Tuberculosis Disease Diagnosis Expert System Method of Certainty Factor

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Abstract—Nowadays computers are widely used in the medical world to aid in the diagnosis of a disease. The most frequently encountered Penyakit yangdiderita users. The value of these beliefs using Certainty Factor, because the CF is able to determine the value of trust in a greater uncertainty and be able to demonstrate absolute confidence.

Keywords Applications, Disease, Diagnosis, Certainty Factor.

1. Introduction

The expert system is a computer-based system that uses knowledge, facts or reasoning techniques in solving problems that normally can only be resolved by an expert in the field of tertentu. Oleh Therefore, in the medical world, many emerging applications of expert systems. This expert system is able to diagnose a variety of diseases in humans, one tuberculosis. [1] Tuberculosis is an infectious disease caused by bacteria Mikobakterium tuberculosis. This bacteria is very difficult treated and takes time to treat it. These bacteria are often found in the lungs compared to elsewhere in the body. [2] Sometimes society does not want to consult a doctor and tend to ignore it. The reason that easel is cost, shame, the length of the queues and the fear of fear when exposed to the disease have more severe. For some people, to see a doctor need not cost you a little bit not to mention having to buy medicine and must undergo a check that is not a short queue. In addition, the limitations of the lung specialist makinmemperburuk this state. That's why we need a system that can help the community in diagnosing disease will Tuberculosis Disease Diagnosis expert system. To see a doctor need not cost you a little bit not to mention having to buy medicine and must undergo a check that is not a short queue. In addition, the limitations of the lung specialist makinmemperburuk this state. That's why we need a system that can help the community in diagnosing disease will Tuberculosis. [3] Therefore research inibertujuan construct an expert system that is used for early diagnosis of Tuberculosis disease by gejalayang in anguish. The system displays the amount of credence to the possibility of disease symptoms yangdiderita users. The value of these beliefs using Certainty Factor, because the CF is able to determine the value of trust in a greater uncertainty and be able to demonstrate absolute confidence.
Certainty Factor provides a concept (MB) is the belief hypothesis is affected by symptoms and (MD) is the uncertainty hypothesis that is affected by the symptoms. This method was chosen because it can display the value of the percentage of confidence in the fact that identified, but it is also this method in sekalihitung can only handle two data alone so that its accuracy is maintained. [5]

2. Theory

2.1 Certainty Factor (Certainty Factor)

The basic formula certainty factor. CF (h, e) = MB (h, e) - MD (h, e).

Information:
CF (h, e): certainty factor of the hypothesis h that are affected by the symptoms e.
MB (h, e): the size of the increase in confidence in the hypothesis h that are affected by the symptoms e.
MD (h, e): the size of the increase in distrust of hypothesis h which is affected by symptoms e.
h : hypothesis
e : Event / facts

In one case there will be more than one size of the increase in trust in accordance with many of the symptoms that are owned by hypothesis, so the formula MB and MD as follows: [6]

\[
MB[h,e_1 \land e_2] = \begin{cases} 
0MB[h,e_1 \land e_2] = 1 \\
MB[h,e_1] + MB[h,e_2].(1 - MB[h,e_1]) \text{Lainnya}
\end{cases}
\]

\[
MD[h,e_1 \land e_2] = \begin{cases} 
0MB[h,e_1 \land e_2] = 1 \\
MD[h,e_1] + MD[h,e_2].(1 - MD[h,e_1]) \text{Lainnya}
\end{cases}
\]

3. Research methods

This method describes the methods to be used in the study, then used a method Certanty Factor

To help the preparation of this study, the need for a clear framework arrangement in phases, the following research framework:

![Research Framework](https://iocscience.org/ejournal/index.php/CNAPC)

Fig. 1. Research Framework

4. Analysis and Results

Analysis GrandMed datadi Hospital is located at Jl. Medan - Lubukpam Kwn. 25 No. 66 Lubukpam District of Deli Serdang and conducted interviews to physicians who are experts in tuberculosis. [7]

| Disease   | symptom                                                                 | Weight |
|-----------|--------------------------------------------------------------------------|--------|
| tuberculosis lung | Batu continuous and bloody 3 during weeks / more | 0.9    |
### Case study

A case of diagnosis of tuberculosis by the name of Pulmonary Tuberculosis disease. Rule used is to use rule 1 and the following answer to the symptoms experienced users.

| Symptom                                                                 | Score |
|-------------------------------------------------------------------------|-------|
| Persistent cough and blood mixed for 3 weeks / more                     | 0.9   |
| Demamlebih dari 3 weeks                                                 | 0.5   |
| Shortness of breath and chest pain.                                     | 0.9   |
| Decreased appetite                                                      | 0.3   |
| Weight loss                                                             | 0.5   |
| I am not feeling well                                                   | 0.3   |
| Berkerengat night while not doing anything                              | 0.6   |
| Persistent cough and blood mixed for 3 weeks / more                     | 0.2   |
| Fever of more than 3 weeks                                              | 0.5   |
| Decreased appetite                                                      | 0.3   |
| I am not feeling well                                                   | 0.2   |
| Night sweats while not doing anything                                   | 0.2   |
| The emergence of bumps on problematic parts glands such as the neck,    | 0.9   |
| groin, and armpits                                                      |       |
| Lumps glands burst and discharge such as pus dirty                      | 0.9   |
| Lumps arising gland feels supple                                        | 0.9   |
| Persistent cough and blood mixed for 3 weeks / more                     | 0.2   |
| Fever for three weeks / more                                            | 0.4   |
| Decreased appetite                                                      | 0.6   |
| Weight loss                                                             | 0.4   |
| Taste unwell, weak                                                      | 0.6   |
| Sweating at night while not doing anything                              | 0.1   |
| Lumps in the breast                                                     | 0.9   |
| Pain in the breast                                                      | 0.8   |
| Signs of inflammation around the bump that arises in the breast         | 0.9   |
| Persistent cough and blood mixed for 3 weeks / more                     | 0.2   |
| Fever for three weeks / more                                            | 0.6   |
| Decreased appetite                                                      | 0.4   |
| Taste unwell / malaise, weakness                                        | 0.4   |
| Sweating at night while not doing anything                              | 0.4   |
| Pain the back or merasakaku                                             | 0.8   |
| Pain in the spine was reduced when patients rest                        | 0.8   |
| Lumps on the back / spine                                               | 0.9   |
| Body aches tired in the afternoon desertai                              | 0.6   |
| bone swelling                                                           | 0.9   |
| Pain in the joints of bones                                             | 0.9   |
4.2. Rule Tuberculosis with Certainty Factor Method

Production rule is usually written in the form of if-then. Rule inidapat connected impliksi two parts, namely jikadanmaka. If the premise section filled with the part then also be true. A rule consists of clauses. There is a premise clauses and clauses So on a rule. A rule consists of some of the more than one premise and conclusion. Between the premise and the conclusion may be associated with "OR" or "AND".

The ygtersedia rule base in the rules that form the pair state action "IF (IF) met or circumstances occur THEN (THEN)" adalahsebagai follows:

**rule 1**: IF Cough and phlegm for three weeks / more is True
AND Sputum mixed with blood / blood cough is True
AND Fever for three weeks is True
AND Shortness of breath and chest pain is True
AND Decreased appetite is True
AND Weight loss is True
AND Taste unwell (malaise, weakness) is True
AND Sweating at night while not doing anything is True
THEN Tuberculosis lung

**rule 2**: IF Coughing up phlegm mix for three weeks / more is True
AND Fever for three weeks / more is True
AND Decreased appetite is True
AND Weight loss is True
AND Kurang enakbadandanlemah is True
AND Night sweats while not doing anything is True
AND The emergence of a lump in the neck, groin, and ketiakdll is True
AND Lumps glands rupture and ooze pus kotorausejeniscairannynais True
AND Lumps arising gland feels supple is True
THEN Tuberculosis Lymph gland

**rule 3**: IF Persistent cough and phlegm for three weeks / more is True
AND Fever three mingguataulebih is True
AND Decreased appetite is True
AND Weight loss is True
AND Taste less enakbadandanlemah is True
AND Sweating at night while not doing anything is True
AND Lumps in the breasts True
AND Pain in daerahpayudara is True
AND Signs of inflammation around the bump that arises in the breast.is True
THEN Tuberculosis Breast

**rule 4**: IF Persistent cough and phlegm for three weeks / more is True
AND Fever for three weeks / more is True
AND Decreased appetite is True
AND Weight loss is True
AND Discomfort badandan weak is True
AND Sweating at night while not doing anything is True
AND Pain in the back or experiencing back stiffness is True
AND Back pain was reduced when patients rest is True
AND Lumps on the back / spine is True
AND Body aches tired in the afternoon desertai is True
AND bone swelling is True
AND Pain in the joints of bones is True

THEN Tuberculosis Spine. [9]

4.3. Application of Certainty Factor Method

| Table 2 | Weight |
|---------|--------|
| hypothesis | weights Symptoms | CF User |
| CF [H, E] 1 | 0.9 | 1.0 |
| CF [H, E] 2 | 0.9 | 1.0 |
| CF [H, E] 3 | 0.5 | 0.6 |
| CF [H, E] 4 | 0.9 | 0.8 |
| CF [H, E] 5 | 0.3 | 0.4 |
| CF [H, E] 6 | 0.5 | 0.6 |
| CF [H, E] 7 | 0.3 | 0.4 |
| CF [H, E] 8 | 0.6 | 0.6 |

then the value CF (H, E) are:

\[
\begin{align*}
\text{CF [H, E] 1} &= \text{CF [H] 1} \times \text{CF [E] 1} \\
&= 0.9 \times 1 \\
&= 0.9 \\
\text{CF [H, E] 2} &= \text{CF [H] 2} \times \text{CF [E] 2} \\
&= 1.0 \times 1 \\
&= 1 \\
\text{CF [H, E] 3} &= \text{CF [H] 3} \times \text{CF [E] 3} \\
&= 0.5 \times 0.6 \\
&= 0.3 \\
\text{CF [H, E] 4} &= \text{CF [H] 4} \times \text{CF [E] 4} \\
&= 0.9 \times 0.8 \\
&= 0.72 \\
\text{CF [H, E] 5} &= \text{CF [H] 5} \times \text{CF [E] 5} \\
&= 0.3 \times 0.4 \\
&= 0.12 \\
\text{CF [H, E] 6} &= \text{CF [H] 6} \times \text{CF [E] 6} \\
&= 0.5 \times 0.6 \\
&= 0.3 \\
\text{CF [H, E] 7} &= \text{CF [H] 7} \times \text{CF [E] 7} \\
&= 0.3 \times 0.4 \\
&= 0.12 \\
\text{CF [H, E] 8} &= \text{CF [H] 8} \times \text{CF [E] 8} \\
&= 0.6 \times 0.6 \\
&= 0.36
\end{align*}
\]

Combination of Value CF [H, E] based on the above calculation for each symptom-disease dalah as follows:

\[
\begin{align*}
\text{CFcombine} \text{ CF [H, E] 1.2} &= \text{CF [H,E] 1} + \text{CF [H, E] 2} \times (1 - \text{CF [H, E] 1}) \\
&= 0.9 + 0.9 \times (1 - 0.9) \\
&= 0.9 + 0.09 \\
&= 0.99 \rightarrow \text{old1}
\end{align*}
\]

\[
\begin{align*}
\text{CFcombine} \text{ CF [H, E] old1,3} &= \text{CF [H, E] old1} + \text{CF [H, E] 3} \times (1 - \text{CF [H, E] old1}) \\
&= 0.99 + 0.3 \times (1 - 0.99) \\
&= 0.99 + 0.003 \\
&= 0.993 \rightarrow \text{old2}
\end{align*}
\]
CFcombine CF [H, E] old2,4 = CF [H, E] old2 + CF [H, E] 4 * (1 - CF [H, E] old2)
= 0.993 + 0.72 * (1 - 0.993)
= 0.993 + 0.00504
= 0.99804 old3

CFcombine CF [H, E] old3,5 = CF [H, E] old3 + CF [H, E] 5 * (1 - CF [H, E] old3)
= 0.99804 +0.12 * (1 - 0.99804)
= 0.99804 + 0.0002352
= 0.9982752 old4

CFcombine CF [H, E] old4,6 = CF [H, E] old4 + CF [H, E] 6 * (1 - CF [H, E] old4)
= 0.9982752 + 0.3 * (1 - 0.9982752)
= 0.9982752 + 0.00051744
= 0.99879264 old5

CFcombine CF [H, E] old5,7 = CF [H, E] old5 + CF [H, E] 7 * (1 - CF [H, E] old5)
= 0.99879264 + 0.12 * (1 - 0.99879264)
= 0.99879264 + 0.000144832
= 0.9989375232 old6

CFcombine CF [H, E] old6,8 = CF [H, E] old6 + CF [H, E] 8 * (1 - CF [H, E] old6)
= 0.9989375232 + 0.36 * (1 - 0.9989375232)
= 0.9989375232 + 0.0003824916
= 0.9993200148

Then the value of the percentage level of user confidence in tuberculosis based on the above cases are:
Percentage = CF Disease * 100
= 0.9993200148 * 100
= 99.93%

From the results of the process using the method of Certainty Factor above, it can be seen that the patient "Great Possibilities" underwent pulmonary tuberculosis disease-paru with 99.93% confidence value.

5. Conclusion

1. This application can decipher the data on the role of the expert system and apply the method to diagnose disease Certainty Factor Tuberculosis
2. This application mendaptkan Parudengan Tuberculosis disease outcomes using methods Certanty Factor.
3. The application uses a Web-based programming languages and data base used is Php MyAdmin.

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