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Determining Gender Using Facial Recognition Based On Neural Network With Backpropagation

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Abstract. Automated Facial Recognition is one of the essential problems in computer research. There is a various method available to solve this problem. In this paper, the researchers present a way to perform gender recognition by using an artificial neural network. Our approach uses backpropagation as the engine of the neural network. The writers have tested the application using 30 images, and the result shows an average MSE value of 0.14796. We also differentiate the test between the male and female sample. The male samples give 0.1488 MSE value while for the female samples give 0.1497 MSE value.

Keyword: Face Recognition, Artificial Neural Network, Backpropagation

Abstrak. Pengenalan wajah secara otomatis adalah salah satu masalah yang utama dalam penelitian berbasis komputer. Ada bebrapa metode yang dapat digunakan untuk menyelesaikan masalah ini. Penelitian ini bertujuan untuk memperkenalkan sebuah metode untuk melakukan pengenalan jenis kelamin dengan berdasarkan wajah pengguna dengan menggunakan sistem jaringan saraf tiruan. Metode ini menggunakan backpropagation sebagai mesin dari sistem jaringan saraf tiruan. Hasil uji coba dari aplikasi yang dibangun menunjukan dari 30 gambar yang digunakan, sistem memberikan nilai MSE 0.14796. Untuk sample wajah pria, sistem memberikan MSE 0.1497 dan untuk sample wajah pria, sistem memberikan nilai MSE 0.1488.

Kata Kunci: Pengenalan Wajah, Jaringan Saraf Tiruan, Backpropagation

1. Introduction

Image processing is a process and analysis in the image that involves a lot of visual perception. This process has the characteristics where data input and data output are in the form of images. The term digital image processing is generally defined as processing two-dimensional images with a computer. Artificial neural networks are computational systems whose architecture and operations are understood from the knowledge of biological neurons in the brain. Artificial neural can be described as a mathematical and computational model for non-linear approximation

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function, cluster data classification, and non-parametric regression or a simulation of a collection of neural network models.

Training on the backpropagation neural network, feedforward is done to calculate the weight; therefore at the end of the training will be obtained good weights. During the training process, weights are arranged interactively to minimize errors. The error is calculated based on the mean of the squared error (MSE). The average squared error is also used as the basis for calculating the performance of the activation function. Most of the training for the feedforward network (advanced feed) uses a gradient of the activation function to determine how to set the weights to minimize performance. This gradient is determined by using a technique called backpropagation.

Based on the background of the above problem interactively to minimize errors that occur by using a technique called backpropagation The formulation of the problem, in this case, is: Determination of image data types to be processed in the introduction of facial classification to determine gender. Application and the implementation of Backpropagation are used for the introduction of facial classification to determine gender. How to determine face classification to determine gender. The objectives to be achieved from this research are as follows: Determining the value of Mean Square Error (MSE), Determining the value of proximity to existing training data and analyzing the accuracy of systems that have been designed to detect the gender of human groups based on facial features using Backpropagation. From several reference journals, Previous research which related to the research topic and used as a reference for developing this research are as follows: Technique of taking picture or photo with the medium [1]. The focus of this research is to know the performance of a classification machine separating one's gender based on facial texture feature. [2]. To classify gender (male or female) through facial recognition by way of Measurement of the key points of the face component. [3]. The recognition of facial expression patterns based on the features of the mouth and eyes using edge detection.[4.] How to determine the value of MSE.[5].

2. Research Methods

The research is done by using the literature study method by collecting data, reading books and articles related to image processing, color model, face detection, basic matrix theory, artificial intelligence, artificial neural network, and MATLAB programming language related to image processing. Backpropagation, i.e., weights are arranged interactively to minimize errors (errors) that occur. The error is calculated based on the mean of the squared error (MSE). The retrieval of objects as data is done using the camera. To assist the process of implementing the program, a graphical user interface is developed as an interface using MATLAB as an application to create facial classification applications to define gender.
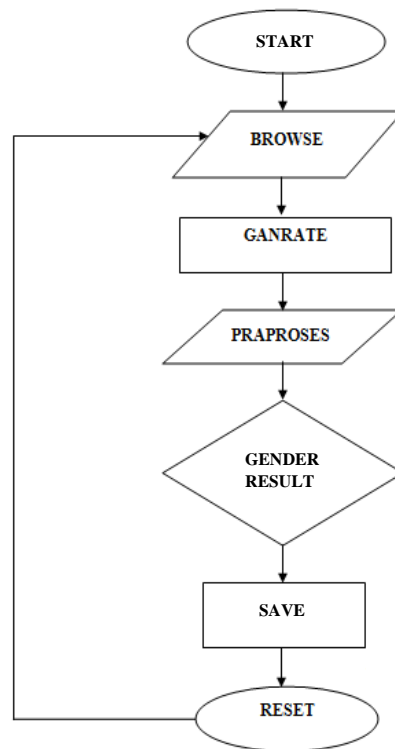
Figure 1. Style Menu in Toolbar

The design of facial classification based on gender in brow start and then do select generate and then proposes to proceed with step neural network object from neural network object will emerge result of gender. From the results of the object of the neural network will appear the results of the results whether to save or reset if yes we will go back to browse and when will not be completed. Table 1 shows the software and hardware specification needed to run the system running smoothly.

Table 1. Software Specification

Software	Specification
Matlab 2017	System Language Programming
Camera	Image Capture System
Hardware	**Specification**
Laptop Acer	Intel B830 (1.8 GHz, 2 MB, L3 Cache)
	Intel HD Graphics
	2GB DDR3 Memory
	320 GB HDD

3. Result and Discussion

In this discussion will be discussed about the look of the application and the menu button that is used more clearly the image display application is below.
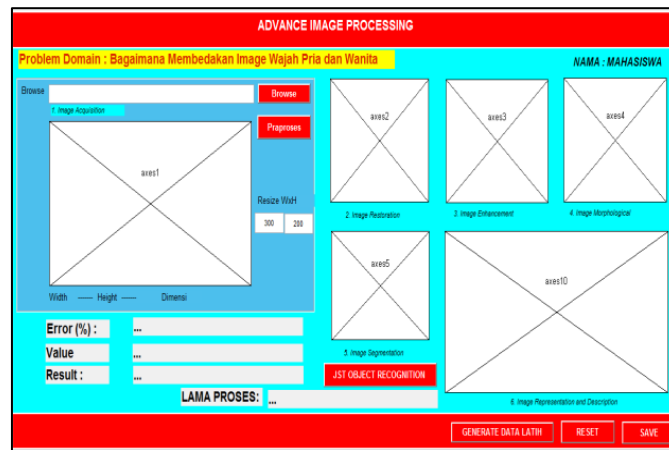
Figure 2. App View

Browse to display images on axes1, Generate data train to select gender, Preprocess has four views which will appear in axes2, axes3, axes4, axes5, Neural network Object Recogneretation for MSE and Gender results, Reset To remove from axes1, axes2, axes3, axes4, axes5, and Save Buttons to save images from axes2, axes3, axes4, axes5.
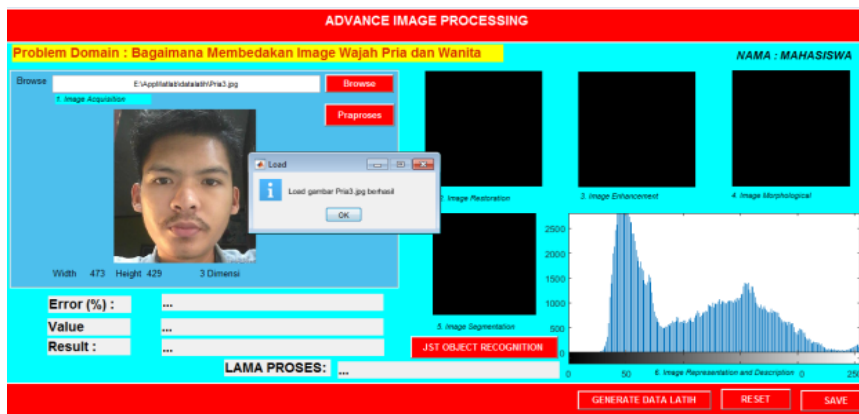

Figure 3. Selecting a Picture

Selecting picture can be done by pressing Browse Button to search for photos that are stored on the computer. Selected photo will appear at axes1 like the picture above.
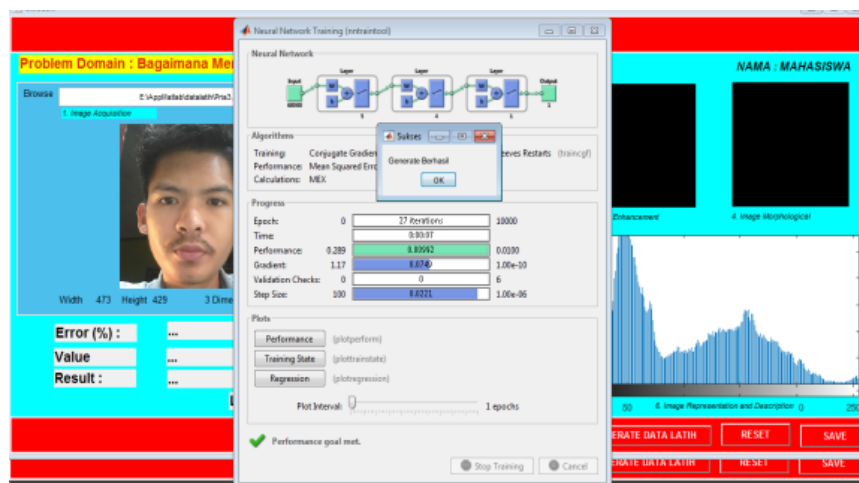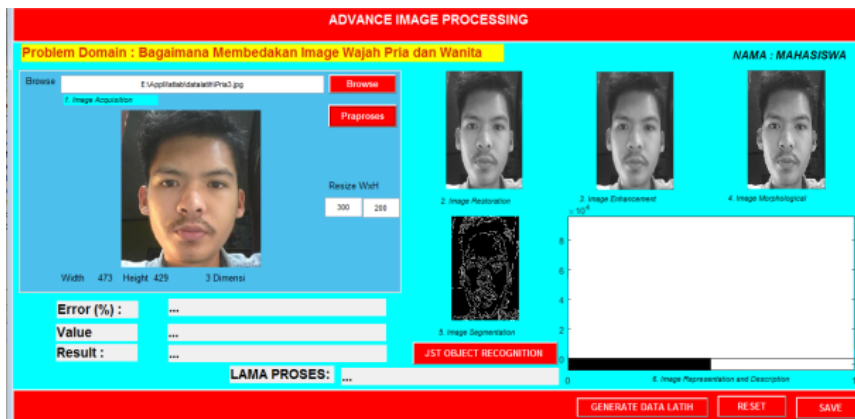

Figure 4. Generating Traning Data

Generate Training Data serves to make gender changes automatically to the already processed training data.

Figure 5. Image Preprocessing

The next step is to perform image restoration, enhancement, morphological, and segmentation. Image restoration is needed to eliminate defects in the image. Image Enhancement is also required to improve image quality by manipulating image parameters. Image Morphological is used for dilation. Image Segmentation to perform pattern recognition. After the preprocessing is done, the image can be processed for facial recognition. The result presented is in the value of MSE error results, Mean, Valu, Result, and Process Duration.

Figure 6. Facial Recognition

The table below shows the result of performing the process to our sample image.

Table 2. Test for Male Image

Image Restoration	
Image Enhancement	
Image Morphological	
Image Segmentation	

The result of the image above gives error mean value of 0.0047 and MSE value of 0.1488. The test also performed for the woman image shown below.

Table 3. Test for Female Image

Image Restoration	
Image Enhancement	
Image Morphological	
Image Segmentation	

The woman image gives a mean error value of 0.0097 and MSE value of 0.1497. Table 4 below shows the result of the system by using multiple image sample.

Table 3. Test for Female Image

Error	Value	Result	Running Time
0.14877 / 0.0047421	0.12013	Man1	0.37491 s
0.14967 / 0.0096816	0.051052	Man2	0.14803 s
0.1488 / 0.0047	0.13533	Man3	0.16859 s
0.085912 / 0.0054202	0.13196	Man 4	0.11181 s
0.14421 / 0.011879	0.16398	Man 5	0.12525 s
0.14637 / -0.018229	0.14684	Man 6	0.11191 s
0.13794 / 0.021678	0.15294	Man 7	0.12278 s
0.14994 / 0.02791	0.14797	Man 8	0.14058 s
0.14796 / -0.028053	0.2631	Man 9	0.11928 s
0.14877 / 0.0047421	0.19141	Man 10	0.28385 s
0.14967 / 0.0096816	0.35441	Man 11	0.16014 s
0.085912 / 0.0054299	0.4174	Man 12	0.13709 s
0.085912 / 0.0054288	0.41493	Man 13	0.14244 s
			Continued on Next Page

Table 3. Continued From Previous Page

Error	Value	Result	Running Time
0.14421 / 0.11879	0.33547	Man 14	0.13616 s
0.14421 / 0.011879	0.33862	Man 15	0.13244 s
0.14637 / 0.018229	0.51163	Woman1	0.13727 s
0.1497 / 0.0097	0.56824	Woman 2	0.14432 s
0.13597 / 0.065473	0.69039	Woman 3	0.130395 s
0.44014 / 0.0005273	0.72481	Woman 4	0.13072 s
0.14938 / -0.018442	0.71334	Woman 5	0.15233 s
0.33801 / -0.018358	0.74377	Woman 6	0.13763 s
0.45901 / 0.024766	0.67355	Woman 7	0.12753 s
0.79103 / 0.54889	0.61448	Woman 8	0.16754 s
3.03312 / 0.52278	0.72290	Woman 9	0.25882 s
0.96221 / 0.63577	0.78244	Woman 10	0.46789 s
0.86991 / 0.85433	0.66845	Woman 11	0.34778 s
0.79556 / 0.65337	0.87433	Woman 12	0.24335 s
0.54897 / 0.46779	0.68455	Woman 13	0.12667 s
0.48955 / 0.56744	0.75441	Woman 14	0.25890 s
0.96288/ 0.54127	0.69882	Woman 15	0.12446 s

4. Conclusion and Future Works

Based on the results, the research can conclude that gender classification using facial recognition is possible by using an artificial neural network based on backpropagation method. The test results show the error is considerably low if it was compared to any other method. However, the improvements are required to make this method applicable in real life. Our main concern for future work is to create a larger amount of sample with more diversification and to test the performance of the software regarding a different set of samples.

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