Management of Information System Journal
Vol 2, No 3, Juli 2024, Hal. 18 - 22
ISSN: 2964-9455 (media online)
DOI: 10.47065/mis.v2i3.1915
https://journal.fkpt.org/index.php/MIS

Rhabdomyosarcoma Diagnosis Expert System Applying Adaptive Neuro Fuzzy Inference System Method

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Abstract- - Rhabdomyosarcoma (RMS) is a cancer that originates from striated muscles (muscles that move the body). Is a cancer that is formed from the soft tissues in the body, such as muscles, fat cells, bones, joints and blood vessels. This cancer grows and develops in any part of the body and Rhabdomyosarcoma disease is most commonly found in children. To get an accurate diagnosis, it requires an expert system using the Adaptive Neuro Fuzzy Inference System (ANFIS) method. Rhabdomyosarcoma disease was designed using the Visual Basic Net 2008 programming language and using the MYSQL database, hoping that it could become an alternative tool and bring positive impacts for all its users.

Keywords: Expert Diagnostic System, Rhabdomyosarcoma, Adaptive Neuro Fuzzy; Inferencce System, Visual Basic Net 2008

1. INTRODUCTION

Disease is something that is an enemy for everyone and that needs to be avoided because diseases that are very life-threatening and diseases that are difficult to cure are so widespread that even though there is medicine and the possibility of recovery, they always take time and the recovery process.

Rhabdomyosarcoma is a cancer that originates from the striated/skeletal muscles. This cancer has its own symptoms according to the size and location of the body, and this cancer often occurs at an early age, aged 6 years and under, although this disease can also be found in teenagers and In adults, this cancer is rare and rarely occurs, therefore sometimes specific treatment for this disease is lacking so that the diagnosis is often late and inaccurate.

Expert system to overcome the problems that occurred above, the author built a system to diagnose rhabdomyosarcoma disease to be able to help experts to overcome Rhabdomyosarcoma cancer, so to build a system the author used the help of the Visual Basic net 2008 programming language and used the MYSQL database, hoping that it could become an alternative tool and has a positive impact on all its users.

In the explanation, a method is needed to solve a problem. The method used to deal with Rhabdomyosarcoma disease is the Adaptive Neuro Fuzzy Inference System method. This method is also a method that can be used to make the right decision, and is very capable of diagnosing various diseases [1].

The Adaptive Neuro Fuzzy Inference System method has five layers of solving or solving problems in diagnosing Rhabdomyosarcoma disease so that this method really provides solutions at each layer of the solution and they are interconnected...

2. RESEARCH METHODOLOGY

Artificial Intelligence or (Artificial Intelligence) is a part of computer science that teaches how to create a technology or machine (computer) so that it can do the work ordered by the user and the results are exactly as desired and as good as those done by humans or even better. compared to humans themselves[2].

The author's own opinion means that artificial intelligence is the result of a duplicate of the human mind which is applied in the form of technology that contains programs and rules to help speed up certain human tasks.

Rhabdomyosarcoma (RMS) is a cancer that originates from the striated muscles (muscles that move the body). It is a cancer that forms from soft tissue in the body and Rhabdomyosarcoma is most often found in children.

Table.1 Symptoms of Rhabdomyosarcoma

No	Symptoms of Rhabdomyosarcoma
1.	The eyes bulge out more and more
2.	The upper eyelid cannot open completely,
3.	like drowsiness (ptosis)
4.	Cockeye
5.	Swelling of the eyes Redness, pain, or infection around the eyes

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2.1.1. Rhabdomyosarcoma Treatment

Treatment for Rhabdomyosarcoma must be adjusted to the tissue from which the cancer grows and the stage of the cancer itself and this treatment can be done through surgery, chemotherapy and radiotherapy.

1. Operation
   The aim of the operation is to remove the surrounding tumor tissue and the main tumor, the operation is also carried out to remove tumors that are not too difficult or are in a place that allows them to be easily removed.
2. Chemotherapy
   Chemotherapy aims to reduce the risk of cancer growing again and reduce the size of large tumors before surgery. In chemotherapy, the drugs often used are doxorubicin, etoposide, cyclophosphamide.
3. Radiotherapy
   Apart from chemotherapy, radiation therapy can also be done to kill cancer cells that cannot be removed. Usually it is often combined with chemotherapy [4].

2.2. Adaptive Neuro Fazzy Inference System (ANFIS)

ANFIS was developed by J.S.R Jang in 1992. According to Jang, the adaptive network class is functionally equivalent to fuzzy inference. The ANFIS system is an architecture that is functionally the same as the first order Sugeno fuzzy rule base model (Jang et al, 1997). If fuzzy inference is assumed[5].

2.2.1. ANFIS Architecture

The system has two inputs x and y and has one output z, so according to the first order Sugeno model, there are two rules as follows:

Rule 1: If x is A1 and y is B1, then f1 = P1x + q1y + r

Rule 2: If x is A2 and y is B2, then f2 = P2x + q2y + r

To find the average value of A and b, use a formula.

$$y = \frac{w_1}{w_1 + w_2} y_1 + \frac{w_2}{w_1 + w_2} y_2 \qquad (2.1)$$

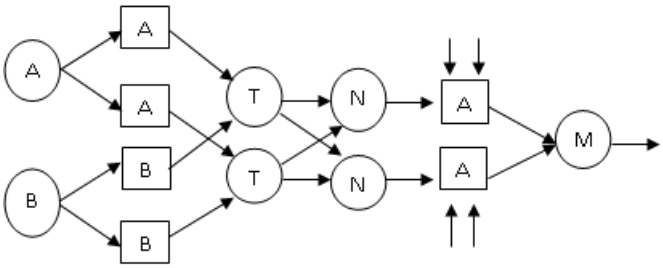

Figure 1. Anfis structure

According to J.S.R.Jang (J.S.R.Jang, 1997) in Kusumadewi's quote (Kusumadewi, 2003) the ANFIS network consists of 5 layers as follows:

1. Layer 1: Fuzzyfication Layer

   Make O1,i the output at layer 1 node. Node i at layer 1 is an adaptive node with the node function:

   O1,i = μAi (x) for i = 1, 2; or O1,I = μBi (y) for i = 3, 4,

   Where x and y are the inputs at node i, (μAi or μBi-2). This node functions as a linguistic (big, small). The membership function used is the generalized bell (gbell) type and the following is the gbell formula.

   $$\mu A(X) = \frac{1}{1 + \left|\frac{X - C_1}{a}\right| 2_b} \qquad (2.2)$$

   These parameters can change and the form of function can also be adjusted to what is needed.

2. Layer 2: Product Layer

   This layer is a non-adaptive layer, the result of multiplying all the inputs in this layer

   $$O_{2,i} = \text{wi} = \mu A, \text{i}\,(x).\mu B, \text{i}(y) \qquad (2.3)$$
   $$\text{w } 1 = \mu A_1 * \mu B_1 \qquad (2.4)$$
   $$\text{w } 2 = \mu A_2 * \mu B_2$$

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Each node in this layer serves as a measure of the strength of the rule

3. Layer 3: Normalization Layer

The nodes in this layer normalize the weight function of the results of each node in this layer serving various rule sizes. The normalized output is calculated by [5]:

$$O_{3,i} = i = w_1/(w_1 + w_2) \quad (2.4)$$

4. Layer 4: Defuzzyfication Layer

The nodes in this layer are naturally adaptive. The defuzzification output of this layer is solved by formula[6].

$$O_{4,i} = wf_i = wt_i\ (P_i x + q_{iy} + r_i) \text{ or } (2.5)$$

$$w_1 y_1 = (w_1 x_1)p_1 + \overline{(w_1 x_2)q_1} + \overline{r_1} \quad (2.6)$$
$$\overline{P_i} = w_1 * x_1 \quad (2.7)$$
$$\overline{q_i} = w_1 * x_2 \quad (2.8)$$
$$r_1 = \overline{w_1} \quad (2.9)$$

5. Layer 5: Total Output Layer

A single node in this layer synthesizes the information sent by layer 4 and returns the entire output using the following fixed function[7]:

$$O_{5,i} = \sum w_i f_i = \frac{\sum w_i f_i}{\sum w_i} = = (2.6)$$

3. RESULT AND DISCUSSION

3.1 Discussion

Kode	Symptom	Expert value
G1	The eyes bulge out more and more	0,7
G2	The upper eyelid does not open completely	0,65
G3	Like sleepy	0,25
G4	Cockeye	0,7
G5	Swelling of the eyes, redness, pain or infection around the eyes	0,4

From the data above, calculations to obtain results or conclusions from the membership data are as follows:

1. Layer one

Predict data from the rules, namely w1 and w2, then the calculation using the ANFIS method is as follows:

For example, the values x1 = 0.25 and x2 = 0.15

Priority p1 (1 = high, 0 = low)

Highest x1 input value = 0.25

Then the value of Mx1 = 0.25/0.7 = 0.3571

Then the value of Mx2 = 0.25/0.65 = 0.3846

Then the value of Mx3 = 0.25/0.25 = 1

So the highest value has the highest priority = 1

Input low x2 value = 0.15

Priority p1 (1 = high, 0 = low)

Then the value of Mx4 = 0.15/0.7 = 0.2142

Then the value of Mx5 = 0.15/0.4 = 0.375

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So the low priority value is = 0.2142

2. Layer two

In the second layer of calculations, the results of high priority x1 and low x2 are taken from the results

W1 = 1

W2 = 0.2142

3. Third layer

To calculate values:

Wt1 = w1/(w1 + w2)

= 1/1+ 0.2142

= 0.8235

Wt2 = w2/(w1 + w2)

= 0.2142/1+0.2142

= 0.1764

4. Layer four

To calculate values:

w1f1 = wti (pix + qiy+ riz)

= 0.8235 (0.3571*1+0.3846*1 + 1*1)

= 0.8235 *1.6203

= 1.3343

w2f2 = wt2 (pix + qiy+ riz)

= 0.1764 (0.2142*1 + 0.375*1+ 0*1)

= 0.1764 * 0.5892

= 0.1039

5. Layer five

To calculate the final results

=

wifi = w1f1 + w2f2

= 1.3343 + 0.1039

= 1.4382

Wti = Wt1 + Wt2

= 0.8235 + 0.1764

= 1.5875

Then the sum result = wifi / wti

= 1.4382/ 1.5875

= 0.9059

So the average value of Rhabdomyosarcoma is = 0.9059

4. CONCLUSION

The conclusions outlined by the author from the Expert System for Rhabdomyosarcoma Diagnosis Applying the Adaptive Neuro Fuzzy Inference System Method include the following:

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1. To confirm the symptoms of Rhabdomyosarcoma, you must carry out a detailed microscope examination (biopsy) including a complete blood test, and including counting anemia blood cells.
2. To apply the Adaptive Neuro Fuzzy Inference System method in diagnosing Rhabdomyosarcoma, first find out what symptoms you are suffering from.
3. To design a Rhabdomyosarcoma diagnosis system, the program was created using Visual Studio 2008 and mySQL as the database concept. Make data more accurate and detailed to make searching easier.

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