EMOTION CLASSIFICATION BASED ON EEG SIGNAL USING SUPPORT VECTOR MACHINE AND INDEPENDENT COMPONENT ANALYSIS

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Abstract—In making a decision, choose the results of the decision. For example when happy, the show will be fine, on the contrary if sad it will provide bad convenience. Emotions include physiological, namely electroencephalographic (EEG) signals from the brain. EEG recording Appears when electrical problems occur in the brain[1]. EEG signals come from DEAP research: The database for Emotion Analysis uses physiological signals from arousal and valence levels and is processed by Independent Component Analysis (ICA). With ICA, existing data will be processed and obtained new data in the form of a matrix. The results of the matrix will be conveyed by Support Vector Machine (SVM) to produce comfortable conditions when happy, relaxed, nervous, and sad. Thus, the results obtained by the data know what percentage of the index is useful when happy, relax, nervous, and sad.

Index Terms--EEG, ICA, SVM

I. INTRODUCTION

Emotions are often associated with conscious and unconscious states that refer to feelings, personality, and temperament. Emotions can be expressed in two ways, namely verbal and non-verbal. The verbal method is through written or verbal communication and non-verbal means, namely through facial expressions and gestures [1]. The emotions experienced by each person are different and varied and therefore we look for ways to identify emotions to take appropriate action. One way to find out emotions is to use electroencephalogram (EEG). The wave types are gamma, teta, alpha, and beta. The data used is secondary data from DEAP: A database for Emotion Analysis using physiological signals. From these data there are several categories, namely arousal, valence, dominance, liking, and familiarity. The scale used is taken from Russell's valence arousal scale where the arousal emotional state is on the horizontal axis and valence on the vertical axis. The Arousal Scale is seen from inactive to active. Non-active examples are bored or not interested and active examples are enthusiastic and alert. The valence scale is seen from unpleasant conditions to pleasant [2]. Examples of unpleasant conditions are stress and sadness and pleasant circumstances are happy and happy. Arousal and valence values are categorized into two, namely low (1-5) and high (5-9). From this category, the data is labeled as happy, relaxed, nervous and sad. The data taken is processed to get the signal characteristics. The method used is by extracting data features with Independent Component Analysis (ICA). Characteristics produced are in the form of a matrix containing numbers. Feature extraction contains ZICA, W, T and mu. from extraction the obtained features are classified by Support Vector Machine(SVM) to obtain the percentage value of each label. Of all the labels it will be concluded what is the dominant emotional condition that occurs.

II. METHODOLOGY

This study aims to classify emotions from EEG signal parameters. To obtain this, ICA and SVM are used to obtain feature extraction for the classification of EEG signals

A. ICA

Independent Component Analysis (ICA) is a method for finding information from a set of data where an independent factor is traced, to separate the independent signals that are mixed and the signal will be recorded by several sensors [3]. In the mixing model, s is the signal source that is still mixed with other signals, A is the mixing matrix, and x is the mixed signals.

$$x = As \tag{1}$$

B. Features Extraction

In this study, feature extraction was used for the classification of EEG signals. Based on the ICA method and GA classification, there are four features taken from the data, namely:

1) Zica
   Zica is a matrix that contains independent components r and n scaled to 1 from the input sample. independent component to compute is r. sampel of d-dimensional is n.

$$\text{Zica} = W * \text{Zcw} \tag{2}$$

   Where Zcw is a variable whiten input data.
2) W and T
   W and T is transformation matrix approximation of Z.

$$W = \text{normRows}(W) \tag{3}$$

3) Mu
   Mu is an mean sample of matrix Z.

$$[Zc, mu] = \text{centerRows}(Z) \tag{4}$$

   Where ZC is a variable to center the input data.

C. Classification Support Vector Machine

SVM is an algorithm that is often used as a classification in the medical field. This algorithm works by classifying a pattern by plotting the features it has as a specific coordinate value to be

observed. SVM aims to minimize errors and find a hyperplane that can distinguish each class[4].

D. Performance Analysis

To get the results of this study, there are parameters as a result of classification:

1) Accuracy: the percentage result of the classification carried out on the EEG signal. The higher the result, the more appropriate Genetic algorithm grouping is used.

III. RESULT AND ANALYSIS

in this study, processed data was converted into two-dimensional data containing the results of the classification of EEG signals. The converted data contains 1280x4 in the .xls file.

TABLE I. Feature extraction and emotional classification

P1	P2	P3	P4	Classification
0.2510	0.4323	0.7820	0.3916	Nervous
0,3345	-0,2234	-0,2722	-0,5419	Relax
-0.4199	-0.4900	-0.5962	-0.3295	Sad
0,023	-0,2183	-0,4023	-0,0335	Happy

From the existing data there are ranges from 1-9 and the classification seen from the 4 classes are high arousal high valence, high arousal low valence, low arousal high valence, and low valence low arousal[5]. In that class the scaling is low (1-5) and high (6-9).

Type	Accuracy
Linier SVM	51,8%
Quadratic SVM	51,5%
Cubic SVM	51,0%
Fine Gaussian SVM	50,4%
Medium Gaussian SVM	51,8%
Coarse Gaussian SVM	51,8%

Figure 1. Accuracy of SVM method

IV. CONCLUSION

The conclusion of this is that the classification is done to get the percentage of conditions that occur. With this case the most dominant emotion can be found by the participants. In the future, the proposed method can be used for EEG signal analysis.

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