Login : Jurnal Teknologi Komputer
ISSN : 2302-9692 (print) | 2723-8695 (online)
Vol. 13, No. 2, December 2019, pp. 12-17
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Implementation of Artificial Nervous Networks using Backpropagation Methods Knowing Batik Motives

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Article Info

Article history:

Received, Ags 10, 2019
Revised, Sep 06, 2019
Accepted, Des 05, 2019

Keywords:

Neural network,
Backpropagation,
Implementation,
Recognizing batik motifs.

ABSTRACT

Artificial neural networks can be imagined like artificial brains in science fiction stories. These artificial children can think like humans and are also as smart as humans in deducing something from pieces of information received. This human delusion encourages researchers to make it happen. Computers are endeavored to think in the same way as humans think. The trick is to mimic the activities that occur in a biological neural network. The use of the backpropagation neural network method as a training model for recognition of complex patterns, the success rate for recognizing a pattern from an object is very good. Especially in the introduction of this model batik motif is very precise and quite effective. The implementation of the backpropagation neural network to identify batik motifs is very appropriate to test the truth using the backpropagation method. The resulting level of accuracy is very high, by learning the batik motifs and then introducing them.

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1. INTRODUCTION

The development of increasingly advanced technology makes scientists competing to create and develop computers to be able to act like humans, starting from seeing an object to recognizing that object by building an artificial neural network adapted from biological neural networks found in humans[1]. There are two types of learning methods in artificial neural networks, namely supervised learning and unsupervised learning. Supervised learning is learning that has a target output. Backpropagation is one of the supervised learning methods that can handle complex patterns and uses output errors to change the weight value in the backward direction so that the value can be corrected in image recognition[2].

Based on the results of a literature study using the backpropagation neural network method as a training model for complex pattern recognition, the success rate for recognizing a pattern from an object is very good[3]. For example, the research conducted to identify the character recognition of Javanese letters, the average accuracy rate produced in this study was 99.563%, the research conducted to identify psychological disorders, the average accuracy rate produced in this study was 97.5%, and Research conducted for the identification of TB disease (Tuberculosis), the resulting accuracy rate in this study was 77.5% in pattern recognition of TB using the backpropagation method.

Batik is one of the cultures owned by Indonesia, which must be preserved, preserved, and introduced to the younger generation. Batik has a variety of motifs that vary, each region in Indonesia has certain characteristics of batik motifs. Batik is unique, this uniqueness lies in its complex motives, pattern (the way the motifs are organized), and in (small ornaments used to fill the space between the main motifs). A motive has an important role in defining philosophy. Batik motifs are divided into two major groups, namely geometry and non-geometry batik motifs, there is the last motif on non-geometric patterns namely special pattern motifs. Special motives contain motifs that cannot be included in other classes. This special motive will be used as training data and will be tested to be identified.

Nowadays, not everyone can recognize batik through the characteristics of the motifs that appear visually. This is because batik has varied motifs and almost every batik motif has a unique pattern that is similar (but not the same) so it is difficult to recognize. Motive recognition knowledge may only be possessed by certain people who have fields of expertise in related fields such as batik. Batik is very suitable used as an object of research to implement backpropagation because batik has complex and varied patterns of motifs. The same theme in the introduction of batik motifs using the wavelet package transformation image processing method. The resulting accuracy rate in this study is the highest recognition rate using the Daubechies - 2 levels 2 wavelet filter 80% and the lowest recognition of 3.3%. The research raises the theme of implementing backpropagation neural networks to identify batik motifs that aim to test the truth by using the backpropagation method whether the resulting level of accuracy is very high, by learning the batik motifs and then introducing them. According to the results of the review, one way to identify batik motifs before entering the pattern recognition stage is to process the image first. The image processing is carried out to simplify the pixel value of the image and to extract the information contained in the image.

2. RESEARCH METHOD

The stages in this research are described in the form of a diagram in order to understand each stage carried out. The stages of this research can be seen in Figure 1 below:

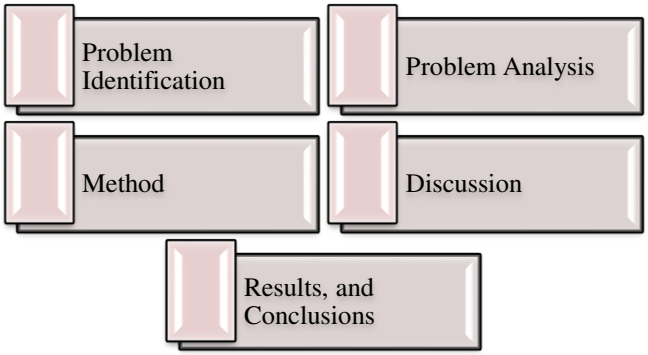

Figure 1. Diagram of Methods and Research Stages

2.1. Basic theory

A. Artificial Intelligence

Artificial intelligence (Artificial Intelligence) is a computer science that makes machines (computers) do work as well as humans do. Artificial intelligence has two main parts that are needed in doing an application, as shown in Figure 2 the components needed are[4]:

a. Knowledge Base, contains facts, theories, thoughts and relationships between one another.

b. Inference Engine, which is the ability to draw conclusions based on experience.

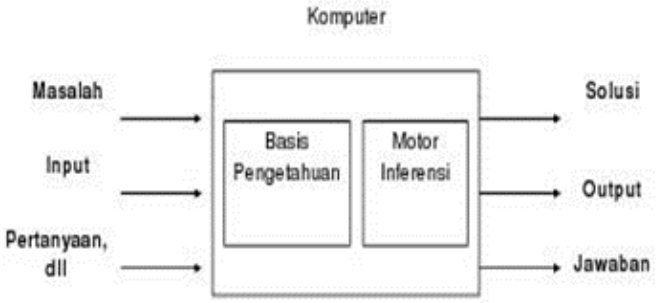

Figure 2: Applications of Artificial Intelligence

Artificial intelligence consists of several studies including expert systems, artificial neural networks, computer vision, crowd simulation, fuzzy logic, genetic algorithms, mining documents.

B. Artificial Neural Network

Artificial neural networks can be imagined like artificial brains in science fiction stories. This artificial brain can think like humans and is also as smart as humans in deducing something from the pieces of information received. These human delusions encourage researchers to make it happen[5]. Computers are endeavored to be able to think in the same way as humans think. The trick is to mimic the activities that occur in a biological neural network. The ANN component consists of neurons and these neurons are interconnected. These neurons will transform information received through the outgoing connection to other neurons, in the ANN the relationship of these neurons is known as weight. The ANN component as shown in Figure 3 consists of input (information) weights (certain values), the activation function functions if the input entered matches the threshold value specified if it does not match the activation function is not activated, and if the neurons are activated then the neuron will send the output through the weights.

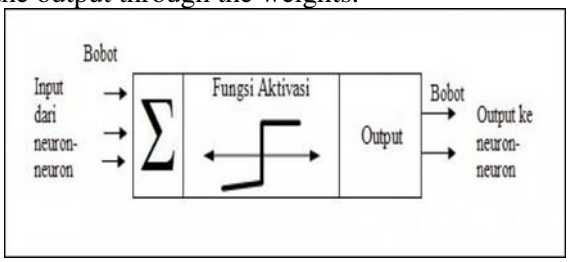

Figure 3: Components of an Artificial Neural Network

Artificial Neural Networks have two kinds of learning processes, namely supervised learning and unsupervised learning. Supervised learning is when the expected output is known beforehand, while unsupervised learning is a learning process that does not require an output target.

1. Supervised Learning

   Learning methods in neural networks are called supervised if the expected output is known in advance. In the learning process, an input pattern will be given to a neuron in the input layer. This pattern will be propagated along with the neural network to the neurons in the output layer. This output layer will generate an output pattern which will later be matched with the target output pattern. If there is a difference between the learning output pattern and the target pattern, an error will appear here. If the error value is still large enough, it indicates that more learning is needed.

Supervised learning methods include Hebb Rule, Perceptron, Delta Rule, Backpropagation, Learning Vector Quantization, Heteroassociative Memory.

2. Unsupervised Learning
   In this unsupervised learning method does not require output targets. In this method, it cannot be determined what kind of results are expected during the learning process. One of the unsupervised learning methods is the Kohonen network.

C. Backpropagation architecture

Backpropagation has several units that are in one or more hidden screens. Figure 4 is a backpropagation architecture with x inputs (plus a bias), a hidden screen consisting of z units (plus a bias), and m output units[6]. V_{ij} is the line weight from the X_i input unit to the hidden display unit Z_j (V_{j0} is the line weight connecting the bias in the input unit to the hidden display unit Z_j). W_{kj} is the weight of the hidden screen unit Z_j to the output unit Y_k (W_k0 is the weight of the hidden screen bias unit Z_k).

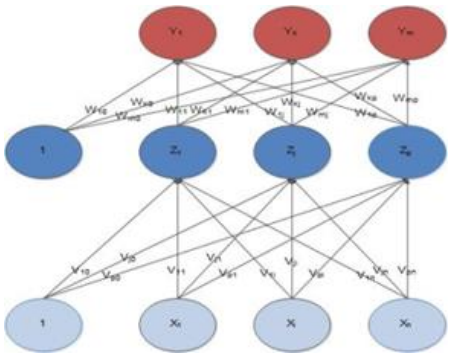

Figure 4: Backpropagation Network Architecture

Backpropagation or backpropagation is a learning algorithm and is used by perceptrons with many layers to change the weights associated with neurons in the hidden layer (Siangg, 2009). The backpropagation algorithm uses an output error to change the value of the weights in the backward process to get this error, the forward propagation stage, the neurons are activated using the sigmoid activation function, while in carrying out a process of propagating forward and backward it is called epoch or iteration, activation of the binary sigmoid which has a range of values (0,1)

Phase I: forward propagation

During forward propagation, the input signal (= x_i) is propagated to the hidden screen using the specified activation function. The output of each hidden display unit (= z_i) is then propagated forward again to the hidden screen above it using the specified activation function. And so on until it produces network output (= y_k). Next, the network output (= y_k) is compared with the target to be achieved (= t_k). Difference t_k - y_k is an error that occurs. If this error is less than the specified tolerance limit, the iteration is terminated. However, if the error is still greater than the tolerance limit, then the weight (w and v) of each line in the network will be modified to reduce the errors that occur.

Phase II: Backward propagation

Based on the error to - y_k, the factor (k = 1,2, ..., m) is calculated which is used to distribute the error in y_k units to all units hidden directly connected to y_k. also used to change the line weight that is directly related to the output unit. In the same way, the factor in each hidden on-screen unit is calculated as the basis for the change in the weight of all lines originating from the hidden unit in the lower screen. And so on until all the factors in the hidden unit that are directly related to the input unit are calculated.

After all the factors are calculated, the weights of all the lines are modified together. The change in weight of a line is based on the neuron factor on the screen above it. Based on the explanation of the phases in backpropagation, the training algorithm for the network is as follows:

Step 0: Initialize all weights with small random numbers
Step 1: If the termination conditions have not been met, do steps 2-9
Step 2: For each pair of training data, perform steps 3-8

3. RESULTS AND DISCUSSION

Back propagation is a method in artificial neural networks to perform the gradient error of hidden units derived from recycle errors associated with output units. Every unit in the input layer is connected to every unit in the hidden layer. And every unit in the hidden layer is connected to every unit in the output layer. The output of the network is an actual output vector.

Then the actual network output vector is compared with the target output vector to find out whether it is in line with expectations (the actual output is the same as the target output). The error that arises due to the difference between the actual output and the target output is then calculated and used to update the relevant weights by propagating the error again.

It is assumed in this study that you want to create a computer program design that is tasked with recognizing alphanumeric characters by translating a 5 x 7 matrix containing binary numbers that describe a bit-mapped pixel image of a pixel image. Alphanumeric batik in the form of 8-bit ASCII codes.

Figure 5: Each batik image is mapped into the ASCII code.

The asci value of the batik motif above :

= 00100 01010 01010 11111 10001 10001 10001
= 114AFC63116

The results of the program execution when it is first to run can be seen in Figure 6 below, wherein this form it consists of several parts, namely: two mtf buttons which function to enter the batik motif to be examined[3]. The form can be seen in the image below.

Figure 6: Main Form

In this section, the first process that will be carried out is to enter the batik motif that will be checked or recognized. So in the process, the two batik motifs that will be recognized will be recognized by an artificial neural network algorithm. The display can be seen in the image below.

Figure 7: Form Process

After inputting the two motifs, the next step is to click the process button so that the system will check and recognize the similarity level of the two types of batik motifs that are inputted. The display of process results can be seen in the image below.

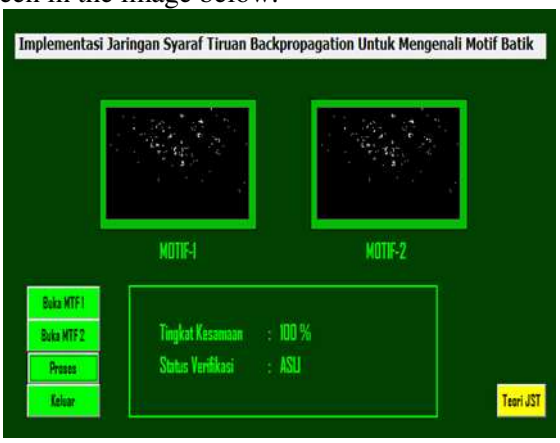

Figure 8: Result Form

4. CONCLUSION

Based on the results of research, analysis, design, manufacture and simulation testing of backpropagation neural network implementation to identify batik motifs, the conclusion is that The accuracy results obtained in the case of the introduction of this batik motif is 85% and The resulting system will make it easier for the user to recognize the types of batik that exist in Indonesia.

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