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The Vocal Patterns Recognition In Artificial Neural Network By Using The Hebb Rule Algorithm

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Abstract

ArtIficial network recognition Pattern Recognition is a branch of Artificial Intelligence which is better known as artificial neural networks. This method is growing rapidly at this time because it has a more accurate security system and has information that has a devise system that can be blocked with an attached system and embedded in a pattern recognition feature, such as pattern recognition that can be detected including signature patterns, facial patterns and fingerprints. The problem that often occurs is the lack of information and securing data and confidentiality to produce information so that it can be used by authorized people only. The algorithm used in this study is the Hebb Rule algorithm. The Hebb Rule algorithm is an algorithm that has similarities to the McCulloch Pitts network architecture by using the concept of input units combined directly with output units, plus a bias value. The results of Pattern A = after being tested, the value is 4, Pattern I is recognized as -12, Pattern U is recognized as 13, Pattern E is recognized as much as 16 and Pattern O is recognized as much as 18. The final result of the research on recognizing vowels A, I, U, E and O unable to recognize patterns because they have different values in each vowel.

Keywords; *Artificial Intelligence, Artificial Neural Networks, Pattern Recognition, Hebb Algorithm Rule*

1. Introduction

Currently, the use of image processing technology to facilitate humans in solving certain problems has been widely applied, especially in the field of identification. Identification is an important process in recognizing and distinguishing the characteristics of an object. One example is a self-recognition system, which is a technology used to identify a person's identity through biometric identification techniques [1]. Backpropagation algorithm artificial neural network (ANN) modeling is one of them. Artificial neural network technique is an information processing technique that works by imitating the workings of a human neural network [2]. The ANN method is a system based on the workings of the human neural network. The ANN method has many variants, namely the feed-forward, RBF, recurrent, and backpropagation methods [3]. In general, the architecture of the Artificial Neural Network consists of 3 layers as shown in Figure 3 below.

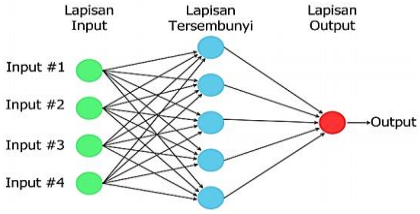

Figure 1. Artificial Neural Network Architecture

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As seen in Figure 1 above, an Artificial Neural Network consists of three types of layers namely input layer, hidden layer and output layer. Each layer consists of a number of nodes depicted by a circle. For each node in each layer will always be connected to nodes in the next layer. In general, all learning methods used for Artificial Neural Networks can be classified into two main categories: guided learning and unsupervised learning [4].

The learning/training algorithm of the Artificial Neural Network is included as a training example into the Artificial Neural Network. Do :

a) Initialize network weights, set i = 1.
b) Enter the i-th example (from the set of learning examples contained in the training set) into the network at the input layer.
c) Find the activation level of the output units using the application algorithm If the network performance meets the pre-defined standards (net meets the requirements). Then exit.
d) Update the weights using network learning rules
e) If i = n, then reset i = 1, Else i = i -1,Go to step 2.

Neural Network inference application algorithm, incorporated a training example into the Artificial Neural Network. Do :

a) Enter the case into the network at the input layer.
b) Calculate the level of activation of network nodes.
c) For a feed-forward connection network, if the activation level of all output units has been calculated, then exit j if not, return to step 2. If the network is unstable, then exit and fail.

So with a very good level of ability, several Artificial Neural Network applications are very suitable to be applied to:

1) Classification, selecting an input data into a certain category that is applied.
2) Association, describes an object as a whole only with a part of another object.

2. Research Methodology

Self organizing, the ability to process input data without having to have data as a target[5]. Artificial neural network is understood as an information processing system that works on the working principle of the biological nervous system. Artificial neural networks are formed to solve a particular problem such as pattern recognition or classification due to the learning process [6]. The results of research [7] a can be done using a computer, so it will save time when compared to being done manually. In this study, a new approach for signature identification is based on Backpropagation Artificial Neural Network (ANN BP). Backpropagation is a general algorithm of artificial neural networks. In the learning process, the Backpropagation algorithm is included in the category of supervised learning methods. The training method using this algorithm can produce a balance between the ability of the network to recognize the patterns used during training and the ability of the network to respond correctly to input patterns similar to but not the same as the patterns used during training. With this Bacpropagation artificial neural network, several examples of signatures will be given for the learning or training process so that later this ANN can carry out the recognition process when it receives the input signature to be tested (testing).

Artificial Neural Network (ANN) is one of the artificial representations of the human brain which always tries to simulate the non-human learning process [8].

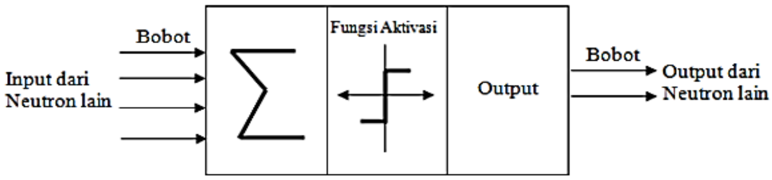


Figure 2. Neuron Structure of Artificial Neural Networks

The Hebb rule is the earliest and simplest training rule for artificial neural networks in general. In this Hebb rule, the training that occurs is by modifying the synaptic strength (weight). If both neurons are both "on" at the same time, the weight of the neurons will increase. We will lead to a single layer (feedforward) neural network trained using (extension of the hebb rule as a hebb network. Hebb rules are also used for training other networks that discussed later. Since we are considering a single-layer network, one of the interconnected neurons is one input unit and one output unit because no input units are connected to each other, nor are many output units connected). If the data are shown in bipolar form, it is easy to express the desired update of the weights so that: wi(new) wi(old) xi y If the data is binary, this formula does not distinguish between training pairs in which the input unit is “on” and the target value is “off” and the training pair which is between the input unit and the target value is “off”. Here is the hebb architecture.

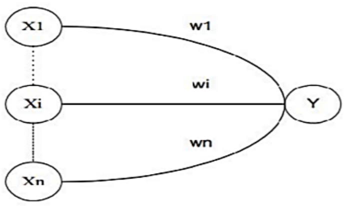


Figure 3. Hebb Architecture

2.1. Activation Function

Characteristics that must be possessed by the activation function of the back-propagation network, among others, must be continuous, differentiable, and not monotonically non-decreasing. Furthermore, for computational efficiency, the derivative of the function is easy to obtain and the value of the derivative can be expressed by the activation function itself. The second activation function is a bipolar sigmoid which has a range of values [-1.1] and is defined as:

$$f(x) = \frac{2}{1+\exp(-\sigma x)} - 1$$

dengan

$$f'(x) = \frac{\sigma}{2}[1+f(x)][1-f(x)] \quad (1)$$

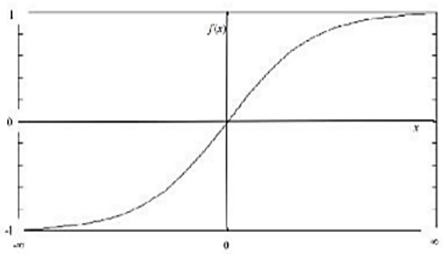


Figure 4. Bipolar sigmoid activation function

2.2. Research Methodology

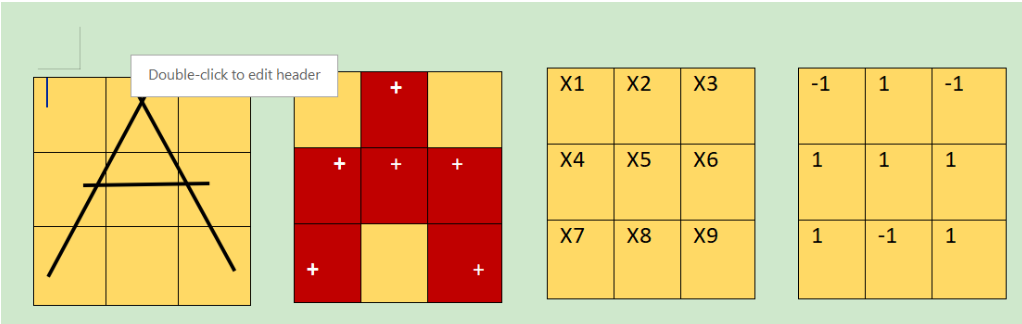
To complete the introduction of Letter Patterns, structured steps are needed, including:

a) Initialization of Weights and Bias
b) For each pair of input and target (s-t) do a. Input unit activation set, b. Output unit activation set
c) Fix output
d) Fix Bias
e) Test

3. Results and Discussion

In this study using 5 letter patterns A, I, U, E and O by using the inputTo solve the case of Vowels using bipolar data representation, for example, the character with A is assigned a value of 1, I is assigned a value of -1, U is assigned a value of 1, E is assigned a value of -1 and the last o is assigned a value of 1. Each pattern is arranged with a matrix of size 3x3=9, means the number of hebb that will be formed will consist of 9 inputs. The pattern can be seen in the image below:

a) Vowel Pattern A



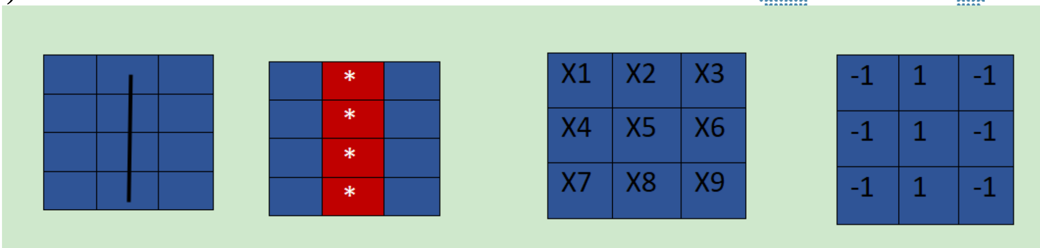
Hebb's Training Algorithm
Initialization of Weights and Bias
W1=w2=w3=w4=w5=w6=w7=w8=w9=0 and Bias =0
Pattern to -1
Changes in weight and bias for the 1 pattern

1) W1(new) = w1(old) + x1*y= 0 + (- 1).1 = -1
2) W2(new) = w2(old) + x2*y= 0 + 1.1 = 1
3) W3(new) = w3(old) + x3*y= 0 + (- 1).1 = -1
4) W4(new) = w4(old) + x4*y= 0 + 1.1 = 1
5) W5(new) = w5(old) + x5*y= 0 + 1.1 = 1
6) W6(new) = w6(old) + x6*y= 0 + 1.1 = 1
7) W7(new) = w7(old) + x7*y= 0 + 1.1 = 1
8) W8(new) = w8(old) + x9*y= 0 + (-1).1 = -1
9) W9(new) = w9(old) + x9*y= 0 + 1.1 = 1
10) B(new) = b(old)+ y = 0+1 =1

Result

X1 -1	X2 1	X3 -1
X4 1	X5 1	X6 1
X7 1	X8-1	X9 1

b) Vowel Pattern I



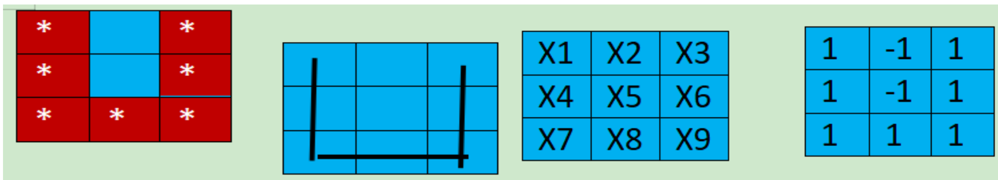
Pattern to -1
Changes in weight and bias for pattern 2

1) W1(new) = w1(old) + x1*y= 1+(-1).(-1)= 2
2) W2(new) = w2(old) + x2*y= 1+1.(-1)=0
3) W3(new) = w3(old) + x3*y= 1+(-1).(-1)= 0
4) W4(new)= w4(old) + x4*y= 1+(-1).(-1)= 2
5) W5(new) = w5(old) + x5*y= 1+1.(-1)=0
6) W6(new) = w6(old) + x6*y= 1+(-1).(-1)= 2
7) W7(new) = w7(old) + x7*y= 1+(-1).(-1)= 2
8) W8(new) = w8(old) + x9*y= 1+1.(-1)=0
9) W9(new) = w9(old) + x9*y= 1+(-1).(-1)= 2
10) B(new) = b(old)+ y = 1+(-1)=0

Result

X1 2	X2 0	X3 0
X4 2	X5 0	X6 2
X7 2	X8-0	X9 2

c) Vowel Pattern U



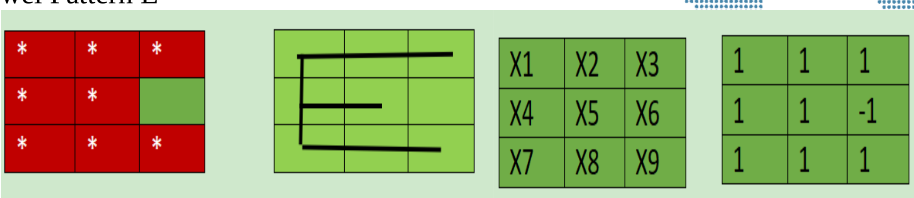
Pattern to -3
Changes in weight and bias for the 3 pattern

1) W1(new) = w1(old) + x1*y= 1 + 1.1 = 2
2) W2(new) = w2(old) + x2*y= 1 +(- 1).1 = 0
3) W3(new) = w3(old) + x3*y= 1 + 1.1 = 2
4) W4(new) = w4(old) + x4*y= 1 + 1.1 = 2
5) W5(new) = w5(old) + x5*y= 1 +(- 1).1 = 0
6) W6(new) = w6(old) + x6*y= 1 + 1.1 = 2
7) W7(new) = w7(old) + x7*y= 1 + 1.1 = 2
8) W8(new) = w8(old) + x9*y= 1 + 1.1 = 2
9) W9(new) = w9(old) + x9*y= 0 + 1 = 1
10) B(new) = b(old)+ y = 1+1 =2

Result

X1 2	X2 0	X3 2
X4 2	X5 0	X6 2
X7 2	X8-2	X9 1

d) Vowel Pattern E



Pattern to -4

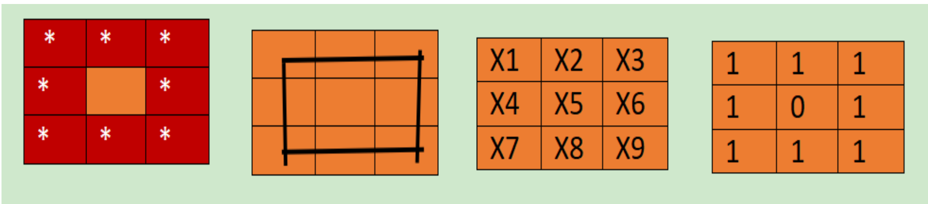
Changes in weight and bias for the 4th pattern

1) W1(new) = w1(old) + x1*y= 1+1.1_= 2
2) W2(new) = w2(old) + x2*y= 1+1.1_= 2
3) W3(new) = w3(old) + x3*y= 1+1.1_= 2
4) W4(new) = w4(old) + x4*y= 1+1.1_= 2
5) W5(new) = w5(old) + x5*y= 1+1.1_= 2
6) W6(new) = w6(old) + x6*y= 1+1.(-1)=0
7) W7(new) = w7(old) + x7*y= 1+1.1_= 2
8) W8(new) = w8(old) + x9*y= 1+1.1_= 2
9) W9(new) = w9(old) + x9*y= 1+1.1_= 2
10) B(new) = b(old)+ y = 1+(-1)=0

Result

X1 2	X2 2	X3 v2
X4 2	X5 2	X6 0
X7 2	X8 2	X9 2

e) Vowel Pattern O



Pattern to -5

Changes in weight and bias for the 5th pattern

1) W1(new) = w1(old) + x1*y= 1 + 1.1 = 2
2) W2(new) = w2(old) + x2*y= 1 + 1.1 = 2
3) W3(new) = w3(old) + x3*y= 1 + 1.1 = 2
4) W4(new) = w4(old) + x4*y= 1 + 1.1 = 2
5) W5(new) = w5(old) + x5*y= 1 +(- 1).1 = 0
6) W6(new) = w6(old) + x6*y= 1 + 1.1 = 2
7) W7(new) = w7(old) + x7*y= 1 + 1.1 = 2
8) W8(new) = w8(old) + x9*y= 1 + 1.1 = 2
9) W9(new) = w9(old) + x9*y= 1 + 1.1 = 2
10) B(new) = b(old)+ y = 0+1 =1

Result

X1 2	X2 2	X3 2
X4 2	X5 0	X6 2
X7 2	X8 2	X9 2

Result
W1=2, w2=2,w3=2,w4=2,w5=0,w6=2,w7=2,w8=2,w9=2 dan b=1
Pattern Recognition to-

1) net=-1.-1 +1.1+(-1).(-1)+1.-1+1.1+1.(-1)+1.-1+(-1).1+1.(-1)=4
$$f\ net = \begin{cases} -1 & ;\ IF\ net < 0 \\ 1 & ;\ IF\ net \geq 0 \end{cases}$$
f(4) = -1 (Not Equal to Target)
2) net= 2.(-1)+0.1+2.(-1)+0.(-1)+0.1+2.(-1)+2.(-1)+0.1+-.1 =-12
$$f\ net = \begin{cases} -1 & ;\ IF\ net < 0 \\ 1 & ;\ IF\ net \geq 0 \end{cases}$$
f(12) = -1 (Not Equal to Target)
3) net =2.1+0,(-1)+2.1+2.1+0,(-1)+2.1+2.1+2.1+1.1= 13
$$f\ net = \begin{cases} -1 & ;\ IF\ net < 0 \\ 1 & ;\ IF\ net \geq 0 \end{cases}$$
f(13) = -1(Not Equal to Target)
4) net = 2.1+2.1+2.1+2.1+2.1+0,(-1)+2.1+2.1+2.1+2.1=16
$$f\ net = \begin{cases} -1 & ;\ IF\ net < 0 \\ 1 & ;\ IF\ net \geq 0 \end{cases}$$
f(16) = -1 (Not Equal to Target)
5) Net= 2.1+2.1+2.1+2.1+0,(-1)+2.1+2.1+2.1+2.1
$$f\ net = \begin{cases} -1 & ;\ IF\ net < 0 \\ 1 & ;\ IF\ net \geq 0 \end{cases}$$
f(18) = -1(Not Equal to Target)

Based on the search for the output value, the value of each vowel letter A, I, U, E, O with different training results is different with a fairly far value, so it can be concluded that each pattern is difficult to recognize. To get maximum results, training is needed repeatedly to have the same value.

4. Conclusion

The final result of this study proves that an artificial neural network using the Hebb Rule Algorithm is able to prove that the recognition of the vowels A, I, U, E and O is able to recognize patterns that have been formed on the network, so that these patterns can be studied again for further tranning. The results of Pattern A = after being tested, the value is 4, Pattern I is recognized as -12, Pattern U is recognized as 13, Pattern E is recognized as much as 16 and Pattern O is recognized as much as 18. The final result of the research on recognizing vowels A, I, U, E and O unable to recognize patterns because they have different values in each vowel. It is hoped that this research can be developed into a deeper study so that it can be applied to a wider object. To get maximum results, a lot of training in the training process is needed so that the results obtained are more accurate. So it is necessary to add knowledge after the data is tested against a new pattern.

References

[1] Pauzi, Gurum Ahmad. 2015. “Sistem Identifikasi dan Pengenalan Pola Citra Tanda-Tangan Menggunakan Sistem Jaringan Saraf Tiruan (Artificial Neural Networks) Dengan Metode Backpropagation” 03 (02): 93–101.
[2] Tarigan, Gian Habriandi, Manyuk Fauzi, dan Imam Suprayogi. 2000. “Analisa Prediksi Data Debit Runtun Waktu Menggunakan Jaringan Syaraf Tiruan Algoritma Backpropagation (Studi Kasus Das Indragiri)” 1 (2).
[3] Saputra Ramadoni, Dkk. 2020. “Prediksi Beban Listrik Menggunakan Algoritma Jaringan Syaraf Tiruan Tipe” 23 (2): 143–55.
[4] Avianto, Donny. 2016. “Menggunakan Algoritma Momentum Backpropagation Neural Network” 10 (1): 1199–1209.

[5] Zola, Fatmi, Gunadi Widi Nurcahyo, dan Teknik Komputer Jaringan. 2018. “Jaringan syaraf tiruan menggunakan algoritma backpropagation untuk memprediksi prestasi siswa” 1 (1): 58–72.
[6] Tandrian, Alvin Hanjaya, Adhi Kusnadi, Fakultas Teknik, Universitas Multimedia Nusantara, dan Gading Serpong. 2018. “Pengenalan Pola Tulang Daun Dengan Jaringan Syaraf Tiruan Backpropagation” X (2): 53–58.
[7] Barry Ceasar Octariadi, Dkk. 2020. “Jaringan Syaraf Tiruan Backpropagation” 14 (1): 15–21.
[8] Irwanda Sony, Dkk. 2019. “Jaringan Syaraf Tiruan Backpropogation dalam Memprediksi Jumlah Tilang di Kejaksaan Negeri Simalungun,” no. September: 697–708.
[9] Muliona Rizki, Dkk. 2018. “Jaringan Syaraf Tiruan Pengenalan Pola Huruf” 2 (1): 46–50.