

COMPARISON OF FACIAL FEATURE EXTRACTION ON STRESS AND NORMAL USING PRINCIPAL COMPONENT ANALYSIS METHOD

(CASE STUDY OF INFORMATICS ENGINEERING STUDENTS
BATAM STATE POLITECHNICAL)

Mira Chandra Kirana, S.T., M.T*, Yogsal Ramadhan Putra*

*Batam State Polytechnic
Informatics Engineering Program
Parkway Street, Batam Centre, Batam 29461, Indonesia
E-mail: mira@polibatam.ac.id, yogsalr@gmail.com

Abstract

Face is included in one person's biometric characteristics that are unique. By looking at a person's face can be known whether stress or not. To determine the value of the stress on the face we conducted a comparative analysis of the extracted facial features between normal face and stress face using image processing technology.

This study using Principal Component Analysis method used for extraction of features so we can know the features of each facial image data. To identify the facial image stress and image normal we researchers used questionnaires Depression Anxiety Stress Scale (DASS). At the final stage of the comparison of the extracted face normal and stress. The results of the analysis graph of the image data on the face that stress has a percentage above average image amounted to 50.38% and the percentage below the average image amounted to 49.63%, while the data of face images normal have a percentage above average image to 43.81% and the percentage image below the average to 56.19%.

Keyword: Feature Extraction, image processing, Principal Component Analysis, Depression Anxiety Stress Scale.

1 Introduction

Student is a person who is in the process of studying and enrolled is undergoing education in one form of college consisting of academic, polytechnic, high school, institute and university [1]. Students are also required to complete their studies within the time specified in each college. It also applies to students majoring in Informatics Engineering studying at the State Polytechnic of Batam.

The fact to complete the study at Batam State Polytechnic is not easy, so the students are asked to keep learning harder. The one of the requirements for graduation of D3 and D4 program of Informatics Engineering Department in Batam State Polytechnic is complete the final project. Students are advised to

complete it within 1 (one) semester. In the final stages, students will face trial as a determinant of the end of this course. If the student does not pass the hearing then it must repeat. That is one of the reasons why students can not complete the study on time because they have to repeat the course of this Final Project.

From the level of the number of graduates of students majoring in regular Informatics Engineering and employees who take the final course. Students of Informatics Engineering in the year 2013/2014 who follow the final assignment are 250, 230 graduated with 92% graduation rate, and 2014/2015 year is 249, graduated 212 with graduation rate 85,2%, and year 2015 / 2016 totaled 250, graduated amounted to 209 with a pass rate of 83.6%. Based on these data it can be

concluded that the level of the number of graduates of students majoring in Informatics Engineering from the year 2013/2014 to 2015/2016 decreased by 8.4%.

According to Dwi Ninda, a student of Informatics Engineering class of 2013 said that obstacles or difficulties when doing the final assignment are lack of time management, lack of understanding on chosen method, fear of meeting with supervisor, and difficult in algorithm implementation. Students also often avoid the process of guidance due to lack of ready work of the Final Project. This problem is included in one of the indications of stress symptoms that are often experienced by the final grade students.

To identify end-stage students who are under stress Then the required comparison of the results of the results of experiencing stress and normal use of image processing technology (image processing) on the image of the student's face by the method of Principal Component Analysis (PCA). Principal Component Analysis (PCA) is a technique that can be used for face recognition and pattern recognition of an image [2]. First discovered by Karl Pearson in 1901 and used in the field of biology. For validation of stress determination and normal use of questionnaires Depression Anxiety Stress Scale (DASS). DASS is a set of subjective scale to measure the emotional state of depression, anxiety, and stress. DASS using standard instruments with depression alpha coefficient 0.947, 0.0897 anxiety and stress 0.933 so that the instrument is reliable. [3]

2 Basic Theory

A. Measurement Scale DASS (Depression Anxiety Stress Scale)

Dass Measurement Scale (Depression Anxiety Stress Scale) were pioneered by Lovibond (1995) [4] is tools that have been standard and does not need to test its validity again. DASS consists of 42 items of questions that describe the level of stress and anxiety. DASS is a set of three self-report scales designed to measure the negative emotional state of depression, anxiety and stress. The DASS is built not only as a set of scales to measure the conventionally defined emotional state, but to advance the process of defining, understanding,

and measuring the ubiquitous and clinically significant emotional states typically described as depression, anxiety and stress.

B. Digital Image

Digital images are representative of the image taken by the machine with the approach based on sampling and quantization. The sampling states the size of the boxes arranged in rows and columns. In other words, the sampling in the image stating the size of the size of the pixels (dots) in the image, and the quantization declare the value of the brightness levels are expressed in terms of gray level (grayscale) in accordance with the total of binary bits used by the machine, in other words quantization on image Indicates the number of colors present in the image. [5]

C. Image processing

Image processing (Image Processing) is the process of taking the pixels in a digital image for a particular purpose. At the beginning of this image processing is done to improve the image quality, but with the development of the computing world is characterized by the increasing capacity and speed of computer processes and the emergence of computing sciences that allow humans to retrieve information from an image. [6]

D. Feature Extraction

Feature Extraction or retrieval feature extraction is a characteristic or feature of the image that will be the value obtained will be analyzed for further processing [7]. Feature extraction is done by counting the number of dots or pixels encountered in each check, which checks carried out in various directions tracing checks on the Cartesian coordinates of the digital image is analyzed, namely vertical, horizontal, right diagonal and left diagonal. Extraction features tend to identify traits that can form a good representation of objects, so as to distinguish between categories of objects with variations in tolerance. [8]

E. Principal Component Analysis

Principal Component Analysis (PCA) or Karhunen-Loeve transformation is a classical linear technique for reducing data dimensions. [9] The PCA technique selects an optimal base that can be used to represent an image vector given by the eigenspace

formed from nonzero eigen values of the covariance matrix of the entire image. Using a base formed by the eigenspace can be done dimensional reduction by performing a linear transformation of a space Dimension into a lower space dimension. To determine the lower dimension with minimum error, information loss can be done by selecting the largest number of eigenvalues from the high-dimensional space. This stage is a general description of a method called Principal Component Analysis. [10]

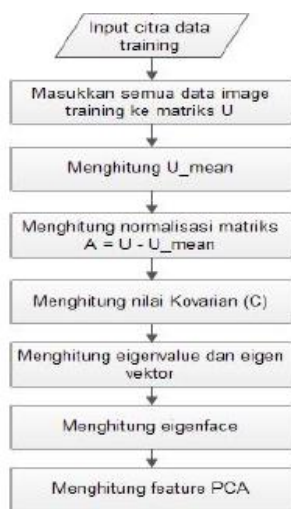


Figure 1 PCA Feature Extraction Algorithm

Figure 1 is a Principal Component Analysis algorithm used for face recognition as the image feature extraction training data.

3 Research Methodology

A. Research Design

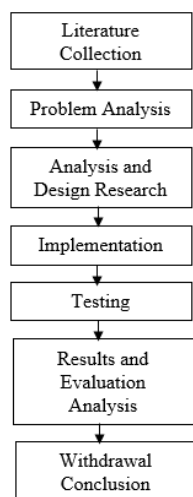


Figure 2 Flow of Research Process

Figure 2 shows that this research process starts from

- a. Literature Collection
At this stage collect literature related to the problems it has to assist in supporting the process of building and designing the system so it can run well.
- b. Problem Analysis
At this stage mengalilis problems about stress that occurs in students majoring in Informatics Engineering Piliteknik Negeri Batam. The method used is DASS questionnaire.
- c. Analysis and Design Research
At this stage begin to analyze and design with certain considerations for easy to use and understood by the user.
- d. Implementation
At this stage, the implementation of the results of the analysis and design into a system. The following process flow or flowchart.

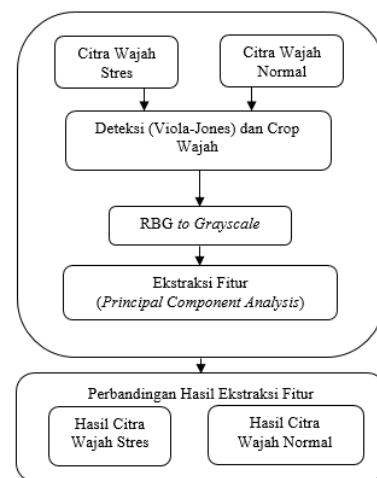


Figure 3 Flow Implementation

Figure 3 shows that in order to perform feature extraction process on the system begins by reading the facial image of the normal stress and then detects faces and doing cropping face. The next stage converts RGB values 24-bit color to grayscale having 8-bit color. After going through the earlier stages (pre - processing) and then do the facial feature extraction using principal component analysis method. The last stage is to compare the results of facial expressions of facial features of students who are identified stress and normal.

- e. Testing
At this stage of testing in order to identify any problems or errors that occur in the system so it can run as expected.
- f. Results and Evaluation Analysis
At this stage, the comparative analysis of the facial features of facial features between the identified face image and the stress and normal.
- g. Withdrawal Conclusion
At this stage obtained the results so that the comparison can be concluded and the success rate of the system in the wake.

B. Hardware and Software

The hardware and software used in this study was

1. Hardware; Intel (R) Core™ i7-4510U CPU @ 2.00GHz, 8GB DDR3 RAM Memory, 1 TB hard drive and screen settings with 1366x768 resolution.
2. Software; Windows 10, Ms. Excel 2016, Ms. Word 2016 and Matlab R2015a.

C. Population and Sample

Population is the whole subject or the totality of research subjects that can be people, objects, or something in which can be obtained and or can provide information (data) research. The sample is part of the number and characteristics possessed by that population, or a small portion of the population members taken according to certain procedures so as to represent the population.

1. Population
The population in this study are all final year students majoring in Informatics Engineering State Polytechnic of Batam.
2. Sample
Sampling using accidental sampling technique where the sampling is done by taking the case or the respondent who happen to be there for 3 weeks in September 2016 which was in Batam Polytechnic Campus. Based on these findings obtained the number of respondents as many as 80 students.

D. Materials Research

The material of this research is the image of the final student level of Informatics Engineering Department of Batam State Polytechnic with resolution 2304x4096 stored in jpeg format.

E. Data Collection Technique

Data collection techniques is a way used by researchers to obtain data in a study. In this study used data collection techniques by means of questionnaires and documentation.

1. Questionnaire

Questionnaires that contain questions to explore stress on final-level students of informatics techniques of the Batam State Polytechnic. This questionnaire measured using 42 Depression Anxiety Stress Scale (DASS 42) from Lovibond and Lovibond (1995). Questionnaires of 42 questions with choice never, sometimes, often and always, but in this study only selected questionnaires that measure the stress of a number of 14 questions. So that later this questionnaire data will be calculated value and categorized between student's stress and normal.

2. Face Image Taking

Facial image acquisition during and after the students fill out a questionnaire DASS. Where distance of respondent with camera as far as 1 (one) meter with ordinary face expression is flat.

F. Data Processing Technique

Based on the data or research material that is obtained in the form of 40 images of faces of students who identified stress and 40 images of faces of students who are identified as normal. The data will then be processed or processed using Matlab to obtain the feature extraction results in each image.

Here's the flow of data processing:

1. Pre-Processing

At this stage, the initial image of the face will be put into matlab then the image of the detected face with Viola-Jones method. Once a face is detected, crop and change the face of this type of RGB to Grayscale types.

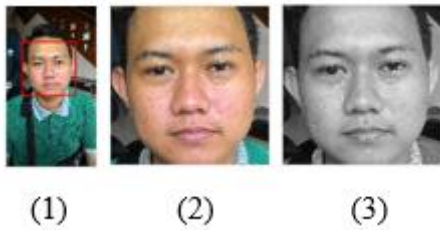


Figure 4 Example of Process Pre-Processing

Figure 4 shows that in step (1) the image of the face image has been detected, step (2) of the face detection results later in the crop and the stage (3) the results of the face it has in the crop then converted from RGB to Grayscale.

2. Feature Extraction

Here are the stages of feature extraction algorithm using Principal Component Analysis in this study:

- a) The converted image of the face to grayscale is reduced from 2 dimensions to 1 dimension to become a vector form. Here's an example of dimensional reduction in imagery measuring 4 x 4 pixels.

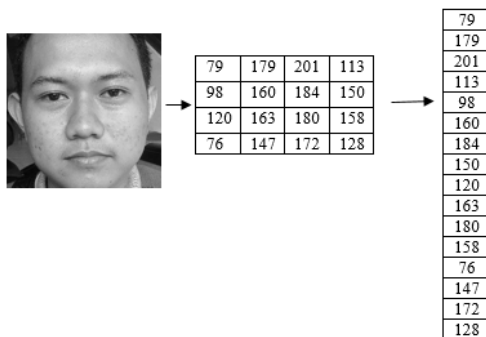


Figure 5 Reducing 2D to 1D

Figure 5 shows that in the face image are taken several pixels that have dimensions of 4 x 4 pixels and then the pixel value is converted into columns.

- b) Arrange all vectors to be rows in X data matrices.

After the image reduction process from 2D to 1D, then the next of 4 sample images are combined into X data matrix.



Figure 6 Example Grayscale Images Face

Table 1 Matrix X

Matrik X			
Image 1	Image 2	Image 3	Image 4
79	65	138	37
179	103	128	95
201	107	151	102
113	50	180	62
98	78	112	73
160	89	101	109
184	106	124	116
150	80	153	101
120	138	111	91
163	14	100	102
180	122	125	112
158	115	156	125
76	150	101	78
147	82	91	80
172	91	119	95
128	77	155	121

Table 1 contains the matrix values obtained from the grayscale image reduction which ranged from 0 to 255 which has been compiled into X matrix.

- c) Calculate the mean of the X matrix.

This stage calculates the average value of rows of X matrices use the following equation:

$$M = (\text{Sum_TiapLaris}) / \text{Multiple Image}$$

Table 2 Average Row Matrix X Value

The value of m	
Row 1	79.75
Row 2	126.25
Row 3	140.25
Row 4	101.25
Row 5	90.25
Row 6	114.75
Row 7	132.5
Row 8	121
Row 9	115
Row 10	94.75
Row 11	134.75
Row 12	138.5
Row 13	101.25
Row 14	100
Row 15	119.25
Row 16	120.25

Table 2 contains the value of m which is the average value of the matrix X. after obtaining the value of m, then next calculates the matrix A which contains the value of the difference between the image of the face data with the average value of the line. Here matrix value A with the following equation:

$$A = X - m$$

Table 3 Matrix Image Value A

Matrik A			
Image 1	Image 2	Image 3	Image 4
-0.75	-14.75	58.25	-42.75
52.75	-23.25	1.75	-31.25
60.75	-33.25	10.75	-38.25
11.75	-51.25	78.75	-39.25
7.75	-12.25	21.75	-17.25
45.25	-25.75	-13.75	-5.75
51.5	-26.5	-8.5	-16.5
29	-41	32	-20
5	23	-4	-24
45.75	-13.25	-17.25	-15.25
45.25	-12.75	-9.75	-22.75
19.5	-23.5	17.5	-13.5
-25.25	48.75	-0.25	-23.25
47	-18	-9	-20
52.75	-28.25	-0.25	-24.25
7.75	-43.25	34.75	0.75

Table 3 contains the value of matrix A which is the value of pixel difference with the center point on the image of face data. This value is used to find the value of L. covariance matrix.

d) Calculate L Covariance Matrix

At this stage to find the L covariance matrix using the following equation:

$$L = A' \times A$$

The following covariance matrix values have been calculated using table equation 3:

Table 4 Covariance Matrix Value L

Covariance Matrix L			
L1	L2	L3	L4
22447.69	-13080.1	593.9375	-9961.56
-13080.1	14475.19	-7788.81	6393.688
593.9375	-7788.81	13475.19	-6280.31
-9961.56	6393.688	-6280.31	9848.188

e) Calculate the eigenvalue (V) and eigenvector (D) of the matrix L.

At this stage to find the value of eigen value and eigen vector of matrix L using the formula in matlab as follows:

$$[V, D] = \text{eig}(L)$$

V is the eigenvector and D is the eigen value.

Table 5 Vector Eigenvalues

Eigen Vektor V			
V1	V2	V3	V4
-0.5	-0.05985	0.538953	-0.67524
-0.5	-0.65353	0.150188	0.54804
-0.5	-0.04009	-0.81866	-0.27963
-0.5	0.753468	0.129516	0.406831

f) Calculates Ehe eigenfaces Value

In this process, the eigenfaces value is the face value of the facial image. This value is calculated using the following equation:

$$\text{Eigenfaces} = A \times V$$

Table 6 Facial Image Eigenfaces Value

Eigenfaces			
Eigenface1	Eigenface2	Eigenface3	Eigenface4
1.77E-14	-24.8617	-55.8431	-41.2577
-1.56E-14	-11.5787	19.45786	-61.5636
-8.45E-15	-11.1573	13.99307	-77.8104
5.14E-14	0.059081	-70.9172	-74.0101
7.37E-15	-6.32748	-17.7029	-25.0464
-3.76E-15	10.3389	31.03209	-43.1609
-8.24E-15	2.144718	28.59765	-53.6337
2.73E-14	8.706599	-19.3154	-59.1364
-3.33E-14	-33.2532	6.315325	0.583303
-1.92E-14	-4.87772	34.81381	-39.5342
-1.85E-14	-11.1263	27.50813	-44.0711
1.19E-14	3.31735	-9.0948	-36.4319
-4.00E-14	-47.8563	-9.09348	34.37781
-1.35E-14	-5.75802	27.40498	-47.2209
-8.56E-15	-2.95656	21.25084	-60.8967
4.78E-14	26.97306	-30.6699	-38.3479

g) Calculate the PCA Value

At this stage after the eigenfaces are obtained, do the data reduction using PCA where the reduction results in the reduction of data dimension, so the dimension of data that has nonessential characteristics will be eliminated. The following equations are used to find the face PCA value of the face:

$$\text{PCA} = \text{Eigenfaces}' \times A$$

Table 7 Value of PCA Face Image Data

PCA			
Image 1	Image 2	Image 3	Image 4
-1.85E-12	-7.24E-12	8.77E-12	3.15E-13
-324.868	-3547.36	-217.622	4089.847
8357.36	2328.914	-12694.6	2008.364
-26544.7	21544.29	-10992.7	15993.15

G. Data Presentation

Of the face image data identified students who had normal stress and the features extracted using Principal Component Analysis method is then compared to determine the differences between the data. To display data comparison of the data presentation of data used is graph.

Here is an example of data presentation in this research:

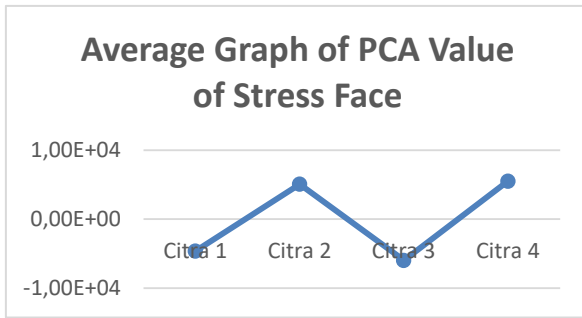


Figure 7 Example of Average Graph PCA Value of Stress Face

Figure 7 shows the mean value of the PCA matrix in the student's face that was identified as stress.

4 Results and Discussion

A. Testing

Table 8 Testing of Feature Extraction Application

No	Function	Testing Case	Testing Data	Expected results	Results obtained
1	Conducting the process of pre-processing	Enter image data	Imagery	Image pre-processing successfully	Image pre-processing successfully
2	Perform feature extraction process using PCA	Enter image data	Results of Pre-Processing image	Data successfully extracted	Data successfully extracted
3	Displays feature extraction data in graphical form	Feature extraction data has been processed	PCA feature extraction data	Display graphs according to feature extraction data	Display graphs according to feature extraction data

B. Pre-Processing

In the pre-processing process aims to prepare a decent data used for further processing. Starting from image data that has a resolution of 2304x4096 pixels and then done face detection using Viola-Jones method. Face detection results will be in the crop and resize to a size of 400x400 pixels. The last stage of this process is to change the type of RGB image into grayscale image type.

(citra 13) (citra 23) (citra 36) (citra 32) (citra 20)



(a). Citra Stres Awal



(b). Citra Stres Setelah Pre-Processing

Figure 8 Results of Stress Image Pre-Processing

Figure 8 (a) 5 initial stress image with a resolution of 2304x4096 pixels and has a RGB image type (b) image that has been through the process of pre-processing which only focus on the face with a resolution of 400x400 pixels and has a grayscale image type.

C. Graphic Per Image

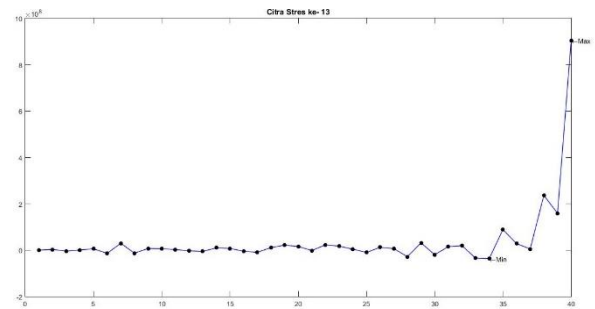


Figure 9 Graph of Stress Image 13

Figure 9 shows the pattern of feature extraction results from the stress image 13 with the highest value of $9.0365e + 08$ and the lowest value is $-3.6308e + 07$.

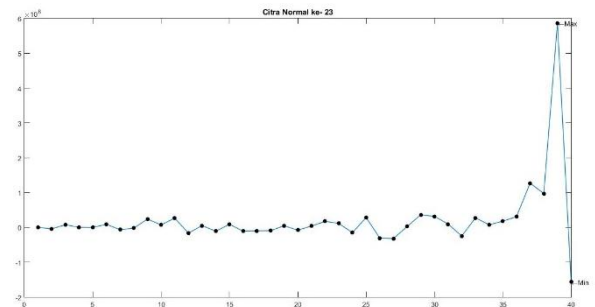


Figure 10 Normal Image Graph 23

Figure 10 shows the pattern of feature extraction results from normal image 23 with the highest value of $5.8646e + 08$ and the lowest value is $-1.5681e + 08$.

D. Graph of Comparative Statistics

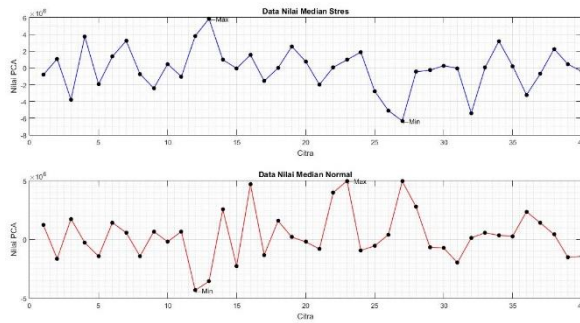


Figure 11 Graph Median Value of PCA Image

Figure 11 shows a graphic pattern based on the feature extraction results of the median value at 80 images and it is known that for 40 identified images the stress has a median value ranging from $-6.3249e + 06$ to $5.8635e + 06$, while 40 normally identified images have median values ranging from Between $-4.3245e + 06$ to $4.9997e + 06$. Based on the PCA results from the stress and normal data indicates that the median graph of the stress data is 3 lows $-6.3249e + 06$, $-5.3937e + 06$ and $-5.1083e + 06$ whose value is below the min value of normal data $-4.3245e + 06$, While from the stress data there is 1 highest point $5.8635e + 06$ whose value is above the normal data max value of $4.9997e + 06$.

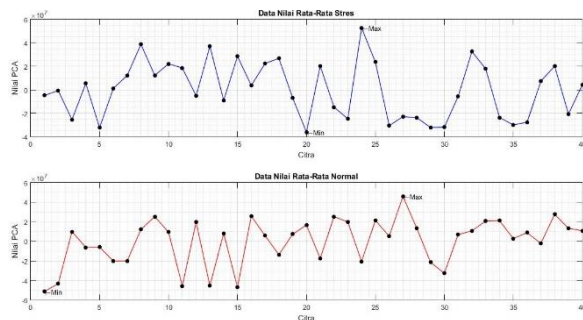


Figure 12 Graph Average Values of PCA Image

Figure 12 shows a graphic pattern based on the feature extraction results of the mean values on 80 images and it is known that for the 40 identified images the stress has an average value ranging from $-3.6142e + 07$ to $5.2675e + 07$, while 40 identified images are normal Has an average value ranging from $-5.1338e + 07$ to $4.5875e + 07$. Based on PCA results from the stress and normal data shows that the average graph of normal data is 4 lows $-5.1338e + 07$, $-4.5819e + 07$, $-4.5508e + 07$ and $-4.7189e + 07$ whose value is below min value Data stress $-3.6142e + 07$, while from the stress data

there is 1 highest point $5.2675e + 07$ which value above the max value of normal data $4.5875e + 07$.

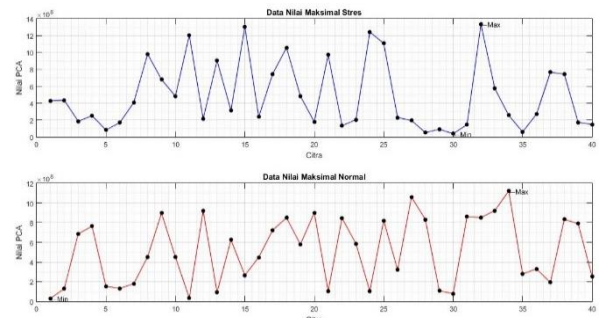


Figure 13 Graph Maximum Value of PCA Image

Figure 13 shows a graphic pattern based on the feature extraction results of the maximal value on 80 images and it is known that for 40 data the identified image of stress has a maximum value ranging from $3.8412e + 07$ to $1.3347e + 09$, while 40 normally identified image data has maximum value Ranging from $3.0542e + 07$ to $1.1219e + 09$. Based on PCA results from the stress and normal data indicate that the maximum graph of stress data is 5 highest point $1.1078e + 09$, $1.2048e + 09$, $1.2440e + 09$, $1.3064e + 09$ and $1.3347e + 09$ which value above max data value Normal $1.1219e + 09$, whereas from normal data there are 2 lowest points $3.0542e + 07$ and $3.4562e + 07$ whose value is below min value of stress data $3.8412e + 07$.

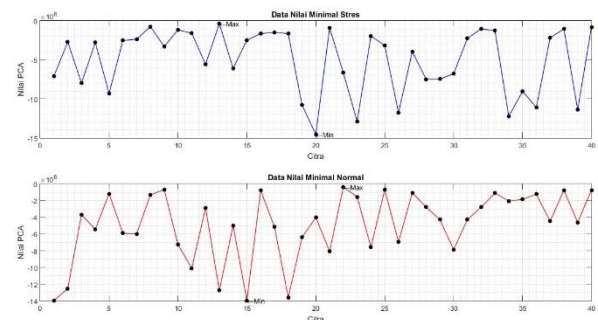


Figure 14 Graph of Minimal Value of PCA Image

Figure 14 shows a graphic pattern based on feature extraction results from a minimum value of 80 images and it is known that for 40 stress-identified image data has a minimum value ranging from $-3.6308e + 07$ to $-1.4550e + 09$, while 40 normally identified image data has the minimum value ranges from $-3.8612e + 07$ to $-1.3955e + 09$. Based on PCA results from stress and normal data shows that the maximum graph of stress data is 1 point low $-1.4550e + 09$ whose value is below min value normal data $-1.3955e + 09$.

E. Average Analysis

Table 9 Average Analysis

Data Stres			Data Normal		
Citra	Jumlah Nilai PCA > Rata - Rata	Jumlah Nilai PCA < Rata - Rata	Citra	Jumlah Nilai PCA > Rata - Rata	Jumlah Nilai PCA < Rata - Rata
Citra 1	27	13	Citra 1	35	5
Citra 2	21	19	Citra 2	35	5
Citra 3	34	6	Citra 3	12	28
Citra 4	16	24	Citra 4	22	18
Citra 5	34	6	Citra 5	25	15
Citra 6	20	20	Citra 6	33	17
Citra 7	11	29	Citra 7	35	15
Citra 8	5	35	Citra 8	8	32
Citra 9	8	32	Citra 9	4	36
Citra 10	11	29	Citra 10	11	29
Citra 11	5	35	Citra 11	36	4
Citra 12	28	12	Citra 12	5	35
Citra 13	4	36	Citra 13	34	6
Citra 14	32	8	Citra 14	13	27
Citra 15	4	36	Citra 15	35	5
Citra 16	16	24	Citra 16	7	33
Citra 17	6	34	Citra 17	14	26
Citra 18	5	35	Citra 18	29	11
Citra 19	27	13	Citra 19	16	24
Citra 20	35	5	Citra 20	5	35
Citra 21	6	34	Citra 21	33	7
Citra 22	31	9	Citra 22	5	35
Citra 23	35	5	Citra 23	10	30
Citra 24	6	34	Citra 24	33	7
Citra 25	6	34	Citra 25	5	25
Citra 26	35	5	Citra 26	16	24
Citra 27	31	9	Citra 27	6	34
Citra 28	31	9	Citra 28	7	33
Citra 29	33	7	Citra 29	31	9
Citra 30	35	5	Citra 30	36	4
Citra 31	27	13	Citra 31	8	32
Citra 32	4	36	Citra 32	11	29
Citra 33	8	32	Citra 33	4	36
Citra 34	34	6	Citra 34	5	35
Citra 35	32	8	Citra 35	13	27
Citra 36	33	7	Citra 36	14	26
Citra 37	11	29	Citra 37	24	16
Citra 38	7	33	Citra 38	7	33
Citra 39	36	4	Citra 39	8	32
Citra 40	16	24	Citra 40	11	29
Percentase	50.38%	49.63%	Percentase	43.81%	56.19%

Table 9 shows the data on the number of values of feature extraction results that are more and less than the average value per image. It is known that the percentage of stress data more than the average is 50.38% and the percentage less than the average is 49.63%. While the percentage of normal data that is more than the average is 43.81% and the percentage less than the average is 56.19%.

F. Graphical Pattern Analysis

In the graphical pattern analysis stage to determine the PCA value of an image is a rising graphic pattern, the descending graph or irregular graph can use the following rules.

Table 10 Pattern Rules

Pola Grafik Naik	Pola Grafik Turun	Pola Grafik Tidak Beraturan
Rata-rata 10 data terakhir citra > 106793459.747298	Rata-rata 10 data terakhir citra < -72774804.0580786	Rata-rata 10 data terakhir citra 106793459.747298 sampai 72774804.0580786

Table 10 shows the rules for determining the PCA value as an up, down, or irregular pattern.

Table 11 Graphical Pattern Analysis

Citra	Data Stres			Citra	Data Normal		
	Naik	Turun	Tidak Beraturan		Naik	Turun	Tidak Beraturan
Citra 1	0	0	1	Citra 1	0	1	0
Citra 2	0	0	1	Citra 2	0	1	0
Citra 3	0	1	0	Citra 3	0	0	1
Citra 4	0	0	1	Citra 4	0	0	1
Citra 5	0	1	0	Citra 5	0	0	1
Citra 6	0	0	1	Citra 6	0	0	1
Citra 7	0	0	1	Citra 7	0	1	0
Citra 8	1	0	0	Citra 8	0	0	1
Citra 9	0	0	1	Citra 9	0	0	1
Citra 10	0	0	1	Citra 10	0	0	1
Citra 11	0	0	1	Citra 11	0	1	0
Citra 12	0	0	1	Citra 12	0	0	1
Citra 13	1	0	0	Citra 13	0	1	0
Citra 14	0	0	1	Citra 14	0	0	1
Citra 15	0	0	1	Citra 15	0	1	0
Citra 16	0	0	1	Citra 16	0	0	1
Citra 17	0	0	1	Citra 17	0	0	1
Citra 18	0	0	1	Citra 18	0	0	1
Citra 19	0	0	1	Citra 19	0	0	1
Citra 20	0	1	0	Citra 20	0	0	1
Citra 21	1	0	0	Citra 21	0	0	1
Citra 22	0	0	1	Citra 22	0	0	1
Citra 23	0	0	1	Citra 23	0	0	1
Citra 24	1	0	0	Citra 24	0	0	1
Citra 25	0	0	1	Citra 25	0	0	1
Citra 26	0	1	0	Citra 26	0	0	1
Citra 27	0	0	1	Citra 27	1	0	0
Citra 28	0	1	0	Citra 28	0	0	1
Citra 29	0	1	0	Citra 29	0	0	1
Citra 30	0	1	0	Citra 30	0	1	0
Citra 31	0	0	1	Citra 31	0	0	1
Citra 32	1	0	0	Citra 32	0	0	1
Citra 33	0	0	1	Citra 33	0	0	1
Citra 34	0	1	0	Citra 34	0	0	1
Citra 35	0	1	0	Citra 35	0	0	1
Citra 36	0	1	0	Citra 36	0	0	1
Citra 37	0	0	1	Citra 37	0	0	1
Citra 38	0	0	1	Citra 38	0	0	1
Citra 39	0	1	0	Citra 39	0	0	1
Citra 40	0	0	1	Citra 40	0	0	1
Jumlah	4	12	24	Jumlah	1	7	32
Percentase	10 %	30 %	60 %	Percentase	2.5 %	17.5 %	80 %

Table 11 shows the number of graphic patterns of 40 stress data with upgraded graphic pattern of 4 data with 10% percentage, down pattern graph is 12 data with 30% percentage and irregular graphic pattern is 24 data with percentage 60%. While the graphic pattern of 40 normal data with the graphic pattern rose by 1 data with 2.5% percentage, the pattern of down graphics amounted to 7 data with the percentage of 17.5% and the pattern of irregular graphs amounted to 32 data with percentage of 80%.

5. Conclusions

Based on the results of analysis and testing it can be concluded as follows.

1. Pre-processing the image data, producing images that focus on the face with a grayscale image type and resolution of 400x400 pixels image. PCA results based on statistical analysis are median, average, maximal and minimal. The median stress score is between $-6.3249e + 06$ to $5.8635e + 06$, normal median value between $-4.3245e + 06$ to $4.9997e + 06$. While the average score is between

-3.6142e + 07 to 5.2675e + 07, the normal average is between -5.1338e + 07 to 4.5875e + 07. While the maximum value of stress between 3.8412e + 07 to 1.3347e + 09, the maximum value of normal between 3.0542e + 07 to 1.1219e + 09. While the minimum value of stress between -3.6308e + 07 to -1.4550e + 09, the minimum normal value between -3.8612e + 07 to -1.3955e + 09.

2. Facial feature extraction comparison results using Principal Component Analysis (PCA) is
 - a. Based on the mean analysis of the facial identity data of the identified stress has a percentage above the average per image of 50.38% and the percentage below the average per image of 49.63%, while the normal face image data has a percentage above the average per image as big as 43.81% and a percentage below the average per image of 56.19%.
 - b. Based on the analysis of the pattern of the facial image data, the identified stress has a percentage of irregular pattern of 60%, while the normal identifiable face image has an irregular pattern percentage of 80%.

Bibliography

- [1] Hartaji, Damar A. (2012). Motivasi Berprestasi Pada Mahasiswa yang Berkuliah Dengan Jurusan Pilihan Orangtua. Fakultas Psikologi Universitas Gunadarma.
- [2] Suriakin, M., Bulkis, K., & IGP, S. W. (2014). Ekstrasi Ciri Wajah Manusia Menggunakan Algoritma Principal Component Analysis (PCA) Untuk Sistem Pengenalan Wajah. Dielektrika, ISSN 2086-9487.
- [3] Henry, J. D., & Crawford, J. R. (2005). The short-form version of the Depression Anxiety Stress Scales (DASS-21): Construct validity and normative data in a large non-clinical sample. British Journal of Clinical Psychology, 227-239.
- [4] Lovibond, S.H & Lovibond, P.F. 1995. Manual for the Depression Anxiety Stress Scales. The Psychology Foundation of Australia Inc.
- [5] Basuki, A. (2005). Metode Numerik dan Algoritma Komputasi. Yogyakarta: ANDI.
- [6] Arymurthy A. M dan Setiawan S. (1992). Pengantar Pengolahan Citra, PT Elex Media Komputindo Jakarta.
- [7] Pratiwi. (2014). Metode Ekstrasi Ciri 2DPCA Pada Pengenalan Citra Wajah Dengan Matlab. Jurnal Teknologi, 1-5.
- [8] Umale, C., & Vaidya, A. (2016). Feature Extraction Techniques and Classification Algorithms for EEG Signals to detect Human Stress - A Review. International Journal of Computer Applications Technology and Research, 08 - 14.
- [9] Utami, E., & Wulanningrum, R. (2014). Penggunaan Principal Component Analysis dan Euclidean Distance untuk Identifikasi Citra Tanda Tangan. IPTEK-KOM, 1-16.
- [10] Nimas, S. (2012). Perbandingan Ukuran Jarak pada Pengenalan Wajah Berbasis Principal Component Analysis. Penelitian Institut Teknologi Surabaya.