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Advance in Science, Technology and Engineering System

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31 Agustus 2020	Artikel disubmit melalui manuscripts management jurnal dengan judul: Human Emotion Recognition Based on EEG Signal Using Fast Fourier Transform and K-Nearest Neighbor (lampiran 1. Bukti email dan foto manuscripts management jurnal)		4
05 September 2020		Email konfirmasi dari editor bahwa artikel telah diterima dengan kode 20M-09-754 (Lampiran 2. Email editor dan lampiran artikel yang dikirim)	5
02 Oktober 2020		Email hasil review dan penyampaian saran dari reviewer untuk di lakukan perbaikan secara signifikan pada tata bahasa, abstrak, konten pembahasan, fokus penelitian, dan similarity rate harus dibawah 19% . (Lampiran 3. Bukti email (decision), dan list comment dari reviewer)	18
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13 November 2020		Email dari editor memberikan notifikasi tentang deadline revisi lampan 8. Bukti email (revision reminder))	23
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Lampiran 1

    a.   Email konfirmasi dari editor

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Author(s): Akbar Muslim
Corresponding Author: Akbar Muslim
Affiliation of Corresponding Author: Ahmad Dahlan University
Date of Manuscript Submission: 31-Aug-2020 (UTC)

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Manuscript ID: 20M-09-754
Title: Human Emotion Recognition Based on EEG Signal Using Fast Fourier Transform and K-Nearest Neighbor
Author(s): Akbar Muslim, Anton Yudhana, Ahmad Azhari, Murein Miksa Mardhia
Corresponding Author: Akbar Muslim
Affiliation of Corresponding Author: Ahmad Dahlan University
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Manuskrip

Human Emotion Recognition Based on EEG Signal Using Fast Fourier Transform and K-Nearest Neighbor

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Abstract : Human emotional states can transform naturally and are recognizable through facial expressions, voices, or body movements, influenced by received stimuli. However, the articulation of emotions is not practicable by every individual, even when feelings of joy, sadness, or otherwise are experienced. Biomedically, emotions affect brain wave activities, as the continuously functioning brain cells communicate through electrical pulsations. Therefore, an electroencephalogram (EEG) is used to capture input from brain signals, study impulses, and determine the human mood. The examination generally included observing a person's frame of mind in response to a given stimulus where the immediate results were inconclusive. In this study, the associated classifications were normal, focused, sad, and shocked. The raw brainwave data from 50 subjects were recorded by employing a single-channel EEG called the Neurosky Mindwave. Meanwhile, the assessments were performed while the candidates' minds were stimulated by listening to music, watching videos, or reading books. The Fast Fourier Transform (FFT) method was utilized for feature extractions, along with the K-nearest neighbours (K-NN) for classifying brain impulses. The parameter k had a value of 15, and the average classification accuracy was 83.33%, while the highest accuracy for the focused emotional state was 93.33%. The Neurosky Mindwave in conjunction with the FFT and KNN techniques is potential analytical solutions to facilitate the enhanced identification of human emotional conditions.

Introduction

The signal of the brainwaves has specific traits and characteristics of the person. The brainwaves cannot be imitated or interpreted by individuals so that there is no chance of resemblance. Identity recognition is essential to identify the features of the person [1].

Identity development is done using biometric technology, which aims at personality-implantation through the use of parts of the body or social behavior—application of Identity Recognition using Biometrics Technology for self-recognition by using parts of the body or human behavior [2-6]. In [7], the author has presented machine-learning algorithms to categorize EEG dynamics according to subject self-reported emotional states during music listening. Support Vector Machine was employed to classify four emotional states and obtained an accuracy of 82.29% across 26 subjects. Vanitha [8] has used Hilbert-Huang Transform (HHT) to remove artifacts and relevant time-frequency features from the EEG signal, and the extracted features are manipulated to detect stress levels using Support Vector Machine (SVM) Classifier on real-time stress detection.

EEG is used as a diagnostic tool by medicine. In comparison, a broader application of the EEG is to analyze a person's mental state, thought patterns, or emotional state [9, 10]. The EEG signal's visual observation is real, given the very low amplitude of the EEG signal, and the pattern is very complex. In addition, EEG signals are strongly influenced by various variables, including emotional conditions, health, respondent activity, environment, electrical disturbances from other organs, and external stimuli [11,12]. Conducting the introduction of the EEG signal requires a pattern of brain activity that is prominent and constant. This pattern emerged due to specific stimulation from volunteers. EEG signals are shown to provide more insight into the subject's emotional processes and responses. The recorded EEG signals will get the waveform, the duration, the orientation of the signal, and the signal rhythm. [13-15].

The EEG signal pattern data's shape and position are not yet known because the signal pattern and response speed response of each individual's brain to the received stimuli are different [16]. Therefore, we need a signal processing method EEG that can pattern specific brain activity [17].

In this study, the Fast Fourier Transform (FFT) based spectrum analysis method converts the EEG signal from the time domain to frequency domain. The FFT results were classified by K-Nearest Neighbor (KNN) as a training data set to characterize the brain wave output from the EEG as a material for analyzing differences in brain waves in each emotional state studied.

Data Acquisition

2.1 Neuurosky Mindwave Mobile

Neurosky Mindwave Mobile is a brain-computer interface (BCI) device that can be used wirelessly and connected to several devices such as computers and smartphones via Bluetooth connection to collect input from the human brain wave activity [18].
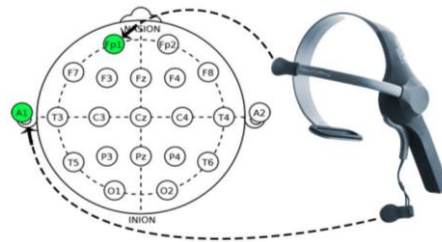

Figure 1: Neurosky Mindwave Mobile and electrode's position

Mindwave provided single-channel EEG in the form of an electrode and placed in the forehead or Fp1 position to measure the brain's electrical voltage and ear-clip on the left ear or A1 position as ground. With Neurosky's ThinkGear and eSense technologies, connected devices can receive a real-time visual representation of brain waves generated from the electrodes [19, 20].

1.1. Subjects

In this study, EEG data were recorded from 50 subjects aged around 20 - 22 years old who were in healthy condition. All of the subjects were undergraduate students and were informed about the purpose of this experiment.

1.2. Stimuli

The use of appropriate stimuli is needed to get better brain wave recording results where a psychologist has validated the stimulus used for this study. Respondents were given stimuli in the form of listening to music, watching videos, and mathematical calculations to influence brain wave activity in the subject to produce an emotional condition that was following the object to be studied [21,22].

1.3. Procedure of Data Collecting

Before starting data collection, make sure that the respondent is in good health. The data collection process is carried out in a quiet and calm place to make subjects feel comfortable and reduce disturbances affecting data collection. We use the computer laboratory at Ahmad Dahlan University for this research.

Figure 2 : Illustration of the data collecting process

Data collection will be needed as much as 200 data with 50 respondents and carried out four times with a span of at least two days. The recording time for data collection is 7 minutes. When the recording begins, the respondent will be given a stimulus in instrumental music, video, and math questions [23].

3. Methods

3.1 Fast Fourier Transform (FFT)

FFT is applied in various fields,from digital signal processing and solving partial differential equations to algorithms to multiplicate integers in large numbers. FFT is an algorithm for calculating discrete Fourier transforms (DFT) quickly and efficiently. Because many signals in a communication system are continuous in the time domain, we use the Fourier transform to represent the frequency domain [24].
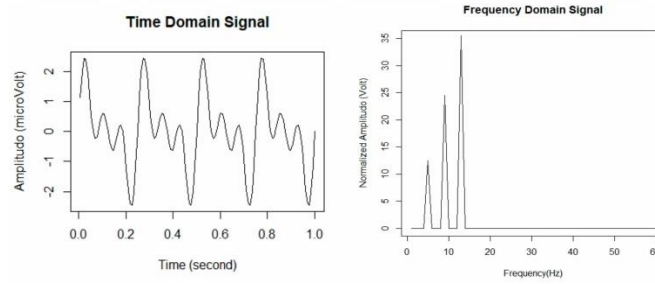

Figure 3: Time-domain signal and frequency domain of EEG signals

FFT is a reliable method for signal processing in the form of a sine wave as EEG signals, and it was proven in previous studies related to real-time applications because of superior speed compared to other available methods. However, it is not suitable for the analysis of short EEG signals [25]. The FFT formula is defined in (1).

$$S(f) = \int_{-\infty}^{\infty} s(t)e^{-j2\pi ft}dt \tag{1}$$

where $S(f)$ is a signal in the frequency domain, $s(t)$ is a signal in the time domain, and $e^{-j2\pi ft}$ is a constant value of a signal, f is frequency, and t is time.

FFT algorithm is used to reduce the complex transformations performed by DFT. For comparison, when using DFT, then the transformation complexity is N2. Meanwhile, with the FFT algorithm and faster transformation times, the complexity of the transformation is too decreased to (N) log (N).

3.2 K-nearest neighbor

K-Nearest Neighbor is a method for classifying objects based on training data closest to the object. The data is then presented with a distance measure to be processed into a mathematical calculation. In this classification, the calculation is done by using Euclidean Distance. The training data with the closest distance are said to be neighbors and then sorted from the closest distance to the farthest distance. Each neighbor is different from one another or the like. Similar neighbors with the largest number among k neighbors correspond to the object being classified [26]. To find the neighbor, it uses distance metrics like euclidean distance as given in equation (2) .

$$D(x, y) = \Sigma_{k=1}^{N}\sqrt{(x_k - y_k)^2} \tag{2}$$

where $D (x, y)$ is the distance between x and y facilities, x_k-y_k is the x and y coordinates of variable k ($k = 1,3,5,…$ n). The value of k must be an odd number, and the number of training data is even to avoid ambiguity. This value is necessary to facilitate the achievement of classification results from the number of closest neighbors. When there is a class with the most neighbors, the test data will get that class result [27].

3.3 Hardawre Design

The block diagram above shows that Neurosky Mindwave Mobile is a major component in this hardware system. Neurosky captures input from brain waves via electrodes attached to the FP1 area of the respondent's head and sends an EEG signal via a Bluetooth connection, which acts as a communication protocol between Mindwave and PC / Laptop.

Figure 4: Hardware system diagram

3.4 Software Design

The block diagram above explains that when raw EEG data is obtained from recording brain waves using Neurosky Mindwave on respondents who have been given a stimulus. Raw data taken in the signal pre-processing stage is cut 2 seconds early to minimize noise at the beginning of the recording, due to external interference such as a Bluetooth connection between the recording device and the application, or due to the imperfect installation of the device on the respondent's head. The next stage of feature extraction is carried out using the FFT algorithm to convert the EEG signal in the time domain into the frequency domain and extract all important frequency components from the EEG signal such as Delta waves (0.1 - 3 Hz), Theta (4 - 7 Hz.), Alfa (8 - 12 Hz), Beta (12 - 30 Hz), and Gamma (30 - 100 Hz) [28].From the results of feature extraction, a huge amount of data is obtained, and data simplification must be done by not including data that is below the average value so that the classification results are more accurate for each emotion. Furthermore, grouping training data and test data are carried out using the KNN classification method in mathematical calculations with the Euclidean formula to calculate the closest distance to the results of the FFT feature extraction. The final step is to determine the accuracy of the KNN classification results on waves using the Confusion Matrix.
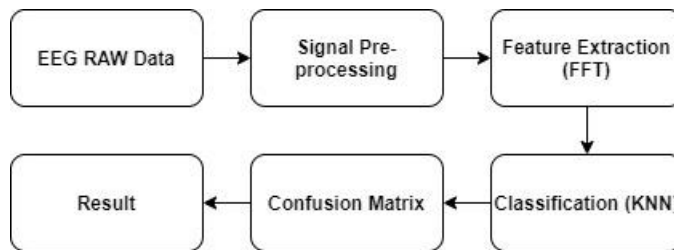

Figure 5: System design diagram

4. Result

In this research, several experimental stages were carried out. The first step is signal pre-processing to reduce noise in raw data, then feature extraction to change the form of RAW data from brain waves to the FFT spectrum. Second, monitoring the FFT results in each emotional state, followed by taking all the highest data from the FFT spectrum with a range of 0.2 Hz. Finally, KNN is used to classify emotions (normal, focused, sad, and shocked) and calculate accuracy using a confusion matrix.

4.1 Feature Extraction of Raw Data

As previously explained, FFT feature extraction with a sampling frequency of 512 Hz is used to convert the time domain signal from raw data to the frequency domain. We use MATLAB2016b software to do this process. The results of running the program can be seen in Figure 6 below.

The picture above shows the feature extraction program results, which produces two different forms of signal output with the same raw data input from subjects who have been given a stimulus in the form of listening to instrumental music. It can be seen that the signal in the time domain has data along with 2.13×10^5 ms with the highest amplitude of 631, which is in the range of 1.32×10^5 ms, while the signal in the frequency domain has data with a range of 0 - 50 Hz where the highest amplitude value is at a frequency of 2.26 Hz. These results will show a different value for each respondent due to different human brain wave activity against the given stimulus.
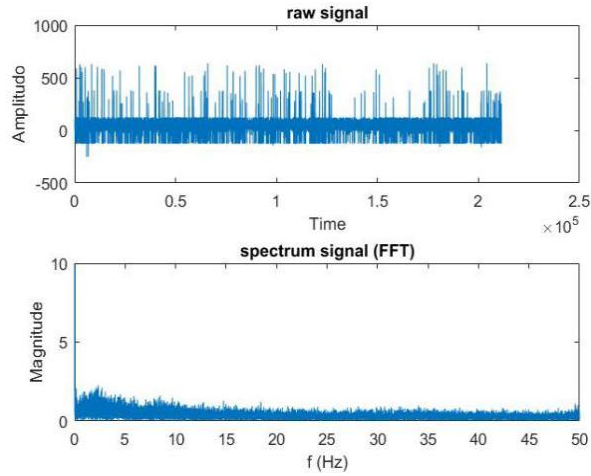
Figure 6: Feature extraction result of raw data

4.2 FFT Spectrum Comparison

In this stage, a comparison of four signal combinations resulted from FFT feature extraction that represented the subject's emotional condition. The results of running programs are shown in Figure 7.
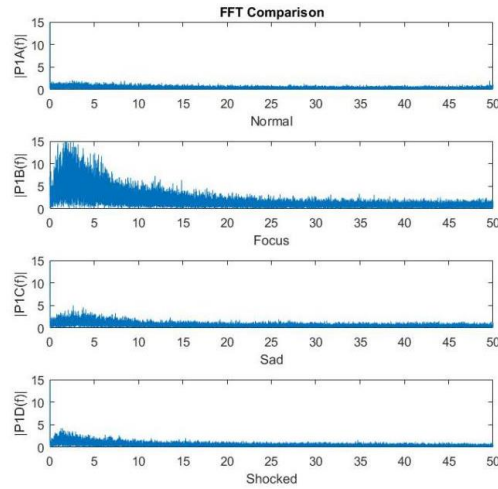
Figure 7: FFT spectrum of all emotional state

10

It can be seen that the spectrum of the FFT signal in four emotional states, namely Normal, Focus, Sad, and Shocked. When the spectrum is observed, there is a significant difference from the shape of the spectrum wherein the Focused and Normal emotional state, the difference in the form of the spectrum is very recognizable compared to the Sad and Shocked emotional states.
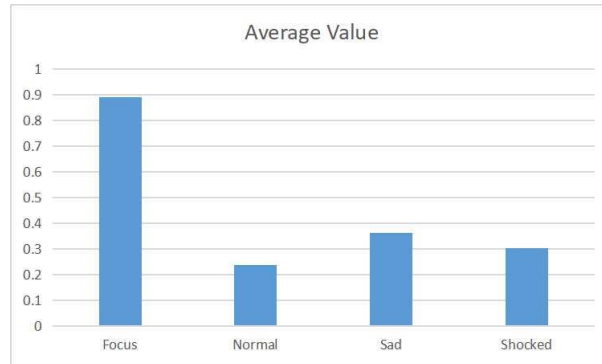

Figure 8: The average value of amplitude in the FFT spectrum

Then the amplitude value is compared to prove the truth of the observations. However, each spectrum with a frequency range of 0 - 50 Hz produces hundreds of thousands of data so that only the average value from data will be taken. Normal emotions get an average score of 0.2386, Focus 0.8904, Sad 0.3625, and Shocked 0.3044. Figure 8 shows the average value of the FFT spectrum.

From a comparison of the average values on each FFT spectrum, focus emotional state has the highest amplitude and lowest for Normal emotions, between Sad and Shocked emotions there is a small difference in the average results so that it can be proven the truth of observation result on the FFT spectrum.

4.3 Collecting Data Based on Spectrum Peaks

A reduction process is carried out at this stage at a frequency of 50 Hz to 10 Hz because the fluctuation of data values in the FFT spectrum always occurs at frequency range 0-10 Hz. Figures 9 to 12 show the results of the reduction process.
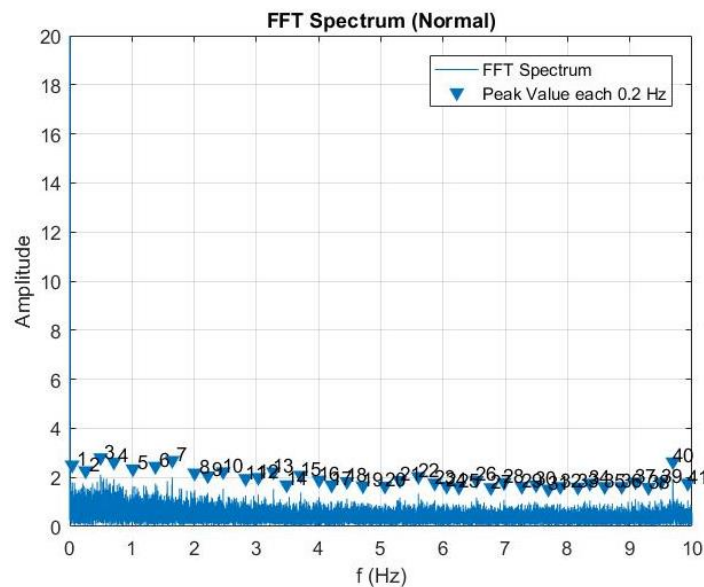

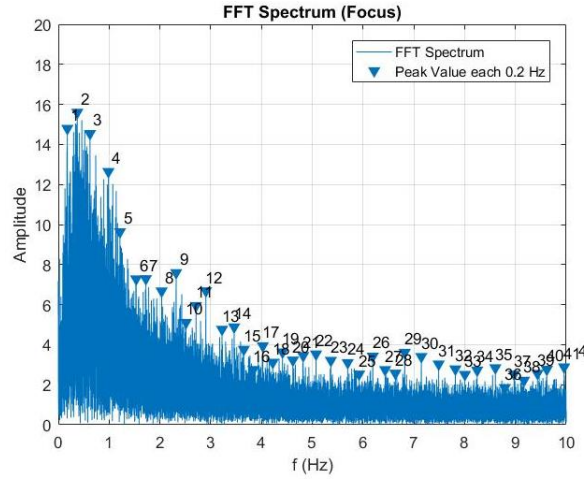**Figure 9**: FFT Spectrum of Normal emotion

11

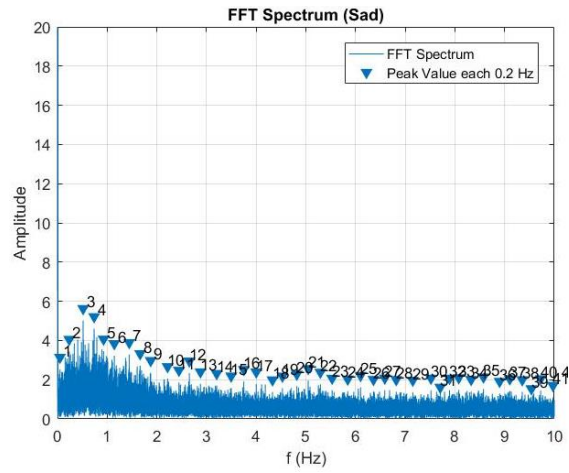**Figure 10**: FFT spectrum of Focus emotion
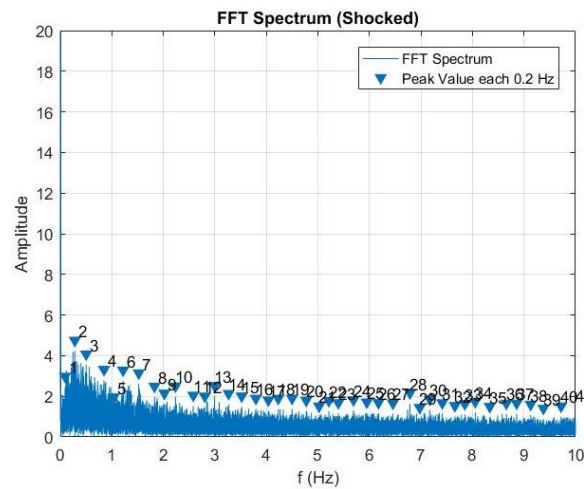

Figure 13. FFT spectrum of Sad emotion

Figure 11. FFT spectrum of Shocked emotion

The Values at the highest peaks of the marked frequency spectrum will be collected from the figure above. The frequency in the range 0 - 10 Hz produces 40 data by looking for the highest peak value every 0.2 Hz. Then, from 40 data, each 10 data's average value will be sought to produce four average values used as material for the classification process. The results of the average value are shown in table 1.

Table 1. Frequency average value

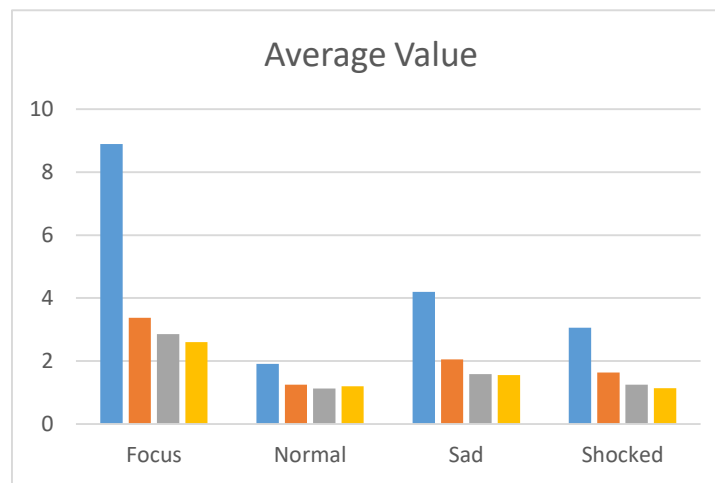| Focus	Normal	Sad	Shocked
8.891733187	1.908573527	4.199081623	3.059306615
3.371044125	1.2510798	2.052021058	1.633249441
2.851979474	1.124556395	1.583934658	1.250179144
2.597699756	1.202698894	1.554512291	1.136366638

Figure 12. Average value of FFT based on spectrum peaks

If the reduction process is not carried out in the FFT spectrum, then based on the previous discussion (4.2), it is explained that the frequency in the range 50 Hz produces hundreds of thousands of EEG data and a minimum average value, which can complicate the classification process. We get between the results of previous observations and the current calculations to get very similar results from this process. It can be proven that the results of recording brain waves with the stimulus used to produce good data quality.

4.4 KNN Classifier

In this process, 50 respondents studied and recorded brain waves four times obtained 200 data with 140 training data and 60 testing data. The KNN classification is then carried out to determine the results of the subject's actual emotional state from the 60 testing data.
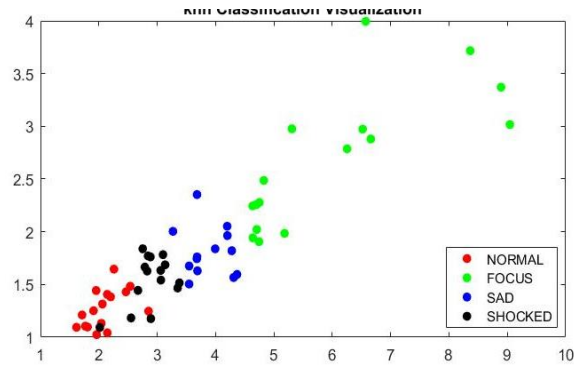
Figure 12. Visualization of KNN classification

The KNN classification results run through MATLAB2016b are displayed in a scatter chart and the coordinate points. It can be seen that each color at the coordinate point is a representation of the emotional condition of the subject, which forms a group based on the value obtained from 60 testing data. If observed, there are several color points whose coordinate values are closer to other neighboring groups. This indicates a change in the status of the color point. more clear results are shown in Table 2 below

Table 2. Result of KNN Classifier

	Match	Error	Match	Error	Match	Error
k **Values**	7		15		23	
Normal	11	4	**13**	**2**	13	2
Focus	13	2	**14**	**1**	12	3
Sad	9	6	**12**	**3**	11	4
Shocked	12	3	**11**	**4**	12	3
Total	45	15	**50**	**10**	48	12

The table above shows that the KNN classification results using the k = 15 value are the best choice among k = 7 or k = 23. Sixty test data produces 50 data that corresponds to the original emotional state status, and 10 data does not match. Then perform accuracy testing using the confusion matrix as in table 3 below.

Table 3. Accuracy result using confusion matrix

	Accuracy		
k **Values**	7	15	23
Normal	73.33%	**86.66%**	86.66%
Focus	86.66%	**93.33%**	80.00%
Sad	60.00%	**80.00%**	73.33%
Shocked	80.00%	**73.33%**	80.00%
Average	74.99%	**83.33%**	79.99%

From the table above, the highest average accuracy is obtained from the results of the KNN classification using a value of k = 15 with a result of 83.33%, where the accuracy value of the focused emotional state gets the highest result of 93.33%, followed by a normal emotional state of 86.66%, 80% sad emotional state, and shocked get the lowest accuracy of 73.33%. Differences in accuracy results using the right stimulus dramatically affects the accuracy obtained. Regulations about sad emotions and focus are needed to help improve the accuracy of the results obtained.

5. Conclusion

This study aims to identify human emotions towards a given stimulus by applying the FFT method as feature extraction from the raw data generated by recording brain waves using the Neurosky Minwave mobile with the KNN method using the variable k = 15 to classify the FFT spectrum. Accuracy in each emotional state studied was performed using a confusion matrix where the best accuracy was obtained for Focus emotions as much as 93.33%, followed by Normal emotions 86.66%, Sad 80%, and Shocked getting the lowest accuracy results of 73.33%. The results of the average accuracy in the classification of brain waves were 83.33%. This research found that FFT and KNN can be used as alternatives in the EEG signal analysis method.

Acknowledgment

References

[1] A. Yudhana, S. Mukhopadhyay, I.R. Karas, A. Azhari, M.M. Mardhia, S.A. Akbar, A. Muslim, F.I. Ammatulloh, "Recognizing Human Emotion patterns by applying Fast Fourier Transform based on Brainwave Features," Proceedings - 1st International Conference on Informatics, Multimedia, Cyber and Information System, ICIMCIS 2019, 249–254, 2019, doi:10.1109/ICIMCIS48181.2019.8985227. This paper is an extension of work originally presented in *International Conference on Informatics, Multimedia, Cyber and Information System (ICIMCIS).*

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Lampiran 3 Bukti email (decision), dan list comment dari reviewer.

[ASTESJ, 20M-09-754] Review results of your manuscript

1 message

ASTESJ <no-reply@manuscriptlink.com>   Fri, Oct 2, 2020 at 1:19 AM
To: akbar1500022007@webmail.uad.ac.id
Cc: w.x.ying@astesj.com

Dear Mr. Akbar Muslim,

We have completed our review process for the following manuscript submitted to the *Advances in Science, Technology and Engineering Systems Journal*.

Track: Special Issue Paper
Special Issue/Section: Special Issue on Multidisciplinary Innovation in Engg Science & Tech
Manuscript ID: 20M-09-754
Title: Human Emotion Recognition Based on EEG Signal Using Fast Fourier Transform and K-Nearest Neighbor
Author(s): Akbar Muslim, Anton Yudhana, Ahmad Azhari, Murein Miksa Mardhia
Corresponding Author: Akbar Muslim
Affiliation of Corresponding Author: Ahmad Dahlan University
Date of Manuscript Submission: 31-Aug-2020 (UTC)

Overall review result: Major Revision Required

The second half of this email contains important review comments and you can also find them in the following online system.

* Online System URL: https://www.manuscriptlink.com/journals/astesj

You should revise your manuscript according to reviewers' comments and resubmit it to the above online system for reconsideration.

You should also write a reply letter giving a point-by-point response to the reviewers' comments. The reply letter should be uploaded as a seperate file in addition to your revised manuscript.

The deadline for submission of the revised manuscript and reply letter is 15-Oct-2020. If you have any question regarding the revised manuscript, please contact the journal manager.

Thank you for submitting your manuscript to the *Advances in Science, Technology and Engineering Systems Journal*.

Review Results

- Comments of Guest Editor-
The paper requires significant editing. Reduce the plagiarism up to 19%. Find the report on the following link.
https://u.pcloud.link/publink/show?code=XZDgu0XZ9hbRMD2fILQFd07fpBhQhXIz4GhV
Please make your contribution and the novelty of your work very clear to readers. The final decision regarding the publication will be based on your revised manuscript.

- Reviewer Review Scores and Comments -
Reviewer #1

Overall Judgement: Reject in current form, but may be resubmitted

In this paper, the human emotion four different states was identified using FFT and KNN.. The finding of this study may be interested, but there are many serious problems. First of all, the language is very poor. Secondly, the content is not scientific and innovative enough, and the research depth is not enough.
Then the experimental results are not further compared with the existing methods .
More importantly, the discussion is insufficient and the content of the discussion is not very technically relevant.
In general, the quality of the article needs to be improved.

Reviewer #2

Overall Judgement: Accept with minor changes

1. Abstract must represent the contents of the report.

2. Research methodology contains no information on the experimental research design used as well as how data were obtained for the study.

Reviewer #3

Overall Judgement: Accept with minor changes

conclusion and abstract part need to reframe.some grammatical mistakes found in text.

Reviewer #4

Overall Judgement: Accept with minor changes

1-Paper can be accepted
2-Abstract is the summary of the research work. The main parameters of the abstract are: what, how, and why. What: It includes definition of the research work means what is going on in research work. How: It covers methodology part means define a technique/ methodology that help to execute your research work. Why: It focus application of the research work means where it can use. Abstract should not be more than 250 to 450 word. Overall, your abstract may be more meaningful if you write your abstract as per above parameters
3-Proposed Algorithm/ Methodology is a process or set of rules to be followed in calculations or other problem-solving operations. It should be written in proper way with comments that help to understand. Overall, It may include step by step in this paper.
4-A conclusion is the last part of something, its end or result. When you write a paper, you always end by summing up your arguments and drawing a conclusion about what you've been writing about. Overall, your paper may conclude more better way

Reviewer #5

Overall Judgement: Accept with minor changes

No comments to the researchers. The researchers established the originality of their research goal by establishing the need for research in the subject area
----

Prof. Wang Xiu Ying, Guest Editor
Advances in Science, Technology and Engineering Systems Journal
Email: w.x.ying@astesj.com
Homepage: https://www.astesj.com

Lampiran 4.

    a. Bukti Submit manuscripts management jurnal

File Name	File Designation	Upload Date
1 mainDocument-1[20M-09-754]-Revision1_human emotion recognition basen on eeg signal using fast fourier transform and k-nearest neighbor.docx	Main Document (Required)	15-Oct-2020
2 replyLetter-1[20M-09-754]-Revision1_reply letter.pdf	Reply Letter	15-Oct-2020

b. Reply Letter

Reply Letter

Dear Prof. Wang Xiu Ying,
Guest Editor-in-Chief
Special Issue on Multidisciplinary Innovation in Engineering Science & Technology
Advances in Science, Technology and Engineering System Journal (ASTESJ)

October 15th, 2020

Thank you for your email dated 2-Oct-2020 enclosing the reviewers comments. We have carefully reviewed the comments and have revised the manuscript accordingly. Our responses are given in a point-by-point manner below. Changes to the manuscript are shown in underline/red/bold.

We apologize for resubmitting at the end of the submission deadline.

we hope the revised version is now suitable for publication and look forward to hearing from you in due course.

Sincerely,

Anton Yudhana
Lecturer and Researcher

Response to Reviewer 1:
First of all, we deeply appreciate your comments of our paper . We have answered each of your points below.

Comments from reviewer 1 :
In this paper, the human emotion four different states was identified using FFT and KNN. The finding of this study may be interested, but there are many serious problems. First of all, the language is very poor. Secondly, the content is not scientific and innovative enough, and the research depth is not enough.
Then the experimental results are not further compared with the existing methods . More importantly, the discussion is insufficient and the content of the discussion is not very technically relevant.
In general, the quality of the article needs to be improved.

Response :
1. We have improved the quality of the language by correcting each sentence used to make it grammatically appropriate.

2. At this point, we conducted a more in-depth study by revising the contents of the abstract and re-testing the FFT feature extraction process and KNN classification on the raw data obtained from brain wave recording.

3. After the retest process on FFT extraction and KNN classification with 140 training data and 60 test data used. we got an increase in the average accuracy result from 81.66% to 83.33%. where an increase in accuracy was obtained in a sad emotional state from 73.33% to 80%.

4. The discussion material has been improved by reviewing all the information in the paper so that the information from the discussion content becomes more technically relevant.

Response to Reviewer 2:
Thank you for your valuable comments. Our answers to your points are as follows.

Comments from reviewer 2:
1. Abstract must represent the contents of the report.

2. Research methodology contains no information on the experimental research design used as well as how data were obtained for the study.

Response :
1. We have made improvements to the abstract by adding some explanations based on the content of the paper.

2. Information in the contents of the explanation regarding how to collect data on respondents, FFT, KNN, design of hardware, and software has been improved.

Response to Reviewer 3:
Thank you for your helpfull comments.

Comments from reviewer 3 :
conclusion and abstract part need to reframe.some grammatical mistakes found in text.

Response :
We have improved the abstract and conclusion's language quality by correcting each sentence used to make it grammatically appropriate.

Response to Reviewer 4:
We deeply appreciate your helpful comments. Our answers to your points are as follows.

Comments from reviewer 4 :
1. Paper can be accepted

2. Abstract is the summary of the research work. The main parameters of the abstract are: what, how,and why. What: It includes definition of the research work means what is going on in research work. How: It covers methodology part means define a technique/ methodology that help to execute your research work. Why: It focus application of the research work means where it can use. Abstract should not be more than 250 to 450 word. Overall, your abstract may be more meaningful if you write your abstract as per above parameters

3. Proposed Algorithm/ Methodology is a process or set of rules to be followed in calculations or other problem-solving operations. It should be written in proper way
with comments that help to understand. Overall, It may include step by step in this paper.

4. A conclusion is the last part of something, its end or result. When you write a paper, you always end by summing up your arguments and drawing a conclusion about what you've been writing about.
Overall, your paper may conclude more better way

Response :
1. Thank you very much. We hope that our paper can be received after the revision process is carried out.

2. An improvement to the abstract has been made where the abstract contains 220 words based on the parameters you described in the comments.

3. Corrections have been made regarding the contents of the FFT and KNN methods so that the stages can be explained based on the algorithm used.

4. Conclusions have been written which cover the entire content of the research process.

Response to Reviewer 5:
Thank you for the judgment. We have made changes to improve the quality of our paper.

Lampiran 5 Bukti email telah submit artikel revisi

[ASTESJ, 20M-09-754] Acknowledgment of a revised manuscript submission
1 message

ASTESJ <no-reply@manuscriptlink.com>   Thu, Oct 15, 2020 at 8:03 PM
To: akbar1500022007@webmail.uad.ac.id

Dear Mr. Akbar Muslim,

Thank you for submitting a revised version of the following manuscript to the *Advances in Science, Technology and Engineering Systems Journal.*

Track: Special Issue Paper
Special Issue/Section: Special Issue on Multidisciplinary Innovation in Engg Science & Tech
Manuscript ID: 20M-09-754
Title: Human Emotion Recognition Based on EEG Signal Using Fast Fourier Transform and K-Nearest Neighbor
Author(s): Anton Yudhana, Akbar Muslim, Dewi Eko Wati, Intan Puspitasari, Ahmad Azhari, Murein Miksa Mardhia
Corresponding Author: Anton Yudhana
Affiliation of Corresponding Author: Ahmad Dahlan University
Date of Manuscript Submission: 15-Oct-2020 (UTC)

In a couple of days, a confirmation e-mail will be again forwarded to you when we look through your submission and confirm it. Further progress on your submission can be checked through the following online system:

* Online System URL: https://www.manuscriptlink.com/journals/astesj

If you have any question regarding your submission, please contact the journal manager.

Best regards,

Prof. Wang Xiu Ying, Journal Manager
Advances in Science, Technology and Engineering Systems Journal
Email: w.x.ying@astesj.com
Homepage: https://www.astesj.com

Lampiran 6 Email konfirmasi artikel diterima oleh editor

[ASTESJ, 20M-09-754] Confirmation of a revised manuscript submission Inbox ×

ASTESJ no-reply@manuscriptlink.com via amazonses.com   Fri, Oct 16, 2020, 1:41 AM
to me, w.x.ying

Dear Mr. Akbar Muslim,

Thank you for submitting a revised version of the following manuscript to the *Advances in Science, Technology and Engineering Systems Journal.*

Track: Special Issue Paper
Special Issue/Section: Special Issue on Multidisciplinary Innovation in Engg Science & Tech
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Author(s): Anton Yudhana, Akbar Muslim, Dewi Eko Wati, Intan Puspitasari, Ahmad Azhari, Murein Miksa Mardhia
Corresponding Author: Anton Yudhana
Affiliation of Corresponding Author: Ahmad Dahlan University
Date of Manuscript Submission: 15-Oct-2020 (UTC)
Similarity rate (%): 17.0 %

Lampiran 7 Email dari editor berisi list comment dari reviewer terkait hasil revisi artikel

UNIVERSITAS
AHMAD DAHLAN

Akbar Muslim <akbar1500022007@webmail.uad.ac.id>

[ASTESJ, 20M-09-754] Review results of your manuscript
1 message

ASTESJ <no-reply@manuscriptlink.com>   Mon, Nov 2, 2020 at 1:03 AM
To: akbar1500022007@webmail.uad.ac.id
Cc: w.x.ying@astesj.com

Dear Mr. Akbar Muslim,

We have completed our review process for the following manuscript submitted to the *Advances in Science, Technology and Engineering Systems Journal*.

Track: Special Issue Paper
Special Issue/Section: Special Issue on Multidisciplinary Innovation in Engg Science & Tech
Manuscript ID: 20M-09-754
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Corresponding Author: Anton Yudhana
Affiliation of Corresponding Author: Ahmad Dahlan University
Date of Manuscript Submission: 15-Oct-2020 (UTC)
Similarity rate (%): 17.0 %

Overall review result: Major Revision Required
The second half of this email contains important review comments and you can also find them in the following online system.
* Online System URL: https://www.manuscriptlink.com/journals/astesj

You should revise your manuscript according to reviewers' comments and resubmit it to the above online system for reconsideration.

You should also write a reply letter giving a point-by-point response to the reviewers' comments. The reply letter should be uploaded as a seperate file in addition to your revised manuscript.

The deadline for submission of the revised manuscript and reply letter is 15-Nov-2020. If you have any question regarding the revised manuscript, please contact the journal manager.

Thank you for submitting your manuscript to the *Advances in Science, Technology and Engineering Systems Journal*.

Review Results

- Comments of Guest Editor-
The paper still requires significant editing. Please make your contribution and the novelty of your work very clear to readers. The final decision regarding the publication will be based on your second revised manuscript.

- Reviewer Review Scores and Comments -
Reviewer #1

Overall Judgement: Reject in current form, but may be resubmitted

Authors have tried to answer many of the reviewers comments, but still paper need one more revision on following points:

1. the grammetical errors need to be corrected; eg: "EEG signals were recorded will get the waveform, the duration,......." ; "EEG signal pattern data the resulting form and position are not yet known due to the signal pattern and speed of response of........" and in few more places such grammetically in correct sentences are there.
2. The experimental results are not further compared with the existing state of art methods, because of which the novelty of the work is not very clear.

Lampiran 8. Email peringatan deadline revisi

UNIVERSITAS
AHMAD DAHLAN

Akbar Muslim <akbar1500022007@webmail.uad.ac.id>

[ASTESJ, 20M-09-754] [Before Due Date] Gentle reminder for the manuscript update and re-submission
1 message

ASTESJ <no-reply@manuscriptlink.com>
To: akbar1500022007@webmail.uad.ac.id
Cc: w.x.ying@astesj.com

Fri, Nov 13, 2020 at 5:07 AM

Dear Mr. Akbar Muslim,

Recently, you have been requested to submit a revised version of the following manuscript submitted to the *Advances in Science, Technology and Engineering Systems Journal*.

Track: Special Issue Paper
Special Issue/Section: Special Issue on Multidisciplinary Innovation in Engg Science & Tech
Manuscript ID: 20M-09-754
Title: Human Emotion Recognition Based on EEG Signal Using Fast Fourier Transform and K-Nearest Neighbor
Author(s): Anton Yudhana, Akbar Muslim, Dewi Eko Wati, Intan Puspitasari, Ahmad Azhari, Murein Miksa Mardhia
Corresponding Author: Anton Yudhana
Affiliation of Corresponding Author: Ahmad Dahlan University
Date of Manuscript Submission: 15-Oct-2020 (UTC)
Date of Review Result Report: 01-Nov-2020 (UTC)
Similarity rate (%): 17.0 %

You can find the review comments in the following online system.

* Online System URL: https://www.manuscriptlink.com/journals/astesj

When preparing a revised version of your manuscript, you should write the reply letter including a list of responses to the review comments. The reply letter to the review comments should be uploaded as a separate file in addition to your revised manuscript. Acceptable formats for the reply letter include PDF (preferred) and MS Word.

The deadline for submission of the revised manuscript and reply letter is 15-Nov-2020.

If you have any question regarding the revised manuscript, please contact the journal manager.

Best regards,

Prof. Wang Xiu Ying, Journal Manager
Advances in Science, Technology and Engineering Systems Journal
Email: w.x.ying@astesj.com
Homepage: https://www.astesj.com

Lampiran 9.

a. Bukti Submit manuscript management jurnal

manuscriptlink.com/journals/astesj/author/manuscripts...

Revision #2

	File Name	File Designation	Upload Date
1	mainDocument-1[20M-09-754]-Revision2_human emotion recognition basen on eeg signal using fast fourier transform and k-nearest neighbor.pdf	Main Document (Required)	15-Nov-2020
2	replyLetter-1[20M-09-754]-Revision2_reply letter.pdf	Reply Letter	15-Nov-2020

b. Reply Letter revisi kedua

Reply Letter

Dear Prof. Wang Xiu Ying,
Guest Editor-in-Chief
Special Issue on Multidisciplinary Innovation in Engineering Science & Technology
Advances in Science, Technology and Engineering System Journal (ASTESJ)

November 15th, 2020

Thank you for your email dated 2-November-2020 enclosing the reviewers comments. We have carefully reviewed the comments and have revised the manuscript accordingly. Our responses are given in a point-by-point manner below.

We apologize for resubmitting at the end of the submission deadline.

We hope the second revised version is now suitable for publication and look forward to hearing from you in due course.

Sincerely,

Anton Yudhana
Lecturer and Researcher

Response to Reviewer 1:
We deeply appreciate your helpfull comments, and we have made changes to improve the quality of our paper. Our answers to your points are as follows.
.

Comments from reviewer 1 :
1. the grammetical errors need to be corrected; eg: "EEG signals were recorded will get the waveform, the duration,.......￼" ; "EEG signal pattern data the resulting form and position are not yet known due to the signal pattern and speed of response of........" and in few more places such grammetically in correct sentences are there.

2. The experimental results are not further compared with the existing state of art methods, because of which the novelty of the work is not very clear.

Response :

1. We have corrected the gramatical errors by correcting each sentence used to make it grammatically appropriate.

2. The discussion of experimental result has been improved by reviewing all the information in the paper so that the information from the disccussion content becomes more technically relevant

Lampiran 10. Email konfirmasi dari editor bahwa artikel sudah diterima

ASTESJ no-reply@manuscriptlink.com via amazonses.co...   Tue, Nov 17, 2020, 1:58 PM   ☆   ↩   ⋮
to me, w.x.ying ▾

Dear Mr. Akbar Muslim,

Thank you for submitting a revised version of the following manuscript to the *Advances in Science, Technology and Engineering Systems Journal*.

Track: Special Issue Paper
Special Issue/Section: Special Issue on Multidisciplinary Innovation in Engg Science & Tech
Manuscript ID: 20M-09-754
Title: Human Emotion Recognition Based on EEG Signal Using Fast Fourier Transform and K-Nearest Neighbor
Author(s): Anton Yudhana, Akbar Muslim, Dewi Eko Wati, Intan Puspitasari, Ahmad Azhari, Murein Miksa Mardhia
Corresponding Author: Anton Yudhana
Affiliation of Corresponding Author: Ahmad Dahlan University
Date of Manuscript Submission: 15-Nov-2020 (UTC)
Similarity rate (%): 17.0 %

Lampiran 11. Bukti email (decision) dan list comment reviewer

[ASTESJ, 20M-09-754] Review results of your manuscript
1 message

ASTESJ <no-reply@manuscriptlink.com>   Sun, Nov 29, 2020 at 1:29 AM
To: akbar1500022007@webmail.uad.ac.id
Cc: w.x.ying@astesj.com

Dear Mr. Akbar Muslim,

We are pleased to inform you that the following manuscript has been accepted for publication to the *Advances in Science, Technology and Engineering Systems Journal.*

Track: Special Issue Paper
Special Issue/Section: Special Issue on Multidisciplinary Innovation in Engg Science & Tech
Manuscript ID: 20M-09-754
Title: Human Emotion Recognition Based on EEG Signal Using Fast Fourier Transform and K-Nearest Neighbor
Author(s): Anton Yudhana, Akbar Muslim, Dewi Eko Wati, Intan Puspitasari, Ahmad Azhari, Murein Miksa Mardhia
Corresponding Author: Anton Yudhana
Affiliation of Corresponding Author: Ahmad Dahlan University
Date of Manuscript Submission: 15-Nov-2020 (UTC)
Similarity rate (%): 17.0 %

Overall review result: Accept with minor changes

Below you will find comments, if any. Also, you can find them in the following online system.

* Online System URL: https://www.manuscriptlink.com/journals/astesj

What you should do at the next step is to make your camera-ready paper for the above manuscript. When making your camera-ready paper, please take into consideration all review comments.

The deadline for the camera-ready paper submission is 08-Dec-2020. We cannot guarantee to include your paper in final edition, in case of late submission of your camera-ready paper.

If you have any question regarding your camera-ready paper, please contact the journal manager.
Thank you for submitting your manuscript to the *Advances in Science, Technology and Engineering Systems Journal.*

Review Results

- Comments of Guest Editor-
The revised manuscript is accepted according to reviewer comment.

- Reviewer Review Scores and Comments -
Reviewer #1

Overall Judgement: Accept with minor changes

The first query has been answered.
I didn't find the comparative result analysis with existing state of art methods. The second query still remains unanswered.

Prof. Wang Xiu Ying, Guest Editor
Advances in Science, Technology and Engineering Systems Journal
Email: w.x.ying@astesj.com
Homepage: https://www.astesj.com

Lampiran 12. Email informasi submit camera-ready paper, copyright transfer dan billing department.

Manuscript ID 20M-09-754 [ASTESJ]
2 messages

Prof. Wang Xiu Ying <w.x.ying@astesj.com>   Sun, Nov 29, 2020 at 2:42 AM
To: AKBAR MUSLIM <akbar1500022007@webmail.uad.ac.id>
Cc: "Dr. Syed Zulqadar Hassan" <zulqadar@astesj.com>

Dear Mr. Akbar Muslim,

The acceptance of your paper is sent to you via our online system. You have to submit the camera-ready paper in the journal's format (Word[.docx] or Latex[.zip]) and copyright transfer [,pdf] before **08-Dec-2020**. From the billing department, Dr. Syed Zulqadar Hassan (zulqadar@astesj.com) will contact you soon regarding the payment of publication fee. If there is any problem with payment or delay in payment for any reason, you can deal with him.

Best Regards
Prof. Wang Xiu Ying
Guest Editor-in-Chief
Advances in Science, Technology and Engineering Systems Journal (ASTESJ)

Lampiran 13.

a. Email terkait teknik pembayaran biaya publikasi

Payment for Manuscript ID 20M-09-754 [ASTESJ]

3 messages

Syed Zulqadar Hassan <zulqadar@astesj.com>   Tue, Dec 1, 2020 at 4:12 PM
To: Akbar <akbar1500022007@webmail.uad.ac.id>

Dear **Mr. Akbar Muslim,**

Recently I received an email about your accepted manuscript (ID 20M-09-754).

I have sent you an invoice via the online system and you can also find it in the link given below. You will need to pay **340 USD** and the due date of payment is **16-Dec-2020**.

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YTx3dgv9dYde8A0c0xHKBHvd95RT6ebqRy8aE0kr9HWDuIkzVwG5jF8Y5NwTojTT3YYuIsF1rR4QPUUgfTNEAIadyN
MIhIQoBm&id=YQmLyUdcVZ8dEYxFruiHhY3h3JV2auL9Xmh61izbnmbNnP5XNbIMEDU9mXgIzkWfO

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Regards,
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Syed Zulqadar Hassan <zulqadar@astesj.com>   Thu, Dec 3, 2020 at 8:35 PM
To: Akbar <akbar1500022007@webmail.uad.ac.id>

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--
Regards,
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Billing Department
ASTES Journal

b. Invoice

ASTES

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Name: Akbar Muslim
Address: Ahmad Dahlan University
Country: Indonesia
Email: akbar1500022007@webmail.uad.ac.id

SUMMARY

ITEM	PRICE	QTY	SUBTOTAL
Article Publication Fee	$340	1	$340
Special Issue/Section: Special Issue on Multidisciplinary Innovation in Engg Science & Tech Manuscript ID: 20M-09-754 Title: Human Emotion Recognition Based on EEG Signal Using Fast Fourier Transform and K-Nearest Neighbor Author(s): Anton Yudhana, Akbar Muslim, Dewi Eko Wati, Intan Puspitasari, Ahmad Azhari, Murein Miksa Mardhia			

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NOTES

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Lampiran 14. Submit camera-ready paper, copyright form dan reply letter

a. Submit manuscripts management jurnal

⊘ Camera-Ready Paper & Related Files

	Version	File Name	File Designation	Upload Date
1	Original	cameraReadyPaper-1[20M-09-754]-CameraReady-Original_human emotion recognition basen on eeg signal using fast fourier transform and k-nearest neighbor.docx	Camera-Ready Paper (Required)	04-Dec-2020
2	Original	copyright-1[20M-09-754]-CameraReady-Original_copyright form anton yudhana.pdf	Copyright	04-Dec-2020
3	Original	cameraReplyLetter-1[20M-09-754]-CameraReady-Original_reply letter.pdf	Reply Letter	04-Dec-2020

b. Copyright Form

ASTES

Advances in Science, Technology and Engineering Systems Journal (ISSN: 2415-6698)

Copyright Form

Title of the paper: Human Emotion Recognition Based on EEG Signal Using Fast Fourier Transform and K-Nearest Neighbor

Corresponding author's information

Name   : Anton Yudhana

Address   : Pelita Sedayu C1, Bantul, Yogyakarta, Indonesia

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Date: 04-12-2020

28

c. Camera-Ready Reply Letter

Reply Letter

Dear Prof. Wang Xiu Ying,
Guest Editor-in-Chief
Special Issue on Multidisciplinary Innovation in Engineering Science & Technology
Advances in Science, Technology and Engineering System Journal (ASTESJ)

December 4th, 2020

Thank you for your email dated 28-November-2020 We would like to thank you for accepting our manuscript entitled "Human Emotion Recognition Based on EEG Signal Using Fast Fourier Transform and K-Nearest Neighbor. enclosing the reviewers comments. We have carefully reviewed the comments and have revised the manuscript accordingly. Our responses are given in a point-by-point manner below.

We again appreciate the kindness of the Editor and Reviewers in helping improve the manuscript. All authors have reviewed and agreed to the submission of the revised manuscript. We hope that the manuscript is now acceptable for publication.

Sincerely,

Anton Yudhana
Lecturer and Researcher

Response to Reviewer 1:
We deeply appreciate your helpfull comments, and we have made changes to improve the quality of our paper. Our answers to your points are as follows.
-

Comments from reviewer 1 :
1. The first query has been answered.
I didn't find the comparative result analysis with existing state of art methods. The second query still remains unanswered.

Response :

1. We use FFT and KNN as alternative methods used for EEG signal analysis. In the experimental result FFT, we analyzed data that was different from the previous method where the process was carried out by collecting hundreds of thousands of data on each recorded brainwave, which was then simplified by calculating the average results. Moreover, data comparison is made from the results of observations and calculations using the values in the FFT spectrum's average peak. Then the classification process is carried out from the test data using KNN so that the accuracy of each classification result will be calculated based on the training data using a confusion matrix.

Lampiran 15. Email pemberitauan bahwa camera-ready paper telah di submit

[ASTESJ, 20M-09-754] Acknowledgment of a camera-ready paper submission
1 message

ASTESJ <no-reply@manuscriptlink.com>   Fri, Dec 4, 2020 at 5:55 PM
To: akbar1500022007@webmail.uad.ac.id

Dear Mr. Akbar Muslim,

Thank you for submitting the camera-ready version of the following manuscript accepted to the *Advances in Science, Technology and Engineering Systems Journal*.

Track: Special Issue Paper
Special Issue/Section: Special Issue on Multidisciplinary Innovation in Engg Science & Tech
Manuscript ID: 20M-09-754
Title: Human Emotion Recognition Based on EEG Signal Using Fast Fourier Transform and K-Nearest Neighbor
Author(s): Anton Yudhana, Akbar Muslim, Dewi Eko Wati, Intan Puspitasari, Ahmad Azhari, Murein Miksa Mardhia
Corresponding Author: Anton Yudhana
Affiliation of Corresponding Author: Ahmad Dahlan University
Date of Manuscript Submission: 15-Nov-2020 (UTC)
Date of Review Result Report: 28-Nov-2020 (UTC)
Date of Camera-ready Paper Submission: 04-Dec-2020 (UTC)
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To: akbar1500022007@webmail.uad.ac.id
Cc: w.x.ying@astesj.com

Dear Mr. Akbar Muslim,

This mail is to confirm that the submitted camera-ready version of the following manuscript has no problem and it will be used to make your manuscript editing and proofread version.

Track: Special Issue Paper
Special Issue/Section: Special Issue on Multidisciplinary Innovation in Engg Science & Tech
Manuscript ID: 20M-09-754
Title: Human Emotion Recognition Based on EEG Signal Using Fast Fourier Transform and K-Nearest Neighbor
Author(s): Anton Yudhana, Akbar Muslim, Dewi Eko Wati, Intan Puspitasari, Ahmad Azhari, Murein Miksa Mardhia
Corresponding Author: Anton Yudhana
Affiliation of Corresponding Author: Ahmad Dahlan University
Date of Manuscript Submission: 15-Nov-2020 (UTC)
Date of Review Result Report: 28-Nov-2020 (UTC)
Date of Camera-ready Paper Submission: 04-Dec-2020 (UTC)
Similarity rate (%): 17.0 %

We will contact you again when your manuscript editing and proofread version is ready.

Best regards,

Prof. Wang Xiu Ying, Journal Manager
Advances in Science, Technology and Engineering Systems Journal
Email: w.x.ying@astesj.com
Homepage: https://www.astesj.com

Lampiran 17. Email konfirmasi galley proofs sudah tahap final

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To: akbar1500022007@webmail.uad.ac.id
Cc: website@astesj.com

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We are pleased to let you know that the galley proofs of the following manuscript are ready.

Track: Special Issue Paper
Special Issue/Section: Special Issue on Multidisciplinary Innovation in Engg Science & Tech
Manuscript ID: 20M-09-754
Title: Human Emotion Recognition Based on EEG Signal Using Fast Fourier Transform and K-Nearest Neighbor
Author(s): Anton Yudhana, Akbar Muslim, Dewi Eko Wati, Intan Puspitasari, Ahmad Azhari, Murein Miksa Mardhia
Corresponding Author: Anton Yudhana
Affiliation of Corresponding Author: Ahmad Dahlan University
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Best regards,

Dr. Jesse Marie, Journal Manager
Advances in Science, Technology and Engineering Systems Journal
Email: website@astesj.com
Homepage: https://www.astesj.com

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a. Bukti Email

Paper Published in ASTES Journal-ASTESJ_0506131
2 messages

ASTESJ - Website Editor <website@astesj.com>   Mon, Dec 14, 2020 at 2:32 PM
To: Eyudhana <eyudhana@ee.uad.ac.id>, Akbar <akbar1500022007@webmail.uad.ac.id>, Dewi Ekowati
<dewi.ekowati@pgpaud.uad.ac.id>, Intan Puspitasari <intan.puspitasari@pgpaud.uad.ac.id>, Ahmad Azhari
<ahmad.azhari@tif.uad.ac.id>, Murein Miksa <murein.miksa@tif.uad.ac.id>
Cc: Zulqadar <zulqadar@astesj.com>

Dear **Anton Yudhana, Akbar Muslim, Dewi Eko Wati, Intan Puspitasari, Ahmad Azhari, Murein Miksa Mardhia**,

Thanks for your confirmation. Now your paper is published and online.

Title: **Human Emotion Recognition Based on EEG Signal Using Fast Fourier Transform and K-Nearest Neighbor**

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Besides this, your name will be registered as a reviewer in ASTESJ. You will receive a separate email from the Reviewer Management System once it is done.

If you have any queries regarding this, we are welcome to answer your questions. You can reply back to this email.
--
Kind regards,
Jesse Marie
Website Editor

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b. Bukti Situs ASTESJ

ASTES Journal
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Human Emotion Recognition Based on EEG Signal Using Fast Fourier Transform and K-Nearest Neighbor

Human Emotion Recognition Based on EEG Signal Using Fast Fourier Transform and K-Nearest Neighbor

Volume 5, Issue 6, Page No 1082-1088, 2020

Author's Name: Anton Yudhana[1,a], Akbar Muslim[1], Dewi Eko Wati[2], Intan Puspitasari[2], Ahmad Azhari[3], Murein Miksa Mardhia[3]

⇣ View Affiliations

[a]Author to whom correspondence should be addressed. E-mail:
eyudhana@ee.uad.ac.id

Adv. Sci. Technol. Eng. Syst. J. **5**(6), 1082-1088 (2020);
DOI: 10.25046/aj0506131

Keywords: Electroencephalography (EEG), Brainwaves, FFT, KNN

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