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Face Recognition Application Using the Eigenface Method for Employee Attendance at STMIK Budi Darma

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Abstract

Attendance is one of the most important repetitive transactions because it is related to the productivity of employees and employees and is one of the controlling indicators Human resources (HR) which aim to increase the potential of human resources as well used in the framework of efficiency. Current technological developments allow making a system that can assist humans in recognizing a digital image. One of them a field that is currently being developed is pattern recognition. This technology identifies the special physical characteristics of a person. An example of pattern recognition is an example of face recognition, iris recognition, fingerprint recognition (finger recognition), and others. The face is part of the human body to be the focus of attention in social interactions. The face has a very important rolethat can show someone's identity, therefore a face can be used asa part of the human body that is used as an indication of knowing someoneor face recognition. Attendance is an administrative act regarding attendance and absence attendance of employees. In this facial recognition, research uses a camera to capturing someone's face was then compared to the face that had previously beenstored in a specific database. Broadly speaking, the process of facial recognition is the webcam camera captures the face. Then we get an R (read) value, G (Green), B (Blue). Using pre-processing, cropped, RGB toGrayscale. After the Grayscale process is carried out, the face processing stage is carried out using the eigenface method. In this eigenface method, there are several core stages namely: converting faces to matrices, calculating Flat Vector averages, determining values eigenface, and perform the face identification process by looking for the eigenface value approaching. One of the ways of facial recognition can be developed into an application absence that can be applied in companies to prevent manipulation of absences by employees or employees.

Keywords: *Face Recognition, Eigenface, Absens, Clerk*

1. Introduction

Attendance is a very important thing to pay attention to in an institution both among government agencies and private agencies. The presence and activeness of employees in an agency will have a major influence on the development and progress of the agency. Attendance is very important to achieve every goal or vision and mission of an agency or company. Attendance is related to discipline, the cooperation of each employee. STMIK Budi Darma is one of the computer colleges located in North Sumatra and in the Coordination area of Private Higher Education (Kopertis) region I which was established since its inception and does not yet have a face recognition application that can be used to record and find out the presence of every employee and lecturer. STMIK Budi Darma has adequate facilities, especially computers that can be used to collect personnel data. The process of data collection on the attendance of employees and lecturers is still carried out manually and will be calculated based on each lecture report of each lecturer in one semester. The data collection process which is carried out will raise a new problem in improving Human Resources (HR).

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Until now, STMIK Budi Darma does not have an application that can be used to collect lecturer attendance data. Along with that, every employee or lecturer does not have a good performance history. At this time, every schedule and operational hours that have been determined by the college will not be achieved properly, due to Human Resources (HR). One of the negative impacts that will occur from the indiscipline of Human Data Sources (HR) is that the vision and mission of STMIK Budi Darma will be difficult to achieve properly. The facial recognition application will be more effective in the process of data collection of staff or lecturer attendance and can also make it easier to achieve a predetermined vision and mission. Through the facial recognition application that is built, it will help certain units in evaluating every performance of employees or lecturers. On the other hand, the application will help lecturers and employees to be more disciplined in every operational hour given by Higher Education. The face imposition application is built with performance assistance rather than the eigenface method which is a face matching method. Employees and lecturers only direct their faces in front of the camera, so the system will work to adjust and search for data that has been stored in the database. Employees or lecturers who have directed their faces in front of the camera, the face data will be presented with the data that has been stored and then displayed according to the data of the employee or lecturer themselves. The facial recognition system which is included in the field of image processing can be combined with the attendance system so that it becomes an interesting thing to do, where later the attendance system can also be done with faces. The process of making an attendance application with facial recognition uses the Eigenface algorithm found in OpenCV [1].

Face Recognition begins by extracting the coordinates of features such as mouth width, eye width, pupils, and comparing the results with the measurements stored in the database and returning the closest record (face metric). Today, there are many facial recognition techniques and algorithms being discovered and developed all over the world. Facial recognition is an interesting research topic. This is proven by the number of papers published related to facial recognition including facial feature extraction, facial algorithm enhancements, and facial recognition implementation. The main objective of this study is to obtain the best facial recognition algorithms (Eigenface and Fisherface) provided by Open CV 2.4.8 by comparing the ROC (Receiver Operating Characteristics) curve and implementing it in the attendance system as the main case study [2]. A facial recognition method using eigenfaces is proposed. We used a face image database that contained 190 images from 38 different people (5 images per person file). From these results, it can be concluded that for such recognition there is enough to take about 10% of the eigenfaces with the highest eigenvalues. It was also clear that the recognition rate increased with the number of exercise images per person. It is clear that if the minimum distance between the test image and another image is zero, the test image fully matches the drawing from the training base. If the distance is greater than zero but less than a certain threshold, it is a known person by another facial expression, otherwise, the person is not recognized [3]. This paper has conducted a comparative study of three new facial recognition techniques, namely, eigenface, auto associations, and tissue classification, and elastic matching. First, this technique is analyzed below.

2. Research Methodology

As for the methodology in this study are the stage of data collection analysis design or design system development and testing. parts related to the making of learning media. Problem analysis This research was conducted by two methods, namely descriptive methods and methods comparative. research (Library Research) This library research aims to take the explanation/information needed when carrying out the task research is carried out. at this stage the system design process will be carried out, starting with the presentation of the material, practice, games and

simulations, input interface design, algorithm creation, and output interface creation.

2.1. Images

Image is a combination of points, lines, colors, and fields to create an imitation of an object, usually a physical or human object. Images are divided into two parts, namely images with two dimensions such as photographs and paintings, while those with three dimensions are like sculptures. In today's world, many applications can be used to produce an image, for example, images that are scanners, images from digital cameras, images from image microscopes, images from fingerprint reader applications, and images that are recorded from CCTV (Closed). Circuit Television). There is much software that can be used to perform and change patterns from digital images, such as CorelDraw, Photoshop, and so on, which can be used to process the digital image reader. CCTV cameras are electric devices that can generate and capture an image both indoors and outdoors by using a closed television signal. The discipline of digital image processing is very broad, covering digital signal processing techniques as well as techniques specific to images. A figure can be thought of as a function of f (x, y) of two continuous variables x and y. To be processed digitally, it must be sampled and converted into a number matrix. Because computers represent numbers using finite precision, these numbers must be quantized in order to be represented digitally. Digital image processing consists of manipulating such as precise numbers. Digital image processing is divided into several classes, namely image repair, image restoration, image analysis, and image compression [9].

2.2. Absens

Employee attendance is an important factor for an agency or company to achieve goals, this is related to discipline and has an impact on the performance of each employee. Therefore, it is necessary to have special data collection to record attendance and absenteeism so that work activities can be recorded in real-time and properly. There are many ways that can be done to achieve a good attendance information system, one of which is using computer technology where its application is a website-based attendance application [7]. Attendance is a form of supervision or control of educators and employees in the world of education. The attendance activities that have been running so far are still using the manual system, by recording the attendance of education personnel and employees in an attendance book or paper. As a result, the possibility of errors or obstacles in making attendance recapitulation is large. Mistakes or obstacles that often arise include the loss of paper or attendance lists. One way to reduce errors that occur is to create a system that can be used anywhere, by using a database that will store attendance data so that the possibility of data being scattered will be small [8]. Based on the research conducted above, it can be concluded that attendance is a form of supervision of employees or employees who are working at an agency or company with a predetermined time and operational hours.

2.3. Eigenface Method

Eigenface is a facial recognition algorithm based on Principle Component Analysis (PCA) developed at MIT. The overall Eigenface algorithm is quite simple. The training Image is represented in a flat vector (combined vectors) and joined together into a single matrix [10]. The steps of the eigenface method are as follows [1]:

a) Sample data by creating a set S consisting of all training drawings (Γ1, Γ2..., ΓM)

S = (Γ1, Γ2,....., ΓM (1)

b) The second step is to take the mean or middle value (Ψ)

$(\Psi) = \frac{1}{M} \sum_{n=1}^{m} \Gamma_n$ (2)

c) The third step is to find the difference (Φ) between the value of the trainning images (Γ_1) and the middle value (Ψ)

$\phi i = \Gamma_i - \Psi$ (3)

d) The fourth step is to calculate the covariance value (C)

$C = \frac{1}{M} \sum_{n=1}^{m} \phi_n \ \phi_n^T = AA^T$

$L = AA^T$

$L = \phi_n^T \ \phi_n$ (4)

e) The fifth step calculates the eigenvalue (λ) and eigenvector (v) of the covariance matrix (C)

$C \times v_i = \lambda_i \times v_i$ (5)

f) The sixth step after the eigenvector (v) is obtained, the eigenface (μ) can be found with

$\mu_i = \sum_{n=1}^{m} v_{ik} \ \phi_k$

L = 1,,,,, M (6)

2.4. Database

A database or database is a collection of data that are interconnected (interrelated data) that are stored together on a media, without seeing or not needing a duplicate of data (although there is one, the duplication of data must be minimized and controlled) and stored in a way -Special way so easy to use or display again. The hierarchy of data in the database can be seen in the following arrangement, Database, File, Record, Field, Byte, Bit [11].

2.5. Mysql

MySQL is RDMBS fast and easy to use and is commonly used for various needs [12]. With this capability, the application will be made more powerful. MySQL can be used as a database management system SQL which is open source and the most popular today. MySQL Database System supports several features such as multithreaded, multi-user, and SQL database management systems (RBMS). This database was created for the purposes of a database system that is fast, reliable, and easy to use

2.6. Visual Basic.Net 2008

Microsoft Visual Basic.Net (VB) is a programming language that offers a visual Integrated Development Environment (IDE) for creating software programs based on the Microsoft Windows operating system using a programming model (COM). Visual Basic is a derivative of the Basic programming language and offers fast graphical software development. Some scripting languages, such as Visual Basic for Applications (VBA) and Visual Basic Scripting Edition (VBScript), are similar to Visual Basic but have a different working method. Programmers can build applications using the components provided by Microsoft Visual Basic. In programming for business, Visual Basic has a very broad market content. A survey conducted in 2005 showed that 62% of software developers reported using some form of Visual Basic, followed by C ++, JavaScript, C #, and Java.

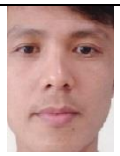
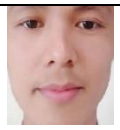
3. Results And Discussion

There are several steps taken to carry out the facial recognition process, namely by preparing data and creating a matrix for each data in the database. Each value obtained will then take the mean or middle value and then find the difference between the image

being trained and the mean value of the images. Calculate the value of the covariance matrix, calculate the eigenvalue and eigenvector, determine the eigenface value, and finally the identification process. For more details on the completion process, we can see the steps below:

a) Consists of data set S which consists of all training data
At this stage, we compile a set of S matrix values where these values are taken from all the trained images (Γ_1, Γ_2,… Γm). For example, in 4 facial data where each image data is taken in three directions and also different lighting. The data can be seen as in the table seen in table 1.

Table 1. Trainning Data

No	Images	Matrix Value for each image with Size 4x4	Information
1		C1 = $\begin{bmatrix} 7 & 7 & 9 & 9 \\ 5 & 5 & 6 & 6 \\ 4 & 3 & 4 & 4 \\ 5 & 5 & 6 & 6 \end{bmatrix}$ RGB	Image is visible and visible from the bottom side
2		C2 = $\begin{bmatrix} 24 & 23 & 23 & 24 \\ 24 & 23 & 23 & 24 \\ 24 & 23 & 23 & 24 \\ 24 & 23 & 23 & 24 \end{bmatrix}$ RGB	Image is visible and seen from the front
3		C3 = $\begin{bmatrix} 20 & 20 & 21 & 20 \\ 19 & 19 & 20 & 20 \\ 19 & 18 & 19 & 19 \\ 19 & 18 & 19 & 18 \end{bmatrix}$ RGB	The image is visible from the top
4		C4 = $\begin{bmatrix} 137 & 145 & 148 & 126 \\ 120 & 142 & 138 & 145 \\ 137 & 144 & 144 & 140 \\ 131 & 139 & 136 & 136 \end{bmatrix}$ RGB	Image is visible and seen from the left side
5		C5 = $\begin{bmatrix} 102 & 127 & 141 & 130 \\ 107 & 130 & 134 & 132 \\ 106 & 114 & 130 & 123 \\ 93 & 121 & 127 & 126 \end{bmatrix}$ RGB	The image is visible and visible from the top with lighting that tends to be bright
6		C6 = $\begin{bmatrix} 121 & 111 & 127 & 107 \\ 115 & 113 & 114 & 115 \\ 120 & 113 & 123 & 113 \\ 118 & 118 & 116 & 120 \end{bmatrix}$ RGB	Images are visible and seen from the front side with lighting that tends to be dimmer
7		C7 = $\begin{bmatrix} 209 & 208 & 205 & 203 \\ 209 & 209 & 207 & 205 \\ 207 & 207 & 207 & 206 \\ 206 & 207 & 208 & 206 \end{bmatrix}$ RGB	The image is visible and visible from the front side with lighting that tends to be brighter
8		C8 = $\begin{bmatrix} 191 & 181 & 207 & 205 \\ 181 & 180 & 202 & 208 \\ 180 & 174 & 204 & 209 \\ 183 & 157 & 200 & 207 \end{bmatrix}$ RGB	The image is visible and visible from the bottom with lighting that tends to be brighter
9		C9 = $\begin{bmatrix} 161 & 163 & 165 & 164 \\ 158 & 159 & 160 & 161 \\ 160 & 160 & 161 & 160 \\ 162 & 161 & 162 & 160 \end{bmatrix}$ RGB	The image is visible and seen from the right side with lighting that tends to be brighter

No	Images	Matrix Value for each image with Size 4x4	Information
		C10= $\begin{bmatrix}232 & 236 & 239 & 239\\231 & 234 & 238 & 242\\232 & 232 & 234 & 239\\233 & 232 & 232 & 235\end{bmatrix}$ RGB	The image is visible and visible from the left side with lighting that tends to be dimmer
10		C11= $\begin{bmatrix}215 & 214 & 214 & 213\\215 & 215 & 214 & 214\\215 & 215 & 214 & 214\\215 & 215 & 215 & 215\end{bmatrix}$ RGB	The image is visible and visible from below the front with lighting that tends to be brighter
		C12= $\begin{bmatrix}205 & 205 & 205 & 205\\205 & 205 & 205 & 205\\205 & 207 & 206 & 204\\198 & 192 & 181 & 171\end{bmatrix}$ RGB	The image is visible and visible from the front side with lighting that tends to be brighter

Note: The table above is a table of the pixel values of each training data where this value can be used to test the eigenface method. The sample data taken from the training data is 4x4 pixels in size from each training data.

b) The second step that needs to be done is to calculate the mean (Ψ) value. Calculating the mean value can use the equation below:

$$(\Psi) = \frac{1}{M} \sum_{n=1}^{m} \Gamma_n$$

$$(\Psi) = \frac{1}{3} \sum_{n=1}^{3} \Gamma_n$$

$$= \frac{1}{3}\begin{bmatrix}7 & 7 & 9 & 9\\5 & 5 & 6 & 6\\4 & 3 & 4 & 4\\5 & 5 & 6 & 6\end{bmatrix} + \begin{bmatrix}24 & 23 & 23 & 24\\24 & 23 & 23 & 24\\24 & 23 & 23 & 24\\24 & 23 & 23 & 24\end{bmatrix} + \begin{bmatrix}20 & 20 & 21 & 20\\19 & 19 & 20 & 20\\19 & 18 & 19 & 19\\19 & 18 & 19 & 18\end{bmatrix}$$

$$= \frac{1}{3}\begin{bmatrix}7 & 7 & 9 & 9 & 5 & 5 & 6 & 6 & 4 & 3 & 4 & 4 & 5 & 5 & 6 & 6\\24 & 23 & 23 & 24 & 24 & 23 & 23 & 24 & 24 & 23 & 23 & 24 & 24 & 23 & 24 & 24\\20 & 20 & 21 & 20 & 19 & 19 & 20 & 20 & 19 & 18 & 19 & 18 & 19 & 18 & 19 & 18\end{bmatrix}$$

$$= \frac{1}{3}\begin{bmatrix}51 & 50 & 53 & 53 & 48 & 47 & 49 & 50 & 47 & 44 & 46 & 46 & 48 & 46 & 59 & 48\end{bmatrix}$$

$$= \begin{bmatrix}17 & 16 & 17 & 17 & 16 & 15 & 16 & 16 & 15 & 14 & 15 & 15 & 16 & 15 & 19 & 16\end{bmatrix}$$

$$= \begin{bmatrix}17 & 16 & 17 & 17\\16 & 15 & 16 & 16\\15 & 14 & 15 & 15\\16 & 15 & 19 & 16\end{bmatrix}$$

c) Finding the difference between (ϕ) trainning images (Γ1) and the value (Ψ), with the following equation:

$$\phi_i = \Gamma_1 - \Psi$$

$$= \begin{bmatrix}7 & 7 & 9 & 9\\5 & 5 & 6 & 6\\4 & 3 & 4 & 4\\5 & 5 & 6 & 6\end{bmatrix} - \begin{bmatrix}17 & 16 & 17 & 17\\16 & 15 & 16 & 16\\15 & 14 & 15 & 15\\16 & 15 & 19 & 16\end{bmatrix} = \begin{bmatrix}-10 & -9 & 8 & -8\\-11 & -10 & -10 & -10\\-11 & -11 & -11 & -11\\-11 & -10 & -13 & -10\end{bmatrix}$$

$$\phi_2 = \Gamma_2 - \Psi$$

$$= \begin{bmatrix}24 & 23 & 23 & 24\\24 & 23 & 23 & 24\\24 & 23 & 23 & 24\\24 & 23 & 23 & 24\end{bmatrix} - \begin{bmatrix}17 & 16 & 17 & 17\\16 & 15 & 16 & 16\\15 & 14 & 15 & 15\\16 & 15 & 19 & 16\end{bmatrix} = \begin{bmatrix}7 & 6 & 6 & 7\\8 & 7 & 7 & 8\\9 & 9 & 8 & 9\\8 & 8 & 4 & 8\end{bmatrix}$$

$$\phi_3 = \Gamma_3 - \Psi$$

$$= \begin{bmatrix} 20 & 20 & 21 & 20 \\ 19 & 19 & 20 & 20 \\ 19 & 18 & 19 & 19 \\ 19 & 18 & 19 & 18 \end{bmatrix} - \begin{bmatrix} 17 & 16 & 17 & 17 \\ 16 & 15 & 16 & 16 \\ 15 & 14 & 15 & 15 \\ 16 & 15 & 19 & 16 \end{bmatrix} = \begin{bmatrix} 3 & 4 & 4 & 3 \\ 3 & 4 & 4 & 4 \\ 4 & 4 & 4 & 4 \\ 3 & 3 & 0 & 3 \end{bmatrix}$$

d) The next step is to calculate the covariance value (C), with the following equation:

$C = \frac{1}{M} \sum_{n=1}^{m} \phi_n \ \phi_n^T = AA^T$

$L = AA^T$

$L = \phi_n^T \ \phi_n$

Hitung nilai matrik kovarian (C):

$$L = \begin{bmatrix} -10 & -9 & 8 & -8 & 7 & 6 & 6 & 7 & 3 & 4 & 4 & 3 \\ -11 & -10 & -10 & -10 & 8 & 7 & 7 & 8 & 3 & 4 & 4 & 4 \\ -11 & -11 & -11 & -11 & 9 & 9 & 8 & 9 & 4 & 4 & 4 & 4 \\ -11 & -10 & -13 & -10 & 8 & 8 & 4 & 8 & 3 & 3 & 0 & 3 \end{bmatrix} x \begin{bmatrix} -10 & -11 & -11 & 11 \\ -9 & -10 & -11 & -10 \\ -8 & -10 & -11 & -13 \\ -8 & -10 & -11 & -10 \\ 7 & 8 & 9 & 8 \\ 6 & 7 & 9 & 8 \\ 6 & 7 & 8 & 4 \\ 7 & 8 & 9 & 8 \\ 3 & 3 & 4 & 3 \\ 4 & 4 & 4 & 3 \\ 4 & 4 & 4 & 0 \\ 3 & 4 & 4 & 3 \end{bmatrix}$$

$$L = \begin{bmatrix} 1 & 5 & 3 & -3 \\ 0 & 1 & 1 & -1 \\ 0 & 2 & 1 & -1 \\ 0 & -2 & -1 & -1 \end{bmatrix}$$

e) The next step is to calculate the eigenvalue (λ) and eigenvector (v) values of the covariance matrix (C) with the following equation:

$C \times v_i = \lambda_i * v_i$

Determine the eigenvalue (λ) and eigenvector (v) values

$L = \lambda * v$

$L*v = \lambda I * v$

$L - \lambda I = 0$ atau $\lambda I - L = 0$

Then the eigenvalue (λ) can be calculated, det (λI-L) = 0

$$= \lambda \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} - \begin{bmatrix} 1 & 5 & 3 & -3 \\ 0 & 1 & 1 & -1 \\ 0 & 2 & 1 & -1 \\ 0 & -2 & -1 & -1 \end{bmatrix} = \begin{bmatrix} \lambda - 1 & 5 & 3 & -3 \\ 0 & \lambda - 1 & 1 & -1 \\ 0 & 2 & \lambda - 1 & -1 \\ 0 & -2 & -1 & \lambda - 1 \end{bmatrix}$$

A value will be generated λ = 0 dan λ = 1

$$v = \begin{bmatrix} v1 \\ v2 \\ v3 \\ v4 \end{bmatrix}$$

eigenvector (v) can be generated by substituting the eigenvalue (λ) value into the equation (λI-L) = 1, for

$$\lambda = 0, \text{ than } \begin{bmatrix} 0-1 & 5 & 3 & -3 \\ 0 & 0-1 & 1 & -1 \\ 0 & 2 & 0-1 & -1 \\ 0 & -2 & -1 & 0-1 \end{bmatrix} \begin{bmatrix} v1 \\ v2 \\ v3 \\ v4 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$= \begin{bmatrix} -1 & 5 & 3 & -3 \\ 0 & -1 & 1 & -1 \\ 0 & 2 & -1 & -1 \\ 0 & -2 & -1 & -1 \end{bmatrix} \begin{bmatrix} v1 \\ v2 \\ v3 \\ v4 \end{bmatrix} = \begin{bmatrix} -v1 & 5_{v2} & 3_{v3} & -3_{v4} \\ v1 & -v2 & 1_{v3} & -1_{v4} \\ v1 & 2_{v2} & -v3 & -1_{v4} \\ v1 & -2_{v2} & -1_{v3} & -v4 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

= the resulting eigenvector $\begin{bmatrix}-1\\0\\0\\0\end{bmatrix}$ *and* $\begin{bmatrix}-3\\0\\0\\0\end{bmatrix}$

λ = 1, than $\begin{bmatrix}1-1 & 5 & 3 & -3\\ 0 & 1-1 & 1 & -1\\ 0 & 2 & 1-1 & -1\\ 0 & -2 & -1 & 1-1\end{bmatrix}\begin{bmatrix}v1\\v2\\v3\\v4\end{bmatrix}=\begin{bmatrix}0\\0\\0\\0\end{bmatrix}$

$= \begin{bmatrix}0 & 5 & 3 & -3\\ 0 & 0 & 1 & -1\\ 0 & 2 & 0 & -1\\ 0 & -2 & -1 & 0\end{bmatrix}\begin{bmatrix}v1\\v2\\v3\\v4\end{bmatrix}=\begin{bmatrix}v1 & 5_{v2} & 3_{v3} & -3_{v4}\\ v1 & v2 & 1_{v3} & -1_{v4}\\ v1 & 2_{v2} & v3 & -1_{v4}\\ v1 & -2_{v2} & -1_{v3} & v4\end{bmatrix}=\begin{bmatrix}0\\0\\0\\0\end{bmatrix}$

= the resulting eigenvector $\begin{bmatrix}0\\0\\0\\0\end{bmatrix}$ and $\begin{bmatrix}-3\\0\\0\\0\end{bmatrix}$

So that the eigenvector generated from the matrix L is:

$\begin{bmatrix}-1 & -3 & 0 & -3\\ 0 & 0 & 0 & 0\\ 0 & 0 & 0 & 0\\ 0 & 0 & 0 & 0\end{bmatrix}$

f) The next step is to find the eigenface value using the following equation:

$\mu_i = \sum_{n=1}^{m} v_{ik}\ \phi_k$

L = 1,,,,, M

$\mu_1 = v \text{ x } \phi_1 = \begin{bmatrix}-1 & -3 & 0 & -3\\ 0 & 0 & 0 & 0\\ 0 & 0 & 0 & 0\\ 0 & 0 & 0 & 0\end{bmatrix}\begin{bmatrix}-10 & -9 & 8 & -8\\ -11 & -10 & -10 & -10\\ -11 & -11 & -11 & -11\\ -11 & -10 & -13 & -10\end{bmatrix}=\begin{bmatrix}10 & 27 & 0 & 24\\ 0 & 0 & 0 & 0\\ 0 & 0 & 0 & 0\\ 0 & 0 & 0 & 0\end{bmatrix}$

$\mu_2 = v \text{ x } \phi_2 = \begin{bmatrix}-1 & -3 & 0 & -3\\ 0 & 0 & 0 & 0\\ 0 & 0 & 0 & 0\\ 0 & 0 & 0 & 0\end{bmatrix}\begin{bmatrix}7 & 6 & 6 & 7\\ 8 & 7 & 7 & 8\\ 9 & 9 & 8 & 9\\ 8 & 8 & 4 & 8\end{bmatrix}=\begin{bmatrix}-7 & -18 & 0 & -21\\ 0 & 0 & 0 & 0\\ 0 & 0 & 0 & 0\\ 0 & 0 & 0 & 0\end{bmatrix}$

$\mu_3 = v \text{ x } \phi 3 = \begin{bmatrix}-1 & -3 & 0 & -3\\ 0 & 0 & 0 & 0\\ 0 & 0 & 0 & 0\\ 0 & 0 & 0 & 0\end{bmatrix}\begin{bmatrix}3 & 4 & 4 & 3\\ 3 & 4 & 4 & 4\\ 4 & 4 & 4 & 4\\ 3 & 3 & 0 & 3\end{bmatrix}=\begin{bmatrix}-3 & -12 & 0 & -9\\ 0 & 0 & 0 & 0\\ 0 & 0 & 0 & 0\\ 0 & 0 & 0 & 0\end{bmatrix}$

By obtaining the eigenface value, it can be concluded that Figure 1, Figure 2, Figure 3 can be concluded that one image with another image has similarities so that it can be read and adjusted to the image that has been stored in the database. This value can be determined based on the eigenface matrix value obtained from each image.

4. Conclusion

Based on the results of the discussion and testing that has been carried out, the research conclusions are as follows :

a) The aigenface method is a method that can be used to detect and recognize faces with images that have been stored in the database.
b) The process of training data from the eigenface method is a process carried out to identify and introduce faces to face data that are already in the database.
c) Eigenface can be applied in applications that are built so that it can simplify the processing of personnel attendance data at Universita Budi Darma

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