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Web-Based Face Recognition using Line Edge Detection and Euclidean Distance Method

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Abstract
A face recognition system is to perform a match face image using the face extraction method. There are many applications used in various algorithms and implemented in many programming languages, but still difficult to implement on web-based applications using the PHP programming language. The purpose of this research is to produce a website-based application focused on the face recognition section. The author will limit the system only to detect the front view of the face, main goal is to get a fairly high level of accuracy. There will be a feature to find where the face is located. The research method used is a laboratory experiment where the search system scheme based on face recognition will produce the appearance of several faces that have the closest Euclidean distance values from grades 1st to 5th. The results from the comparison of the test image with the training image based on Line Edge Detection and Euclidean Distance calculation concluded that the system can be implemented in searching of similarity and recognizing the face.

Keywords: euclidean distance; face recognition; line edge detection; search system

INTRODUCTION

Face recognition is something that grows rapidly in the field of information and communication technology such as artificial intelligence, expert system, and computer vision, one of the implementations of the expert system is developed by Kusrini et al. (2020) which develop for agriculture purpose, and many systems based on facial recognition have been implemented for various purposes, such as; login application (Alam & ShahzahanAli, 2020), attendance system (Mekala et al., 2019). The widespread use of the computers in everyday life have brought these devices as versatile assistants for humans. One of them is in the security field, such as to unlock the key of the security system using biometric facial recognition. A security system that uses a facial recognition system becomes more difficult to breach because the identification process involves a unique identification method, namely face identification, than only people whose faces are recognized and have rights are allowed to pass this system.

Computer vision has become one of the objects of research developed rapidly around the world, one of the things that have been widely applied is facial recognition technology, many experiments on facial recognition, try to understand and characterize the existing representations and processes. The process and face recognition are still unattainable goals due to various obstacles encountered, such as lighting problems, and changes in the pattern of angel image capture, even though face recognition has become a hot topic of discussion in the last two decades, this field has progressed and quite fast.

The facial recognition process carried out by a computer or an emphasis machine has become one of the developments in an artificial neural network where this recognition has output like what is done by the human senses until the face is well recognized, this process is not only required related information with the object or target but also can distinguish information from the characteristics of other objects. The human face has prominent features and can distinguish one another, it has a big problem, where data based on the real world becomes difficult to be used as information by computers or machines, due to several things as follows; The face is multidimensional, these features will be very different depending on the perspective, the face contains various facial features (emotions), an image is two-dimensional, while the world is three-dimensional. This causes some information to be lost when the image is formed, an image can contain many objects it, and these objects overlap each other, the value contained in a pixel is influenced by various things and it is difficult to prevent this effect from occurring (Although it looks easy for humans to recognize, it is very difficult for computers.

Various methods for facial recognition have been widely studied by scientists both at home and abroad. Li and Li (2019), Alam & ShahzahanAli (2020), and Rai et al. (2020), also Nikhilesh (2018) conducted facial recognition research using JavaScript. According to Archilles and Wicaksana (2020), and Khan et al. (2019) used FaceNet deep convolutional network model. The research of Rahmadi et al. (2018), Tuncer et al. (2019), Pereira and Kuhn (2020), Lyanpen et al. (2019), and Tabassum et al. (2022) used wavelet transformation, but Gao and Leung (2002), Kagawade and Angadi (2019) used edge map mapping as a face recognition method. It is different method which used by Pang et al. (2019), and Saad et al. (2019) they uses the Haar-like and Wu et al. (2021) combine Haar and Euclidean distance methods, while Abidin (2018) uses the Haar Cascade Classifier Algorithm which is implemented using Matlab, while Nordin and Fauzi (2020), Mekala et al. (2019), Sutabri et al. (2019) implements facial recognition by implementing the Attendance system. In this study, we will use the Line Edge Detection method for image feature extraction, and the calculation of the Euclidean Distance function for face recognition which is implemented in the search system. Face detection in a digital image has played an important role in the last decade, with field applications such as law enforcement and security. Although face detection is a very easy thing for human eye, making the process run automatically for computers requires the use of various image processing techniques, then this process requires a robust algorithm to be implemented. Edge is a sudden (large) change in the intensity of the grey degree over a short distance (Gao & Leung, 2002). It is the difference in intensity that shows the details in the image. Edges can be oriented in any direction, and this direction varies depending on changes in intensity.

The website is an application on the internet, the website can be run via the HTTP (Hypertext Transfer Protocol) protocol which makes it possible to transfer data in the form of text, images, animations, videos, or other files. This application has grown rapidly since it was first introduced by Sir Tim Barners Lee in the 1990s, and until now this application has been used by all humans for purposes of education, government, business, and so on. Website is an application on the internet network as a delivery medium and it is very easy to use, it has customized through various programming languages such as PHP (Hypertext Pre-processor), Java, Dot Net, this paper tries to offer web-based facial recognition, and also proposes algorithm in implementing facial recognition using face detection dan Euclidean distance calculation in pure PHP, then the application will be easy to use and can be used on any platform.

METHOD

We use the experimental laboratory method in collecting data and analysing it for this research. The paper will be focused on the calculation of the training image with the database

image and compare them using Euclidean Distance. The training image will be captured by the system and transferred in image processing using Line Detection and compare the training image and database image using Euclidean Distance, and then show the result in the last process.

There are several algorithms used for any purpose one of them is Algorithm K-NN which is used to classify the hoax news about covid-19 (Hidayat et al., 2021), Euclidean Distance is the most commonly used metric to calculate the similarity of 2 vectors. Euclidean distance calculates the root of the square of differences between 2 vectors (the root of square differences between 2 vectors). Digital image processing using the Euclidean distance method in terms of recognizing images is calculated by Colour intensity (σ), Average score (μ), Entropy (e), Energy (E), Homogeneity (H), and Contrast (C)

The image recognition based on the above criteria can be described with the following calculations: The instance for calculating Euclidean distance can be shown below, if two vectors are known:

$$a = [a_1,\ a_2,\ a_3,\ \ldots\ldots\ldots,\ a_n]$$
$$b = [b_1,\ b_2,\ b_3,\ \ldots\ldots\ldots\ldots,\ b_n] \quad (1)$$

The Euclidean distance between the two vectors is

$$\|ab\| = \sqrt{(a_1 - b_1)^2 + (a_2 - b_2)^2 + (a_3 - b_3)^2 + \ldots\ldots\ldots (a_n - b_n)^2} \quad (2)$$

If n are images, each has characteristics formed by the following vectors:

$$C_1 = [\sigma_1 \quad \mu_1 \quad e_1 \quad p_1 \quad c_1 \quad h_1]$$
$$C_2 = [\sigma_2 \quad \mu_2 \quad e_2 \quad p_2 \quad c_2 \quad h_2] \quad (3)$$
$$\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$
$$C_n = [\sigma_n \quad \mu_n \quad e_n \quad p_n \quad c_n \quad h_n]$$

The calculation algorithm on image processing using Euclidean Distance is processed by the calculation which shown on the formula number (1), (2) then (3), the input data in this paper are obtained from images captured via a webcam and registering it in the database, then the image will be calculated the vector in the image using the formula which has been mentioned, whereas the test image as database is stored, writer uses a set of facial representation images for testing.

RESULTS AND DISCUSSIONS

Result

The input data is obtained from images captured via a webcam by registering a database, in this study the writer uses a set of facial representation images for testing, then the image will already be available. The design of the system is expected to be used to recognize or distinguish a face from a collection of faces that have been recognized, application will study the edge texture of the existing face shape, and then will calculate the distance between the test image and the training image contained in the database, the distance between the training image and the shortest test image has the dominant similarity. The application made will be designed so that it can find the position of the face in an image, the use of input images is expected to be more flexible. This capability is also expected to increase the accuracy or accuracy of the recognition that will be carried out.

The application will be more focused on the face recognition section, Writer limits it only to the front view with the main goal is to get a fairly high level of accuracy, there will be a feature to find where the face is located, a system based on facial recognition will produce the appearance of several faces that have the closest Euclidean distance value from grades 1 to 5, this system can be used on multiplatform using a web-based, the users only need a web browser application to access it. This system is built using; PHP Programming Language version 5.6, MySQL Databases, Apache Web Server, and Google Chrome Browser

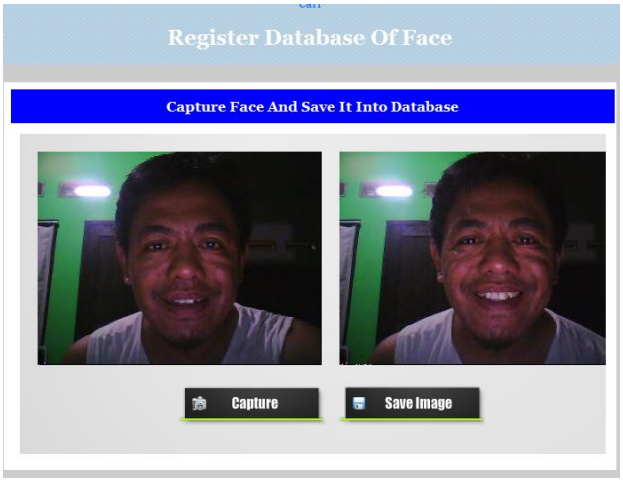

Figure 1. Registration process and saving to database

The framework of the algorithms we offer is as follows; take data in the form of photos or capture photos that represent faces facing forward, do face detection, crop face detection results so that 90% of the image is a face representation, perform edge mapping on the image, calculate the distance between the test image and the training image using the Euclidean distance method, the closest comparison between the test image and the training image is the image that has a dominant similarity, the face-based search query will produce a maximum of 5 face images that will be displayed based on the comparison of Euclidean values

Figure 2. Face recognition process

Figure 1 and 2 are the process of inputting the test image into the database by capturing using the web camera and will be saved in the database MySQL, the stored images are after processing by Euclidean distance calculation.

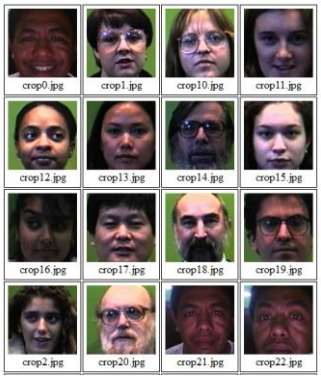

Figure 3. Face database after registration

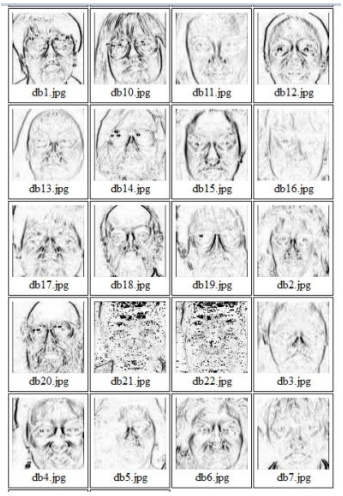

Figure 4. Face database after edge detection

Figures 3, and 4 indicate the stored image database that we have explained the framework of this system, while the database is obtained from the registration form by the user, the form of facial images is to be processed and stored in the database, and the process of cropping in the face area and image processing use line edge detection is shown in figure 5. After processing the facial image, the Euclidean distance is calculated, then the test face image will be compared with the training face image contained in the database, and the system will look for the smallest value of the difference between the test face image and the training face image.

Figure 5. Results of image processing on the system

Discussion

The search results are limited to only displaying 5 face queries which will be displayed with the closest average distance with grades 1 to 5. After the calculation in the table 1, the data are stored by system in array, the system will be shown the nearest value of the test image compared with the database image, the value of the system show that the image of Db10.jpg is

in the first of the result, and db12.jpg is in the second, and the db20.jpg (the same person image) shown in the 3rd result of the search system, then db6.jpg, and db18.jpg are shown in the next grade.

The results of image processing using pure PHP programming language, even though it is not the first grade, this is due to many factors, like the lighting factors or other factors, this system has provided results that can be used for further development. The implementation of this algorithm is easy to use in many programming language such as, (Nikhilesh, 2018) implement in java environment, (Rai et al., 2020) in JavaScript while (Nordin & Fauzi, 2020) implement web based in JavaScript programming language, (Wu et al., 2021), (Abidin, 2018), (Saad et al., 2019) in MATLAB, and most of the previous paper are Python (because of there are several API and modules in this programming language) but it is very difficult to implement in the PHP programming language, the implementation of this system is one of the novelty systems in facial recognition according to the previous research.

Table 1. Results of processing analysis and euclidean distance calculation

No	Database Image	Euclidean Distance	Note	Test Image
1	Db1.jpg	726.20247541172	Not Shown	Search.jpg
2	Db2.jpg	99.091955709202	Not Shown	Search.jpg
3	Db3.jpg	445.91380069141	Not Shown	Search.jpg
4	Db4.jpg	67.948769629167	Not Shown	Search.jpg
5	Db5.jpg	396.36782283681	Not Shown	Search.jpg
6	Db6.jpg	8.493596203646	Show in the 4th grade	Search.jpg
7	Db7.jpg	577.56454184792	Not Shown	Search.jpg
8	Db8.jpg	445.91380069141	Not Shown	Search.jpg
9	Db9.jpg	1683.1476476892	Not Shown	Search.jpg
10	Db10.jpg	0.2975683876272	Shown in the 1st grade	Search.jpg
11	Db11.jpg	520.94056715695	Not shown	Search.jpg
12	Db12.jpg	1.4155993672743	Shown in the 2nd grade	Search.jpg
13	Db13.jpg	124.57274432014	Not Shown	Search.jpg
14	Db14.jpg	445.91380069141	Not Shown	Search.jpg
15	Db15.jpg	99.091955709202	Not Shown	Search.jpg
16	Db16.jpg	99.091955709202	Not Shown	Search.jpg
17	Db17.jpg	396.36782283681	Not Shown	Search.jpg
18	Db18.jpg	67.948769629167	Shown in the 5th grade	Search.jpg
19	Db19.jpg	577.56454184792	Not Shown	Search.jpg
20	Db20.jpg	8.493596203646	Shown in the 3rd grade	Search.jpg

CONCLUSION

The results of the discussion about search systems using Edge Detection and Euclidean Distance techniques have shown that the system can be implemented although there are still many shortcomings in terms of face recognition, the calculation result between the test image and the image database using this technique occupies a significant result, the proof of this system shown that the closest calculation of Euclidean distance obtain the recognition of the face and it is implemented using pure PHP programming language successfully. The use of the

PHP programming language in this paper is shown as an alternative because this programming language is widely used for multi-platform, although the precision in future research is hoped to be focused on development of this system, because there are many influencing factors such as lighting, pixels from the camera, and changes in the pattern of angel image capture.

REFERENCES

Abidin, S. (2018). Deteksi Wajah Menggunakan Metode Haar Cascade Classifier Berbasis Webcam Pada Matlab. *Jurnal Teknologi Elekterika*, *15*(1), 21–27. https://doi.org/10.31963/elekterika.v15i1.2102

Alam, M. J., & ShahzahanAli, T. C. M. (2020). A smart login system using face detection and recognition by ORB algorithm. *Indonesian Journal of Electrical Engineering and Computer Science*, *20*(2), 1078-1087. https://doi.org/10.11591/ijeecs.v20.i2.pp1078-1087

Archilles, A., & Wicaksana, A. (2020). Vision: a web service for face recognition using convolutional network. *TELKOMNIKA (Telecommunication Computing Electronics and Control)*, *18*(3), 1389-1396. https://doi.org/10.12928/TELKOMNIKA.v18i3.14790

Gao, Y., & Leung, M. K. H. (2002). Face recognition using line edge map. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, *24*(6), 764–779. https://doi.org/10.1109/TPAMI.2002.1008383

Hidayat, W., Utami, E., Iskandar, A. F., Hartanto, A. D., & Prasetio, A. B. (2021). Perbandingan Performansi Model pada Algoritma K-NN terhadap Klasifikasi Berita Fakta Hoaks Tentang Covid-19. *Edumatic: Jurnal Pendidikan Informatika*, *5*(2), 167–176. https://doi.org/10.29408/edumatic.v5i2.3664

Kagawade, V. C., & Angadi, S. A. (2019). Multi-directional local gradient descriptor: A new feature descriptor for face recognition. *Image and Vision Computing*, *83–84*(C), 39–50. https://doi.org/10.1016/j.imavis.2019.02.001

Khan, M. J., Khurshid, K., & Shafait, F. (2019). A spatio-spectral hybrid convolutional architecture for hyperspectral document authentication. *Proceedings of the International Conference on Document Analysis and Recognition, ICDAR*, 1097–1102. https://doi.org/10.1109/ICDAR.2019.00178

Kusrini, W., Fathurrahmani, F., & Sayyidati, R. (2020). Sistem Pakar untuk Diagnosa Penyakit Ayam Pedaging. *Edumatic: Jurnal Pendidikan Informatika*, *4*(2), 75–84. https://doi.org/10.29408/edumatic.v4i2.2616

Li, C., & Li, C. (2019). Web Front-End Realtime Face Recognition Based on TFJS. *Proceedings 12th International Congress on Image and Signal Processing, BioMedical Engineering and Informatics, CISP-BMEI*, 1–5. https://doi.org/10.1109/CISP-BMEI48845.2019.8965963

Lyanpen, W., Petrosyan, O. G., & Jianming, D. (2019). Face Recognition Based on the Coefficient Tree for Three Scale Wavelet Transformation. *Automatic Control and Computer Sciences*, *53*(8), 995–1005. https://doi.org/10.3103/S0146411619080315

Mekala, V., Vinod, V. M., Manimegalai, M., & Nandhini, K. (2019). Face recognition based attendance system. *International Journal of Innovative Technology and Exploring Engineering*, *8*(12), 520–525. https://doi.org/10.35940/ijitee.L3406.1081219

Nikhilesh, S. (2018). Face Recognition In Java Environment. *International Journal of Advanced Multidisciplinary Scientific Research*, *1*(5), 46–49. https://doi.org/10.31426/ijamsr.2018.1.5.519

Nordin, N., & Fauzi, N. H. M. (2020). A web-based mobile attendance system with facial recognition feature. *International Journal of Interactive Mobile Technologies*, *14*(5), 193–202. https://doi.org/10.3991/IJIM.V14I05.13311

Pang, J. Y., Low, K. Y., & Wong, H. L. (2019). Development of a multi-client student

attendance monitoring system. *International Journal of Recent Technology and Engineering*, *8*(3 Special Issue), 6–11. https://doi.org/10.35940/ijrte.C1002.1083S19

Pereira, P., & Kuhn, T. (2020). An Experimental Study of Face Recognition Method. *Computer Science & IT Research Journal*, *1*(2), 52–58. https://doi.org/10.51594/csitrj.v1i2.135

Rahmadi, T., Ginting, G., & Fadlina. (2018). Identifikasi wajah manusia berdasarkan warna kulit dengan menggunakan transformasi wavelet. *Pelita Informatika Budi Darma, 6(4),* 394-397.

Rai, L., Wang, Z., Rodrigo, A., Deng, Z., & Liu, H. (2020). Software development framework for real-time face detection and recognition in mobile devices. *International Journal of Interactive Mobile Technologies*, *14*(4), 103–120. https://doi.org/10.3991/IJIM.V14I04.12077

Saad, S. L., Kamal, M. M., & Zamri, N. A. (2019). Monitoring and complaining web-based face recognition using Haar-MATLAB. *8th IEEE International Conference on Control System, Computing and Engineering, ICCSCE*, 206–211. https://doi.org/10.1109/ICCSCE.2018.8685017

Sutabri, T., Pamungkur, Kurniawan, A., & Saragih, R. E. (2019). Automatic attendance system for university student using face recognition based on deep learning. *International Journal of Machine Learning and Computing*, *9*(5), 668–674. https://doi.org/10.18178/ijmlc.2019.9.5.856

Tabassum, F., Imdadul Islam, M., Tasin Khan, R., & Amin, M. R. (2022). Human face recognition with combination of DWT and machine learning. *Journal of King Saud University - Computer and Information Sciences*, *34*(3), 546–556. https://doi.org/10.1016/j.jksuci.2020.02.002

Tuncer, T., Dogan, S., Abdar, M., Basiri, M. E., & Pławiak, P. (2019). Face recognition with triangular fuzzy set-based local cross patterns inwavelet domain. *Symmetry*, *11*(6), 1–18. https://doi.org/10.3390/sym11060787

Wu, H., Cao, Y., Wei, H., & Tian, Z. (2021). Face Recognition Based on Haar like and Euclidean Distance. *Journal of Physics: Conference Series*, *1813*(1), 1–7. https://doi.org/10.1088/1742-6596/1813/1/012036