

# Prediction of Autoimmune Disease Using Backpropagation Method

Debi Setiawan<sup>1</sup>, and Ramalia Noratama Putri<sup>2</sup>

<sup>1</sup>Department of Technical Information STMIK Amik Riau Pekanbaru, Indonesia.

<sup>2</sup>Department of information system Sekolah Tinggi Ilmu Komputer Pelita Indonesia Pekanbaru, Indonesia

\*Corresponding Email : debisetiawan@stmik-amik-riau.ac.id,  
ramalia.noratamaputri@lecturer.pelitaIndonesia.ac.id

**Abstract.** Autoimmune disease is a generally disease caused by immune system disorders or protection in the body. The disease is not contagious, but it can be deadly. The problems of autoimmune disease are unhealthy life styles and unhealthy foods. The purpose of this study is to predict the symptoms of autoimmune diseases, for the prediction process how many people affected by autoimmune disease. The data used in this study is primary data and 50 consisted of. Backpropagation method is selected because it is good method and has small error rate of 0.5%. In this experiment are used 24 variables, with performance measurement in terms of accuracy and error rate.

## 1. Introduction

The higher the level of activity of the person, the weakening of the immune system in the body. This causes the body's immune system to decrease, and causes the body to get sick quickly. Immune reactions are systemic and can cause death [1]. Autoimmune diseases occur when anti-body (lymphocytes) weaken so that the disease easily enters the body. Problems that often arise in civil society often forget about health and are more inclined to unhealthy lifestyles and consuming unhealthy foods.

More than 80 autoimmune diseases have been identified. Some are relatively well known, such as type 1 diabetes multiple sclerosis, lupus, and rheumatoid arthritis, while others are rare difficult to diagnose[2].

One autoimmune disease that causes death is lupus. Based on online hospital information system (SIRS) data, in 2016 there were 858 hospitals reporting their data. It is known that there are 2,166 inpatients diagnosed with lupus, with 550 of them dying. The number of lupus cases in 2016 nearly doubled compared to 2014, which was 1,169 cases. The number of deaths due to lupus in hospitalized patients also increased significantly compared to 2014. The number of patients dying from lupus in 2015 (110 deaths) decreased compared to 2014. But this number increased dramatically in 2016, which was 550 deaths. The high mortality due to lupus needs special attention because around 25% of patients in Indonesia hospital in 2016 ended in death[ 3]

Based on this problem, it is necessary to apply backpropagation method based on artificial neural networks in predicting autoimmune diseases in humans. Backpropagation method has been widely used in solving problems, especially in the health sector. Tanjung's previous researcher, said that the backpropagation method can predict asthma by obtaining almost 100% test results by trial and error 0.001 with simoid activation function [4].

## 2. Research Methods

### 2.1 Dedicated and define the problem

The problem raised in this study is the prediction of autoimmune disease in humans with the symptoms given. Autoimmune disease is a non-contagious disease but a deadly disease. For that must be wary.

## 2.2 Determining research outcomes

The achievement of this research is a decision whether human have an autoimmune disease or not, to determine the outcome of the study this required determination of input and process variables that will be done. For input variables there are 24 input variables: pain in joints and muscles, weakness in muscle, easy to get disease, not cold weather or sensitive to hot weather, skin allergy, prolonged fatigue, insomnia, low fever, night sweats, martial arts, dry eyes, shortness of breath, back pain and sinking, unnatural heartbeat, dizziness, depression, difficulty concentrating and disrupted memory, swelling on the legs, ankles and faces. After the variable is determined for the process we do the calculation with backpropagation.

## 2.3 Determining the process of study literature

There are two stages in the study literature:

### 1. State Of The Art

State Of The Art we use to see previous research with different methods, on the same topic, by looking for weaknesses or advantages of the calculation methodology presented.

### 2. Study literature

We use it as the basis or theoretical foundation that supports the achievement of this research.

## 2.4 Collecting research data

Questioner deals with the questionnaire that we give to the community, in terms of what's lasting for several weeks. In the questioner we give skala 1-3, 3 = yes, 2 = maybe 1 = not as a benchmark whether society is indicated Autoimun disease. The media we use is Google Form as shown below

The screenshot shows a Google Form titled "Prediksi Autoimun". At the top, there are tabs for "QUESTIONS" and "RESPONSES" with a count of "1". The form content includes a title, a description in Indonesian, a red asterisk indicating required fields, and three input fields: "Email address" (filled with "rini.yanti03@gmail.com"), "Nama" (filled with "Rini Yanti"), and "Email". There is also a link for "Add individual feedback".

Fig. 1. Google Form

The following 24 questions are included in the Questioner

No	QUESTION
1	Have you experienced pain or pain in your joints for a few days?
2	Have you experienced weak muscles for a few days?
3	Are you easy to get an attack for some days?
4	Are you not resistant to cold weather or sensitive to hot weather?
5	Do you have skin allergies
6	Do you feel prolonged fatigue?

- 
- 7 Do you feel insomnia?
  - 8 Do you feel unwell like a mild fever?
  - 9 Do you often sweat at night?  
Do you experience numbness in your hands for a few days and
  - 10 legs?
  - Are you visiting the doctor and checking your blood pressure? Is
  - 11 your mother's blood pressure low?
  - Do you experience (tremor) or vibration or shivering that occurs
  - 12 unconsciously?
  - 13 Do you often experience dry eyes?
  - Do you or your mother experience a drastic loss or weight loss in
  - 14 the past few months?
  - 15 Did you experience hair loss?
  - 16 Do you experience dry mouth?
  - 17 Do you feel a short breath?
  - 18 Do you feel pain and sinking in your back?
  - 19 Do you feel that your heart is beating unnaturally?
  - 20 Do you feel prolonged dizziness?
  - 21 Do you feel the Depression?
  - 22 Are you difficult to concentrate and memory is disturbed?
  - 23 Do you experience swelling in your legs?
  - 24 Do you experience swelling of your ankles and face?
- 

### *2.5 Performing Artificial Neural Network Pattern*

The design of artificial neural network pattern is done to get the hidden input pattern and output that we will do before doing the calculation process. In this study there are 8 inputs divided by 2, ie 4 training 4 test of the sample, which represented 24 variables supporting questions on input, 3 hidden value and 1 Output value.

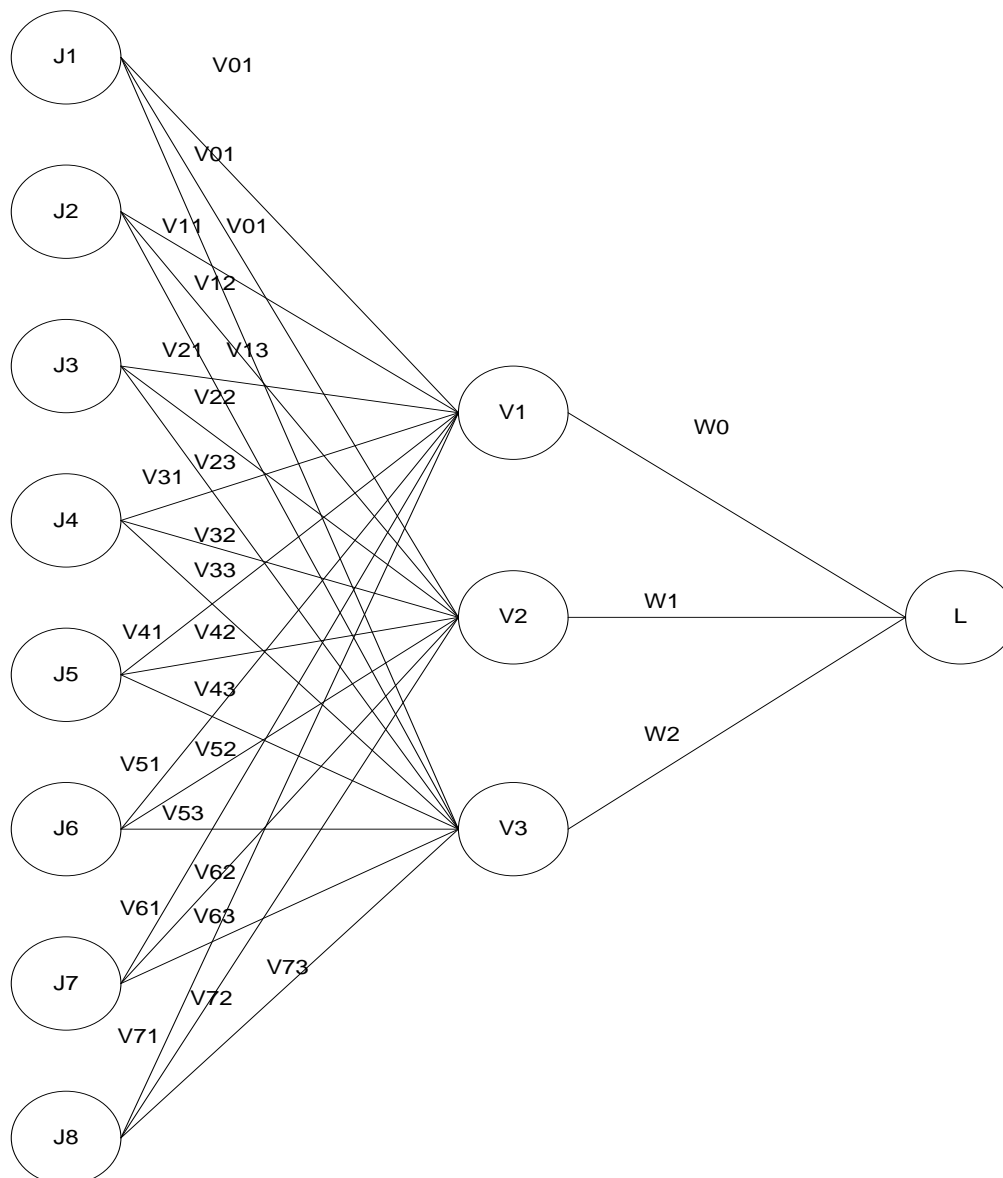


Fig. 2. Patern JST

### 2.6 Train and test using the Backpropagation Method

Train and test the results on backpropagation method this is done in order to get maximal results. The backpropagation method is equipped with 3 phases. Namely the forward phase, the reverse phase and the phase change value of the weight and the phase bias it has

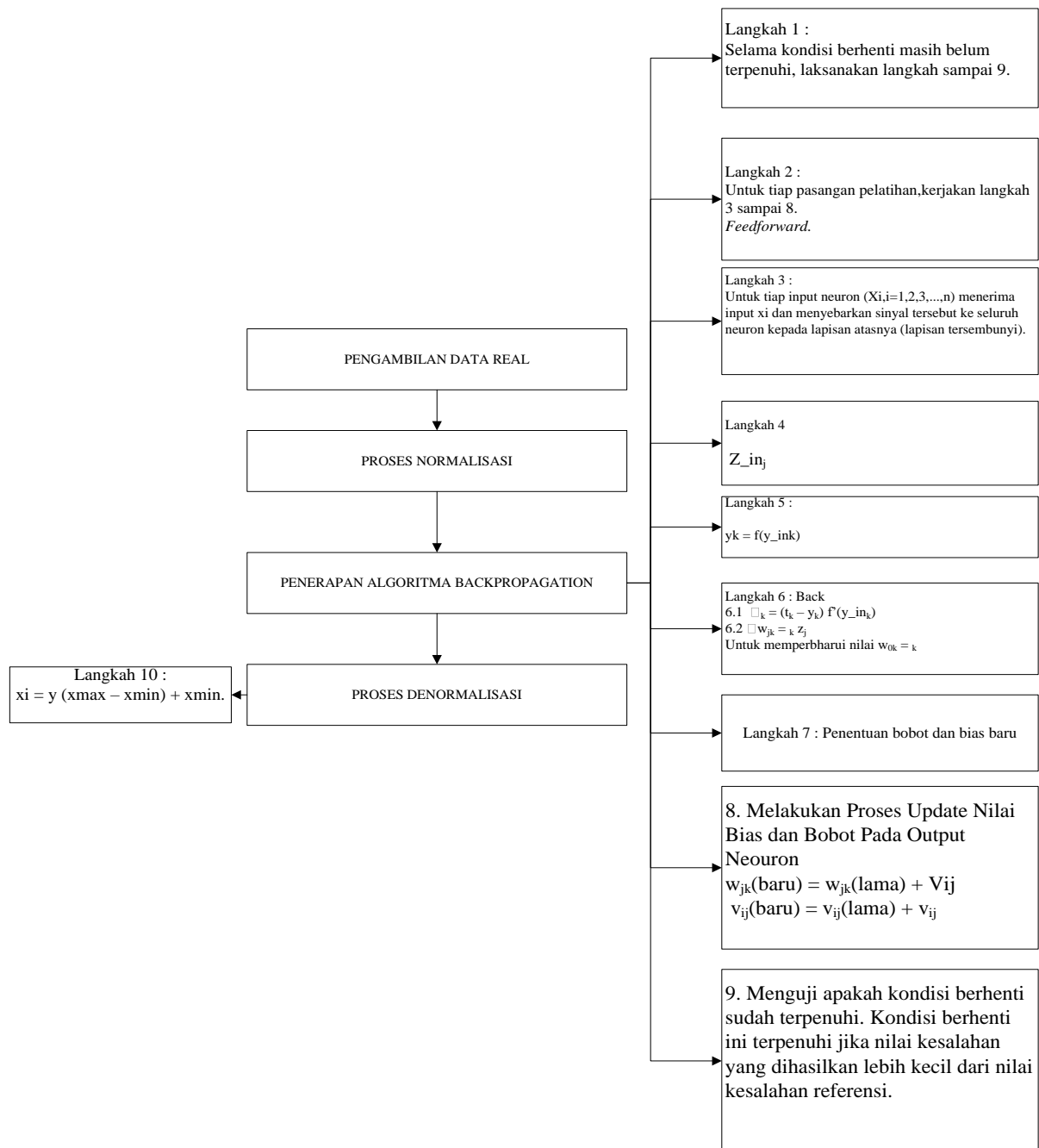


Fig. 3. Work Process Algorithm backpropagation

## 2.7 Evaluating Results obtained from the method used

Evaluation process is considered important, to determine the feasibility of the resulting output, is in accordance with the variable and process algorithm.

## III. Results and Discussion

First Questioner Value before we recap first and do the normalization process. This is useful as a reference to enter the value of the figure in the input JST as shown below:

TABLE 1. Recap Sample Value

PERTANYAAN	JAWABAN SAMPEL							
	1	2	3	4	5	6	7	8
1	1	3	1	1	1	1	1	1
2	3	3	1	1	1	1	1	2
3	1	3	1	2	1	3	3	3
4	1	3	1	1	1	1	1	1
5	2	3	1	1	1	2	1	2
6	1	2	1	1	1	1	1	1
7	1	1	1	3	1	1	1	1
8	1	3	1	1	1	1	1	1
9	1	1	3	3	1	1	1	1
10	1	3	1	1	1	1	1	2
11	1	3	1	1	1	1	1	1
12	1	1	1	1	1	1	1	1
13	3	3	1	1	1	1	1	1
14	1	3	1	2	1	1	1	1
15	1	3	1	2	3	3	3	3
16	1	1	1	1	1	1	1	1
17	1	1	1	1	1	1	1	1
18	1	3	1	1	1	1	1	1
19	1	2	1	1	1	1	1	1
20	1	2	1	1	1	1	1	1
21	1	3	1	1	1	1	1	1
22	1	3	1	1	1	1	1	1
23	1	1	1	1	1	1	1	1
24	2	1	1	1	1	1	1	1
X	1,2500	2,2917	1,0833	1,2917	1,0833	1,2083	1,1667	1,2917
NORMALISASI	0,2104	0,9000	0,1000	0,2379	0,1000	0,1828	0,1552	0,2379
NIL MIN								1,0833
NIL MAX								2,2917

TABLE 2. Recap Sample Value

NORMALISASI	0.2104	0.9000	0.1000	0.2379
	0.1000	0.1828	0.1552	0.2379

Table 3. Normalisation data

J1	J2	J3	J4
0.2104	0.9000	0.1000	0.2379
J5	J6	J7	J8
0.1000	0.1828	0.1552	0.2379

For the training table used to train the data obtained on the backpropagation method that is in the pattern 1-4 and the test on pila 5-8. For training input value we use J1-J4 from pattern 1-4. The target

value we use on the 1-5 pattern. As for test value we use pattern 5-8 with input J5-J8 and target value used Pla 5-8. As shown in table 4 and table 5 below:

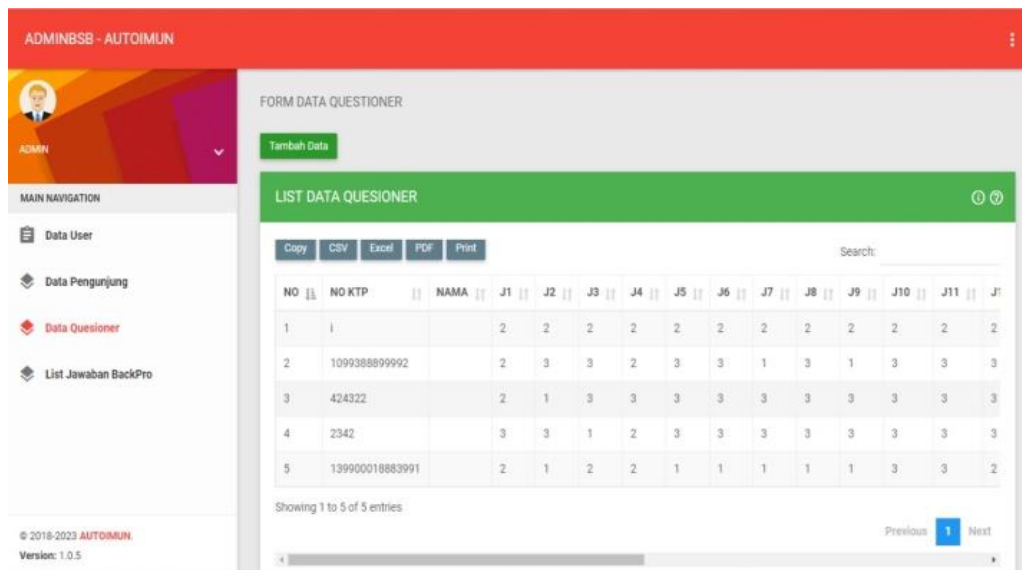
TABLE 4. Training Autoimun

	J1	J2	J3	J4	TARGET
<b>POLA</b>					
<b>1</b>	0.2104	0.9000	0.1000	0.2379	0.1000
<b>POLA</b>					
<b>2</b>	0.9000	0.1000	0.2379	0.1000	0.1828
<b>POLA</b>					
<b>3</b>	0.1000	0.2379	0.1000	0.1828	0.1552
<b>POLA</b>					
<b>4</b>	0.2379	0.1000	0.1828	0.1552	0.2379

TABLE 5. Testing Aoutoimun

	J5	J6	J7	J8	TARGET
<b>POLA</b>					
<b>5</b>	0.1000	0.1828	0.1552	0.2379	0.2104
<b>POLA</b>					
<b>6</b>	0.1828	0.1552	0.2379	0.2104	0.9000
<b>POLA</b>					
<b>7</b>	0.1552	0.2379	0.2104	0.9000	0.1000
<b>POLA</b>					
<b>8</b>	0.2379	0.2104	0.9000	0.1000	0.2379

After that we continue the search process using the Backpropagation Method, and generate the Epoch and error values as shown below:



The screenshot displays the ADMINBSB - AUTOIMUN web application. On the left is a sidebar with a user profile (ADMIN) and a main navigation menu containing: Data User, Data Pengunjung, Data Quesioner (highlighted in red), and List Jawaban BackPro. The main content area is titled 'FORM DATA QUESTIONER' and includes a 'Tambah Data' button. Below this is a 'LIST DATA QUESIONER' section with a table. The table has columns for NO, NO KTP, NAMA, and input fields J1 through J11, and a J12 column. It contains 5 data entries. At the bottom of the table, it says 'Showing 1 to 5 of 5 entries' and has 'Previous', '1', and 'Next' navigation links.

NO	NO KTP	NAMA	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12
1			2	2	2	2	2	2	2	2	2	2	2	2
2	1099388899992		2	3	3	2	3	3	1	3	1	3	3	3
3	424322		2	1	3	3	3	3	3	3	3	3	3	3
4	2342		3	3	1	2	3	3	3	3	3	3	3	3
5	139900018883991		2	1	2	2	1	1	1	1	1	3	3	2

Fig. 4. Question data input

Normalisasi

NO	NO KTP	NAMA	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13	J14	J15	J16	J17	J18	J19	J20	J21	J22	J23	J24	X	TOTAL X	NORMALISASI
1	1		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	46	1.92	0.17
2	1099388899992		2	3	3	2	3	3	1	3	1	3	3	3	2	3	3	3	1	3	3	1	3	1	3	3	58	2.42	0.51
3	424322		2	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	66	2.75	0.9
4	2342		3	3	1	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	66	2.75	0.9
5	139900018883991		2	1	2	2	1	1	1	1	1	3	3	2	2	1	3	1	3	3	1	3	3	1	3	1	44	1.83	0.1

# error(trainingdata)error(controidata)slope(error(controidata))

0	0.46871853767233	1	0
1	0.49283432754044	1	0
2	0.47321451158009	1	0
3	0.4908968716171	1	0
4	0.57388250445328	1	0
5	0.53238748794675	1	0
6	0.45971376497916	1	0
7	0.45783908504864	1	0
8	0.4603168313999	1	0
9	0.44714366296618	1	0
10	0.44562611634638	1	0
11	0.44111545163307	1	0
12	0.43720520814152	1	0
13	0.48215294228429	1	0
14	0.44303873349464	1	0

Fig. 5. Normalization

No	Testset	Traget	Neural Network
1	Testset 0	Tidak Sakit [0]	0.035297936615992
2	Testset 1	Tidak Sakit [0]	0.5399592251439
3	Testset 2	Sakit [1]	0.7310112026907
4	Testset 3	Sakit [1]	0.7310112026907
5	Testset 4	Tidak Sakit [0]	-0.06696959057187

Fig. 6. Results

## 4. Conclusions and Recommendations

### 4.1 Conclusions

Backpropagation method for determining aautoimun disease was successfully applied in this study with eror value -0.0564 and has epoch 15. It can be predicted from the eight samples there is a decision there is 1 sample that suffer from aautoimun and there are 7 who do not.

### 4.2 Suggestions

For further research to be developed more towards the program more structured and developed again pattern Artificial Neural Network.

## Rererence

- [1] . SRIKANDI WALUYO, Dr. budhi marhendra, mha, sakp. (2014). AUTOIMUN DISEASES. (P. E. Komputindo, Ed.). Jakarta: PT. Elex Media Komputindo.
- [2] . U.S. National Institutes of Health and Human Services ,November, 2012
- [3] . SIRS Online, Ditjen Pelayanan Kesehatan, Kementrisn Kesehatan,2017



- [4] . Tanjung, Dahriani Hakim, 2015, Jaringan Saraf Tiruan dengan Backpropagation untuk Memprediksi Penyakit Asma Citec Journal, Vol. 2, No. 1, November 2014 – Januari 2015