and O2 electrode are the following pictures:

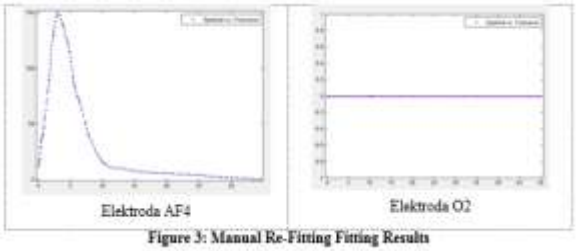


**Figure 3: Manual Re-Fitting Fitting Results**

Based on the analysis results, the equation of the interpolation method that can be used is the Newton order

polynomial interpolation equation n is n$f_n(x) = b0 + b1(x - x_0) + b2(x - x_0)(x - x_1) + \cdots + bn(x - x_0)(x - x_1) \ldots (x - x_{n-1})$and interpolation of the order n Lagrange polynomial are$P_n(x) = \sum_{i=0}^{n} a_i L_i(x) = a_0 L_0(x) + a_1 L_1(x) + \cdots + a_n L_n(x)$which in this case$a_i = y_i, i = 1, 2, 3, \ldots, n$. From this general equation the researcher has obtained an appropriate equation in the experimental data, namely by using the 4th order on the AF4 electrode and the 1st order on the O2 electrode. Therefore, the equation of the Newton order 4 polynomial interpolation method on the AF4 electrode is$f_4(x) = b0 + b1(x - x_0) + b2(x - x_0)(x - x_1) + b3(x - x_0)(x - x_1)(x - x_2) + b4(x - x_0)(x - x_1)(x - x_2)(x - x_3)$based on existing data points, the coefficients of b0, b1, b2 and b3 are then calculated. Whereas the equation of the Lagrange polynomial order 4 method interpolation on the AF4 electrode is$P_4(x) = a_0 L_0(x) + a_1 L_1(x) + a_2 L_2(x) + a_3 L_3(x) + a_4 L_4(x)$. Then produce a special equation from Newton order polynomial interpolation method 4 on the AF4 electrode$f_4(x) = 0{,}004601631\, x^4 + 7{,}38442291\, x^3 - 40{,}1243359\, x^2 + 92.2308455\, x + 12$. Whereas the equation of the Lagrange polynomial order 4 method interpolation on the AF4 electrode is$P_4(x) =$

$$\frac{12\, x^4 - 559{,}2\, x^3 + 5487{,}96\, x^2 - 16963{,}2\, x + 15624{,}36}{1302{,}03} +$$
$$\frac{90\, x^4 - 4041\, x^3 + 34290\, x^2 - 68931\, x}{-413{,}1816} +$$
$$\frac{150\, x^4 - 6540\, x^3 + 48979{,}5\, x^2 - 51451{,}5\, x}{540{,}54} +$$
$$\frac{50\, x^4 - 1960\, x^3 + 8362{,}5\, x^2 - 8797{,}5\, x}{540{,}54} +$$
$$\frac{0{,}5\, x^4 - 6{,}05\, x^3 + 19{,}94\, x^2 - 18{,}87\, x}{965990{,}34}.$$

Whereas the equation of the Newton order 1 polynomial interpolation method on the O2 electrode is$f_1(x) = b0 + b1(x - x_0)$based on existing data points, the coefficients of b0 and b1 are then calculated. Whereas the equation of the first order Lagrange polynomial interpolation method on the AF4 electrode is$P_1(x) = a_0 L_0(x) + a_1 L_1(x)$. Then produce a special equation from Newton order polynomial interpolation method 1 on the O2 electrode is$f_1(x) = 0\, x^4$. Whereas the equation of the first order Lagrange polynomial interpolation method on the O2 electrode is$P_1(x) = 0\, x^4$.

Then there is a difference between Newton Order 4 polynomial interpolation method and Lagrange Order 4 polynomial interpolation method on AF4 electrodes, which is percent error using Newton order 4 when the graph is at the top until it is still stable with an average value of error of 14,118% as well as the polynomial error using Lagrange order 4 is much better than Newton's order 4 with an average value of 4.69% error. While there is a similarity between Newton order 1 polynomial interpolation method with Lagrange order 1 polynomial interpolation method on the O2 electrode, the percent error value is 0%. Of course in this case if you want to produce a better value (stable), you must use a higher order.

## CONCLUSION AND IMPLICATION

The results of this study can be concluded that the EEG signal in the human brain can record that illustrates the electrical activity in the human brain by using electrodes mounted on the scalp and in accordance with the installation procedure. EEG signals in the human brain can describe the condition of the human brain that is normal or sick / sufferers of brain disorders. Thereby utilizing EEG signals in the human brain as a communication tool and detect whether someone who is conducting an experiment (patient) is affected by diseases related to brain and psychiatric disorders in humans or not (normal).

Manual re-editing of the AF4 and O2 electrodes in schizophrenics has a variety of ways, namely (a) graph of the results of analysis, (b) enlarging the graph, (c) for intervals and intersection points, (d) fittings in the matlab and (e) analysis..

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