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CASE REPORT

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SYSTEM DIAGNOSIS SYMPTOMS OF FEVER ON CHILDREN USING ARTIFICIAL NEURAL NETWORK AND CERTAINTY FACTOR METHOD: A STUDY CASE OF FEVER PATIENT AT RSUD Dr. M. HAULUSSY HOSPITAL IN AMBON

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ABSTRACT

Symptoms of fever is a sign of declining health on child, when the treatment is not appropriate then can be a bad conduct to child body. For that reason, to make a parents are easiest to detect the disease its necessary to build an application for detection the disease symptoms of fever on child to get the diagnosis. On this research, the methods are used to build the diagnostic application is combination of *certainty factor* (CF) methods and artificial neural networks (ANN) for this case that is *Backpropagation methods*. This study had 6 disease symptoms of fever and 30 symptoms as a training data on 95 child patient medical data. The result of this study using the application has been conclude that the application can diagnostic the disease symptoms of fever with 76,62% accuracy rate.

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INTRODUCTION

Health is a very important issue for humans life. The level of a person's health depends on his own lifestyle. If humans live with a healthy lifestyle, then the chances of getting the disease are also getting smaller. But in this modern

era, humans prefer an instantaneous lifestyle so that many of the people have the risk of diseases. Especially for children, they have less immunity in surviving the immune system so are easier to attack by diseases. One of these diseases is the fever. It is the body's response to the entry of microorganisms, such as: viruses, bacteria, parasites or fungi. For that early prevention really need the role of parents in maintaining, hearing and even provide the first treatment before being taken to hospital for treatment performed by doctors.

The application of mathematics in health sciences is helpful in solving complex problems associated with the processing of data in recognizing the pattern of a disease. Therefore, it needed a proper method that can be used to analyze the output of data that has been entered in a system. One method that can be used to identify data as pattern recognition of an upcoming event is the Artificial Neural Network (Artificial Neural Network). The Artificial neural networks are one of the processing systems that are designed and trained to have the ability like humans in solving complex problems by learning through weight changes. Neural networks simulate the structure of brain processes (biological nerve function) and then bring them to new class software that can recognize complex patterns and learn from past experiences. The development of pattern recognition technology today create many new applications in accordance with era.

Artificial Neural Network (ANN) and Certainty Factor can be combined to produce a pattern recognition system with good accuracy. The Certainty Factor and JST methods are part of the science of artificial intelligence related to pattern recognition, whereby all outputs or conclusions from the network are based on experience during the training process. Therefore, the more data acquired and training done, the more approaching expected results.

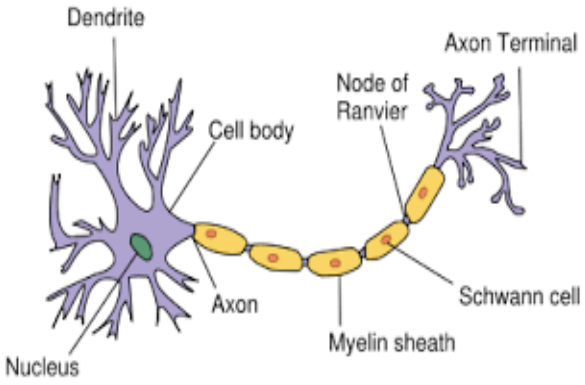

Figure 1. Part Of Human Nerve

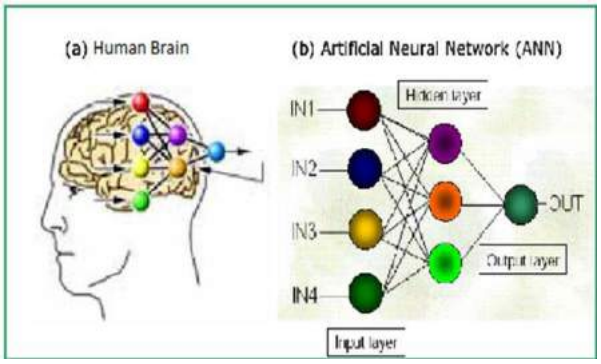

Figure 2. The ANN Adopt The Nerve Of Human Brain

METHODS

The data that used in this research is secondary data obtained from RSUD Dr. M. Haulussy Ambon, the data is about medical records of Fever diagnosis on children and its symptoms, and also some literature related to the diagnosis. Based on clinical symptoms, Fever Symptoms in children consist of: Diphtheria Fever, Morbili (Measles), Varicella (Chickenpox), Dengue Hemorrhagic Fever (DHF), Typhoid Fever, and Influenza Fever. All the diseases have 30 symptoms which subsequently become input variables on Artificial Neural Networks. The data were taken in pediatric patients in 2014. The total numbers of data was 172, and the data were divided in two categories, which 95 data were used as training data and 77 data as testing data.

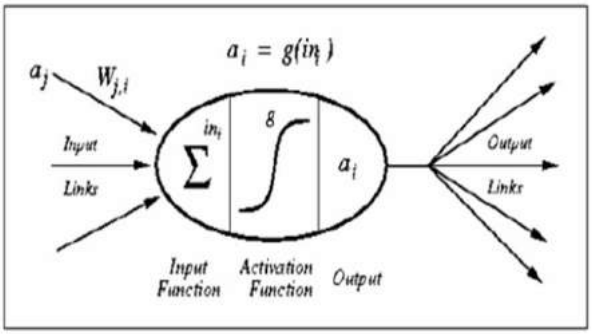

Figure 3. The system of ANN

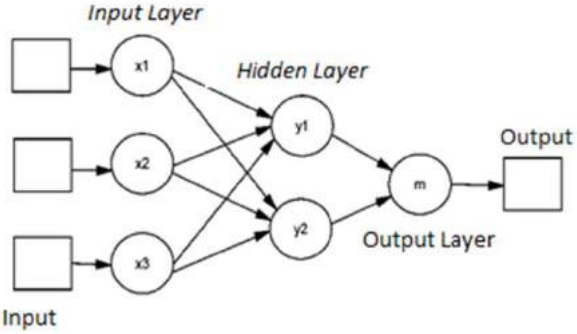

Figure 4. The Architecture of Multilayer ANN

Data analysis techniques in this study using Backpropagation and Certainty Factor method, as the following flowchart figure:

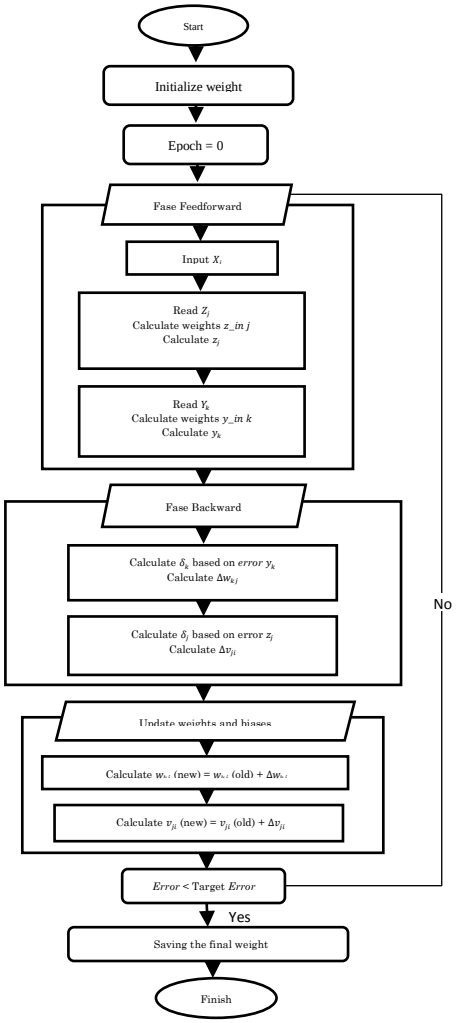

Figure 5. Flowchart Of Training Process On Backpropagation Network.

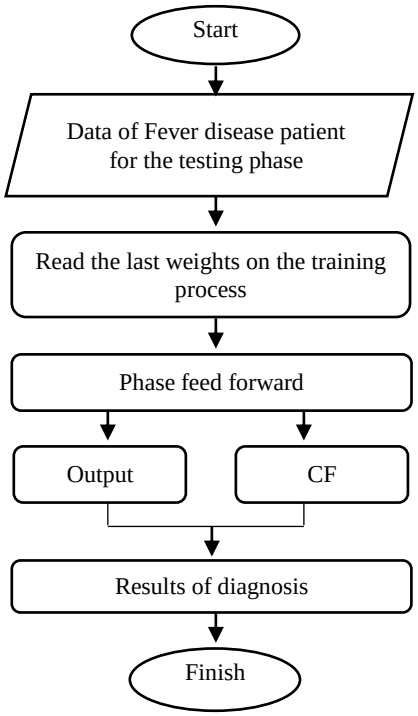

Figure 6. The Flow Chart Of The Testing Process On The Backpropagation Network And Certainty Factor.

After training the final weights (w) will be obtained. This weight is then used for testing. The testing process algorithm is presented in the following figure:

RESULTS

In the Backpropagation method, network architecture will determine the success of the target achieved because not all problems can be solved with the same architecture. The number of hidden layers is determined by the users of the system by the best trial convergence (trial and error) until the best convergence of training results (the smallest number of epochs). The input system parameters for the formation of the established pattern are:

Net Size:

Input Layer: 30 neuron

Hidden Layer: 30 neuron 20 neuron 10 neuron 5 neuron and 1 neuron

Output Layer: 1 neuron

Maximum epoch / iteration: 10000

Show Epoch: 100

From 95 training data and 77 testing data, obtained the following analysis:

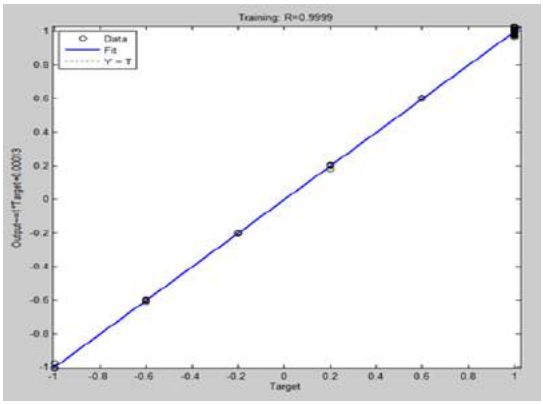

Figure 7. Training result graph of Backpropagation method.

From the results of the training on 95 patient medical records showed that the regression in Figure 4.2 has the value is 0.9999 (close to 1). It shows better results for the matching of output network with target. Next, to see the comparison between the target and the network output, it can be seen in Figure 4.3 which is the network output graph (*) and the target (o) where most of the output and target positions are close together or in other words are in the same position. If the position between output (*) and target (o) is in the same position, it can be said that it is a good result.

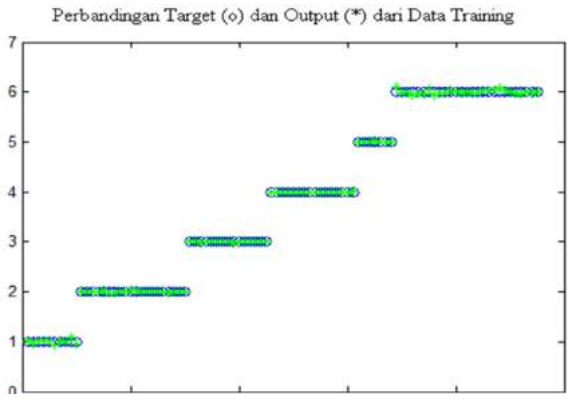

Figure 8. Result graph of network output training and target.

The following will be present a comparison table between the expected target and the target from testing result. When the target input matching with one of the output targets (1) or output (2), then the result is read as an actual result and considered appropriate.

Table 1. Diagnosis results of network testing stage of Backpropagation method

No.	Input Target	Output Target (1)	Output Target (2)	CF Value	Information
1.	Diphtheria	Diphtheria	Influenza	0,97	Matching
2.	Diphtheria	Influenza	Diphtheria	0,96	Matching
3.	Diphtheria	Influenza	Diphtheria	0,98	Matching
4.	Measles	Diphtheria	Influenza	0,78	No
5.	Measles	Measles	Typhoid	0,87	Matching
6.	Measles	Measles	Typhoid	0,90	Matching
7.	Measles	Influenza	Measles	0,95	Matching
8.	Measles	Measles	Influenza	0,98	Matching
9.	Measles	Diphtheria	Influenza	0,78	No
10.	Measles	DHF	Influenza	0,86	No
11.	Measles	Diphtheria	DHF	0,78	No
12.	Measles	Measles	Influenza	0,98	Matching
13.	Measles	Influenza	Measles	0,95	Matching
14.	Measles	Influenza	Diphtheria	0,95	No
15.	Measles	Influenza	Measles	0,92	Matching
16.	Measles	Measles	Typhoid	0,97	Matching
17.	Measles	Diphtheria	Influenza	0,72	No
18.	Measles	Measles	Typhoid	0,97	Matching
19.	Measles	Diphtheria	Influenza	0,80	No
20.	Measles	Influenza	Measles	0.98	Matching
21.	Measles	Measles	Influenza	0,93	Matching
22.	Measles	Diphtheria	Chicken pox	0,86	No
23.	Chicken pox	Typhoid	Influenza	0,90	No
24.	Chicken pox	Chicken pox	Typhoid	0,57	Matching

No.	Input Target	Output Target (1)	Output Target (2)	CF Value	Information
25.	Chicken pox	Influenza	Measles	0,88	No
26.	Chicken pox	Diphtheria	Chicken pox	0,93	Matching
27.	Chicken pox	Chicken pox	Diphtheria	0,95	Matching
28.	Chicken pox	DHF	Influenza	0,79	No
29.	Chicken pox	Chicken pox	Measles	0,92	Matching
30.	Chicken pox	DHF	Influenza	0,86	No
31.	Chicken pox	Chicken pox	Influenza	0,84	Matching
32.	DHF	DHF	Influenza	0,95	Matching
33.	DHF	DHF	Typhoid	0,93	Matching
34.	DHF	DHF	Influenza	0,99	Matching
35.	DHF	DHF	Influenza	0,99	Matching
36.	DHF	DHF	Diphtheria	0,98	Matching
37.	DHF	Influenza	DHF	0,97	Matching
38.	DHF	DHF	Typhoid	0,98	Matching
39.	DHF	Influenza	Measles	0,93	No
40.	DHF	DHF	Influenza	0,99	Matching
41.	DHF	DHF	Typhoid	0,87	Matching
42.	DHF	Typhoid	DHF	0,97	Matching
43.	Typhoid	DHF	Typhoid	0,99	Matching
44.	Typhoid	Influenza	Typhoid	0,96	Matching
45.	Typhoid	Influenza	Measles	0,97	No
46.	Typhoid	DHF	Typhoid	0,98	Matching
47.	Typhoid	Typhoid	Influenza	0,90	Matching
48.	Typhoid	Typhoid	Influenza	0,95	Matching
49.	Typhoid	Chicken pox	Influenza	0,96	No
50.	Influenza	DHF	Chicken pox	0,94	No
51.	Influenza	Influenza	DHF	0,98	Matching
52.	Influenza	Influenza	Diphtheria	0.90	Matching
53.	Influenza	Chicken pox	Diphtheria	0,44	No
54.	Influenza	Influenza	Diphtheria	0,99	Matching
55.	Influenza	DHF	Chicken pox	0,98	No
56.	Influenza	Influenza	Chicken pox	0,99	Matching
57.	Influenza	Influenza	Diphtheria	0,99	Matching
58.	Influenza	Influenza	Chicken pox	0,98	Matching
59.	Influenza	Influenza	Diphtheria	0,88	Matching
60.	Influenza	Influenza	Measles	0,98	Matching
61.	Influenza	Influenza	Diphtheria	0,60	Matching
62.	Influenza	Influenza	Measles	0,97	Matching
63.	Influenza	Influenza	Measles	0,99	Matching
64.	Influenza	Influenza	DHF	0,92	Matching
65.	Influenza	Influenza	Chicken pox	0,89	Matching
66.	Influenza	Influenza	DHF	0,98	Matching
67.	Influenza	Influenza	Chicken pox	0,99	Matching
68.	Influenza	DHF	Influenza	0,95	Matching
69.	Influenza	DHF	Influenza	0,96	Matching
70.	Influenza	Influenza	Measles	0,96	Matching
71.	Influenza	Influenza	DHF	0,98	Matching
72.	Influenza	DHF	Influenza	0,40	Matching
73.	Influenza	Influenza	Measles	0,96	Matching

No.	Input Target	Output Target (1)	Output Target (2)	CF Value	Information
74.	Influenza	Influenza	Typhoid	0,82	Matching
75.	Influenza	Influenza	Typhoid	0,94	Matching
76.	Influenza	Influenza	DHF	0,88	Matching
77.	Influenza	Influenza	Chicken pox	0,96	Matching

Visualize System Diagnose with GUI Matlab

Simplifying the process of diagnosis and make it more interactive used by users, then designed a diagnose system using GUI Matlab version 7.1. At the time of the testing by using the UI (user interface) as shown below (Figure 5), the user then select the button "**Masuk**" to go to the main menu that containing the data of disease symptoms to be tested by the user. The other button "Credit" is the short information about the application (user interface).

Figure 9. *Early Interface* of Main Program

After press the button "**Masuk**" then user will see the Main Program filled by several symptoms of diseases, like in the following Figure 6.

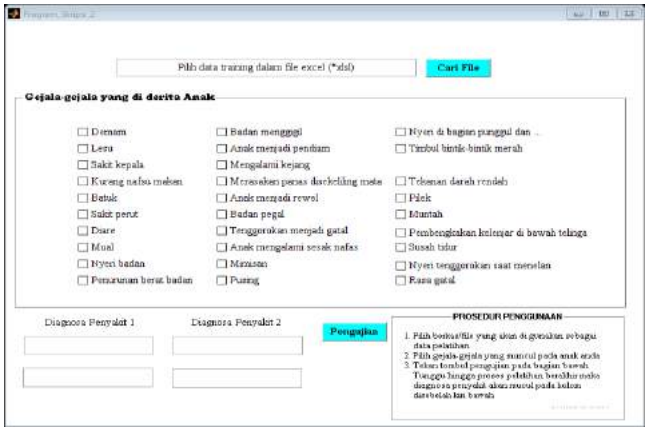

Figure 10. The options of symptoms in Main Program and the output diagnose

By this User Interface, it can diagnose several symptoms of illness to determine the type of illness. The first, the user is required to enter the training data file in excel format (*xsl) then choose the symptoms of disease suffered by Patient. After doing the test by pressing the "Testing" button, then the program will test the symptoms data by training the input data. After the Testing is complete then the test result (diagnosis) will appear in the lower left column of the Main Program UI. Also with the value of certainty factor that indicate the exact type of disease.

CONCLUSION

Based on the results of this study it can be concluded that this application is able to recognize and diagnose 6 illnesses by using 95 patient medical records as a training data and 77 patient medical records as testing data. From the results obtained the application system can diagnose fever illness in children with Accuracy rate of 76.62%.

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