Analysis of Using Binary and Bipolar Data in Knowing the Logic Gate Using Perceptron Method

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Abstract: ***Is a logic gate circuit tha forms the basis of the computer. Millions of transistors in a microprocessor forming thousands of logic gates. Some methods or models are frequently used to recognize the logic gate is a method perceptron. Perceptron is a fast and reliable network for a class of problems that can be solved. While the propagation is one of the Artificial Neural Network architecture that has a learning process forward and backward error correction. In this study, the authors analyze the use of binary data and recognizing bipolar logic gate using perceptron. From the results of this study concluded, among others: Methods perceptron can recognize the logic gate much faster than other methods. Binary better use of the bipolar numbers, as the binary number can recognize the logic gate much faster than bipolar numbers. OR and NOR logic gates with binary input and output more quickly recognized than other logic gates with a maximum error of 0.1 and the number of iterations 20.***

Index terms:Binary, Bipolar, Logical Gates, Perceptron.

I. INTRODUCTION

Is a logic gate circuit that forms the basis of the computer or sneentity in electronics and Boolean math that changing one or more input logic into a logic output signal. Especially logic gate implemented electronically using diode or transistor, But can also be built using the arrangement of components that utilize the properties electromagnetic(Relay),fluid, optics and even mechanics, Millions of transistors in a microprocessor forming thousands of logic gates. A simple logic gate has one input terminal. The output can be high / high (1) or low / low (0), depending on the digital level given to the input terminal [1].

Many methods can be used to identify data patterns such as logic gates. Some methods or models are frequently used to recognize the logic gate is a method perceptron.

Perceptron is a fast and reliable network for a class of problems that can be solved. In addition, understanding of the operation of the perceptron provides a good foundation for understanding the more complex networks [1].

The author assumes that not all the data on the pattern of logic gates can be recognized well by methods perceptron. The author will use binary data, bipolar, and hybrid (binary input and output bipolar). The purpose of this study was to analyze the comparison perceptron method, which method can recognize patterns of data provided is better, and which method can recognize data patterns with the smallest number of iterations.

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II. RELATED RESEARCH

Ravichandran.K, et al. In this study, using a multilayer perceptron to be able to understand the impact of crime. This gap influence on people being analyzed using multilayer perceptron [2].

Qingbin Wang, et al. In this study, using digital image processing technology to process images and then extract. This study sample group 420 enter into multilayer perceptron [3].

Mohri, Mehryar, et al, In the study explained that the method perceptron can recognize patterns of training, but there are some limits to existing errors in the perceptron algorithm and propose a new method that can be used to lower limits in the setting generalize stochastic [4].

III. PROPOSED METHOD

A.Logic Gates

Logic gate is a circuit with one or more input signals, but only produce a signal in the form of high voltage or low voltage as the output signal. Logic gates are the basis of digital system formation. Logic gate used include OR, AND, NOR, NAND, Ex-OR, and Ex-NOR in which [1]:

a. OR gate
   OR gate is a basic logic circuit which states that its output will have a logic 1 if one of its inputs have a logic 1 or everything has a logic 1.

b. AND gate
   AND gate is a basic logic circuit which states its output will have a logic 1 if all its inputs logic 1.

c. NOR gate
   NOR gates as the OR gate, but the output is the inverter (reverse).

d. NAND gate
   NAND gate as the gate, but the output is the inverter (reverse).

e. Ex-OR gate
   Ex-OR is an OR gate and exclusive because its output will be 0 if the input is the same and its output will be worth 1 if any one of its inputs valued differently.

f. Ex-NOR gate
   Ex-NOR gate is a gate Ex-OR, written inverter so that the truth table simply by reversing the Ex-OR truth table.

B.Perceptron

Perceptron network method is the best model at the time. This model was found by Rosenblatt (1962) and Minsky - Papert (1969). Perceptron training algorithm is as follows [5]:

a. Initialize all weights and biases (usually = 0).
Set learning rate. , For simplification set equal to 1.$\propto$ $(0 < \propto \leq 1)$
Set the threshold value (for the activation function.θ)
b. For each pair of st learning, working on:
1) Set activation input unit, indicated by equation (1).
$x_i = s_i;$ (1)
2) calculated response to the output unit, as indicated by equation (2).
$y_{in} = b + \sum_i x_i w_i$ (2)
3) Put it in the activation function, indicated by equation (3).

$$y = \begin{cases} 1, \ jika \ y_{in} > \theta \\ 0, \ jika - \theta \leq y_{in} \leq \theta \\ -1, \ jika \ y_{in} < -\theta \end{cases} \quad (3)$$

4) Compare the value of the network output y with the target t.
if y $\neq$ t make any changes to the weights and biases, as indicated by equation (4) and equation (5).

$$w_i(baru) = w_i(lama) + \alpha^* t^* x_i \quad (4)$$

$$b(baru) = b(lama) + \alpha^* t \quad (5)$$

if y = t, no change in the weights and biases, as indicated by equation (6) and equation (7).
$w_i(baru) = w_i(lama)$
$b(baru) = b(lama)$
c. Perform continuous iteration until all patterns have the same output with the target tissue. That is when all output equal to the target tissue so the network has to recognize patterns well and iteration stopped.

Perceptron training algorithm is used both for binary inputs or bipolar, with particular, and bias can be set. A training cycle that involves all the input data is called an epoch.

IV.RESEARCH METHODOLOGY

The purpose of this study was to analyze the comparison method perceptron. To achieve these objectives, the author will conduct training (training) in the data patterns of logic gates. The data used is the binary input data to the target binary, bipolar input data with bipolar targets, and binary input data with bipolar targets (hybrid).

Data to be trained is data with two inputs and one target. Pattern recognition is done by adjusting the weights. Termination weighting adjustments in the pattern recognition when squared error reaches the target than the specified error.

IV. RESULTS AND DISCUSSIONS

Training and testing data by comparing the perceptron method using three different data patterns and each targets different. The shape of the pattern of the first data to be trained and tested are shown in Table 1 with the binary input data and target data binary.

Table 1 (a). Binary Input Data with Data Target Binary

Data input		Target Data					
X1	X2	OR	AND	NOR	NAND	Ex-OR	Ex-NOR
0	0	0	0	1	1	0	1
1	0	1	0	0	1	1	0
0	1	1	0	0	1	1	0
1	1	1	1	0	0	0	1

The pattern of the data in Table 1 (a) is a data pattern with two input data and the target data that varies with the maximum learning rate = 0.7 epoch = 150000.

The chart comparison squared error reduction method and bakpropagation perceptron on NOR logic functions with a target error of 0.1 is shown in Figure 1.

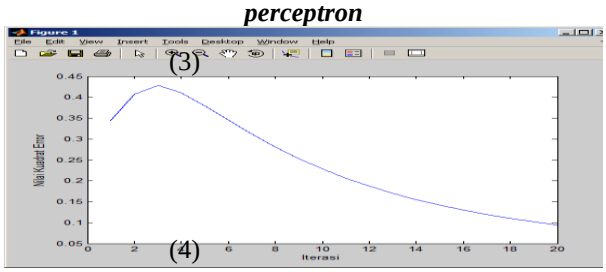

Figure 1. Decrease graph Squares Error

In the test data binary inputs and the target binary method perceptron one who can recognize patterns of data faster than backpropagation, but the method of propagation can recognize all patterns of data provided by either did not like the method perceptron that can not recognize patterns of data supplied to the logic function ex-OR and ex-NOR.

Next is to test the pattern shape of the input data to the target bipolar bipolar shown in Table 2.

Table 2 (a). Data Input Bipolar Bipolar with Target Data

Data input		Target Data					
X1	X2	OR	AND	NOR	NAND	Ex-OR	Ex-NOR
-1	-1	-1	-1	1	1	-1	1
1	-1	1	-1	-1	1	1	-1
-1	1	1	-1	-1	1	1	-1
1	1	1	1	-1	-1	-1	1

The pattern of the data in Table 2 (a) is a data pattern with two input data and the target data that varies with the learning rate and the same maximum epoch previous data testing, the maximum learning rate = 0.7 epoch = 150000.

Next is to test the form with the data pattern with a target bipolar binary inputs (hybrid) shown in Table 3.

Table 3 (a). Binary Input Data with Data Target Bipolar (Hybrid)

Data input		Target Data					
X 1	X2	OR	AND	NOR	NAND	Ex-OR	Ex-NOR
0	0	-1	-1	1	1	-1	1
1	0	1	-1	-1	1	1	-1
0	1	1	-1	-1	1	1	-1
1	1	1	1	-1	-1	-1	1

The pattern of the data in Table 3 (a) is a data pattern with two input data and the target data that varies with the learning rate and the same maximum epoch previous data testing, the maximum learning rate = 0.7 epoch = 150000.

V. CONCLUSION

From the results of the study are Perceptron method can recognize the logic gate much faster than other methods. Binary better use of the bipolar numbers, because binary logic gates can recognize faster than bipolar numbers. OR and NOR logic gates with binary input and output more quickly recognized than other logic gates with a maximum error of 0.1 and the number of iterations 20. perceptron method XOR logic gates can not be identified with the binary inputs and outputs. Tests using bipolar numbers in recognizing the logic gates produce binary output and the result is not appropriate. Tests using hybrid numbers with binary input and output at recognizing bipolar logic gates produce binary output and the result is not appropriate.

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