APPLICATION OF THE DAMPSTER SHAFER METHOD TO DIAGNOSE MALNUTRITION IN TODDLERS

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Abstract

The toddler period is a golden period that must be put to good use by parents. The golden period is a determinant for the growth and development of children. Malnutrition in children can lead to various diseases that can hinder the growth and development of children. Posyandu Desa Tanjung Garbus Kampung is an integrated service center that provides public health services. Lack of knowledge and experience of Posyandu health workers in Tanjung Garbus Village Village is one of the problems in diagnosing malnutrition in toddlers because it is only based on the toddler's weight and height. The dempster shafer method is a method in expert systems that applies a mathematical theory for proof based on a function of belief and reasonable reasoning (belief function and reasonable thinking), which is used to combine separate pieces of information (evidence) to calculate the likelihood of an event. With this system, it is expected to be able to diagnose malnutrition in toddlers quickly and efficiently.

Keywords: Expert system, Dempster shafer, malnutrisi

1. INTRODUCTION

Currently, the development of technology is happening so fast. Almost all aspects of the field of work require technology in the process. Information technology also has a big impact on the fields that apply it, including in the health sector. Technological developments are very beneficial for health workers to increase efficiency and effectiveness in providing services to the community. Malnutrition or what can be called nutritional deficiency is a condition in which a person experiences a lack of nutritional intake. Malnutrition is a condition that should not be taken lightly. Because if malnutrition is neglected in a protracted manner it will cause various complications or the emergence of diseases that are dangerous to health, especially in toddlers, resulting in a decrease in the level of growth and development of children. Usually the main factor of malnutrition is a lack of adequate food intake which is based on poverty, to socio-economic factors. Tanjung Village Posyandu. Garbus Kampung is a health service post that also provides health services for toddlers. Limitations of services and knowledge in diagnosing diseases caused by malnutrition are one of the problems currently occurring where officers make diagnoses based only on the weight and height of the toddler. For this reason, a system is needed that can assist health workers in diagnosing malnutrition in toddlers quickly and effectively. An expert system or Expert System, also known as a Knowledge Based System, is a computer application intended to assist decision making or problem solving in a specific field. This system works by using knowledge and analytical methods that have been defined in advance by experts according to their areas of expertise (W. Yolanda, et al, 2022). One of the methods used in expert systems is the Dempster Shafer method. The Dempster-Shafer method is also known as the belief function theory. This method uses Belief, which is a measure of the strength of evidence in supporting a set of propositions. If it has a value of 0 (zero), it indicates that there is no evidence, and if it has a value of 1, it indicates certainty. The dempster shafer method is a method in expert systems that applies a mathematical theory for proof based on belief functions and plausible reasoning, which are used to combine separate pieces of information (evidence) to calculate the probability of an event. With this system, it is expected to be able to diagnose malnutrition in toddlers quickly and efficiently.
2. METHOD
2.1 Rule

Data The method in the research conducted must be relevant to the problem under study. This research was conducted by collecting data on toddlers at the Tanjung Village Posyandu. Garbus Kampung which is then analyzed, processed and then manually calculated using the Dempster Shafer method is then made into a system where the system will facilitate calculations in diagnosing malnutrition in toddlers. This research has high relevance to the vision and mission of the STMIK Pelita Nusantara informatics engineering study program, namely Smart Application Development. Research by Yolanda Wiguna, et al., 2022 with the title "Expert System for Diagnosing Coral Disease Using the Dempster Shafer Method". This study diagnoses coral disease by implementing an expert system using the Dempster Shafer method, starting from determining the density and plausibility values, then carrying out the Dempster Shafer combination process. Dempster Shafer is a mathematical theory for proof based on belief functions and plausible reasoning, which are used to combine separate pieces of information (evidence) to calculate the probability of an event. Dempster Shafer is a method capable of diagnosing disease based on the function of belief and reasonable thinking of an expert or expert. In general, Dempster Shafer's theory is written in an interval:

1. Belief (Bel) is a measure of the strength of evidence in supporting a set of propositions. If it has a value of 0 (zero), it indicates that there is no evidence, and if it has a value of 1, it indicates certainty. Where is the bell value (0-0.9).

2. Plausibility/logis (Pls) Plausibility/logis juga bernilai 0 sampai 1, jika yakin akan –s, maka dapat dikatakan Bel (X) = 1 dan Pl (Y) = 0, sesuai persamaan.

\[
\text{Pls(X)} = 1 - \text{Bel(X') = } 1 - \sum_{y=x}^{m} \text{m(Y)}
\] ............................. (1)

Sedangkan, Plausibility (Pls) dinotasikan sesuai pada persamaan (2) sebagai berikut.

\[
\text{Pls(X)} = 1 - \text{Bel(X')} = 1 - \sum_{y=x}^{m} \text{m(Y')}
\] ............................. (2)

Dimana:
Bel(X) = Belief (X)
Pls(X) = Plausibility
(X) m(X) = mass function dari (X)
m(Y) = mass function dari (Y)

Methods To overcome this number of evidences in the Dempster-Shafer theory use rules that are better known as Dempster's Rule of Combination, denoted according to equation (3) as follows. evidence t Dempster-Shafer of Combination,

\[
m_3(Z) = \sum_{X \cap Y = Z} m_1(X)m_2(Y)
\] ............................. (3)

That description:
m3(Z) = mass function dari evidence (Z)
m1(X) = mass function dari evidence (X)
m3(Y) = mass function dari evidence (Y)

In general, the formulation for Dempster's Rule of Combination, according to equation (4) is as follows

\[
m_3(Z) = \frac{\sum_{X \cap Y = Z} m_1(X)m_2(Y)}{1 + k}
\] ............................. (4)

Dimana:
k = Jumlah evidential conflict.

Besarnya jumlah evidential conflict (k) dirumuskan dengan persamaan (5) sebagai berikut.

\[
k = \sum_{X \cap Y = Z} m_1(X)m_2(Y)
\] ............................. (5)

Sehingga bila persamaan (5) disubstitusikan ke persamaan (4) akan menjadi:
a system that will help health workers at the Tanjung Village Posyandu. Garbus Kampung in diagnosing diseases caused by malnutrition in toddlers quickly and accurately.

![Image of marasmic malnutrition]

Figure 1: Marasmic Malnutrition

3. RESULTS AND DISCUSSION

3.1 Data requirements

System Doping Recommendations, According to Inner model subsystem system supporter decision allow taker decision for analyze by whole with develop and compare solution alternative. Model integration in system information management conducted based on data integrity of field to in system supporter decision. Ability inner model subsystem system supporter decision among others (Yulyantari & Wijaya, 2018: 24):

1. Can make a new model with fast as well as easy
2. Can make catalog as well as manage models for support all user levels
3. Can connect model with database via harmonious relationship
4. Can manage the model base with function analogous management management database base

Data that has been Becomes vector will be measured closeness with vector results input title, abstract and keywords of student. On research this measurement proximity between vector calculated with use right MOORA method, is method used _ for measure similarity between vector. At stage previously has produce score vector from every study lecturer will represent vector A and value from every input student will represent vector B. Website system designed as interface for student, at the same time used as implementation system recommendation for choose lecturer mentor Duty end. System flow walk one direction started from student input title, abstract and keywords then system will to do calculation for produce lecturer suitable recommendation _ based on input from student. Website system built use structure the project directory has function separately, backend directory as base project later in directory working as apps that will handle requests and data processing from the frontend. Public directory is used for store assets such as images, icons, and html files, last but not least directory on directory this there are useful javascript files for handling required components _ in user interface creation. System recommendation with The MOORA method will depend heavily on the content of each item, the more many content in items then the better result _ from recommendation, but many the content on the MOORA method will also effect on time execution, the more big content so the more the system takes a lot of time for To do calculation. Following this is table determination recommendation lecturer mentor by using the steps solution problem with method MOORA as follows:

1. Insert Score Criteria from Alternative. Alternative value from each criterion can be seen from the following table where each criterion has a weighted value based on the data which has obtained. used in the implementation of a priori algorithm are outlined in the following pattern:
Table 1. Value Alternative for Every Criteria

<table>
<thead>
<tr>
<th>Code</th>
<th>Disease Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Kwashiorkor</td>
</tr>
<tr>
<td>P2</td>
<td>Marasmus</td>
</tr>
<tr>
<td>P3</td>
<td>Beri-beri</td>
</tr>
<tr>
<td>P4</td>
<td>Skorbut (Scurvy)</td>
</tr>
<tr>
<td>P5</td>
<td>Anemia</td>
</tr>
</tbody>
</table>

Table 2. Rules of Weight

<table>
<thead>
<tr>
<th>Code</th>
<th>Symptom name</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
<th>P5</th>
<th>Bobot</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>Fatigue</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.65</td>
</tr>
<tr>
<td>G2</td>
<td>Dry and Scaly Skin</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.7</td>
</tr>
<tr>
<td>G3</td>
<td>Dry or Dull Hair</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.6</td>
</tr>
<tr>
<td>G4</td>
<td>Distended stomach</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.7</td>
</tr>
<tr>
<td>G5</td>
<td>Hard to Increase Height and Weight</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>G6</td>
<td>Skinny Body and Protruding Bones</td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td>0.75</td>
</tr>
<tr>
<td>G7</td>
<td>Skin Looks Sagging and Face Looks Old</td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td>0.6</td>
</tr>
<tr>
<td>G8</td>
<td>Shortness of Breath and Increased Heart Rate</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.4</td>
</tr>
<tr>
<td>G9</td>
<td>Swollen Lower Legs</td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td>0.65</td>
</tr>
<tr>
<td>G10</td>
<td>Hard to Walk</td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td>0.4</td>
</tr>
<tr>
<td>G11</td>
<td>Feet and Hands Numb (Tingling)</td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td>0.45</td>
</tr>
<tr>
<td>G12</td>
<td>Muscle Or Joint Pain</td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td>0.65</td>
</tr>
<tr>
<td>G13</td>
<td>Loss of Appetite</td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td>0.7</td>
</tr>
<tr>
<td>G14</td>
<td>Red Spots On The Skin</td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td>0.7</td>
</tr>
<tr>
<td>G15</td>
<td>Radiation and Swelling of the Gums and Teeth</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.6</td>
</tr>
<tr>
<td>G16</td>
<td>Nausea and Fever</td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td>0.7</td>
</tr>
<tr>
<td>G17</td>
<td>Insomnia and Pale Skin</td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td>0.65</td>
</tr>
<tr>
<td>G18</td>
<td>Brittle Nails</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td>0.7</td>
</tr>
</tbody>
</table>

2 Matrix Decision

Based on from table on so could determined matrix decision like on the following matrix table:

There are 3 (three) symptoms selected, namely G1, G17, G18. Where G1 is a symptom of Kwashiorkor disease (P01) while G17 and G18 are symptoms of Anemia disease (P05). After that, a search for the percentage of possibilities from the existing diagnoses was carried out.

Symptom 1: G1
That is a symptom of malnutrition in toddlers with a diagnosis of P01 (Kwashiorkor)
Belief : \( m_1\{P01\} = 0.65 \)
Plausibility : \( m_1(\theta) = 1 - 0.65 = 0.35 \)
Symptom 2: G17
G17 is a symptom of malnutrition in toddlers with a diagnosis of P05 (Anemia), then:
Belief : \( m_2\{P05\} = 0.65 \)
Plausibility : \( m_2(\theta) = 1 - 0.65 = 0.35 \)
Then we get the combination rule \( m_1\{P01\} \) with \( m_2\{P05\} \)

3 Matrix Normalization

Step next is doing normalization matrix with count value X for each alternative.
Matrix performance normalized for criteria C1
\[
X = \sqrt{2^2 + 5^2 + 2^2 + 4^2 + 2^2 + 4^2 + 4^2 + 3^2 + 2^2} \\
= 12
\]
Soscore every alternative for criteria C1 is:
Matrix performance normalized for criteria C2
4. CONCLUSION

The based on after the tests The conclusion of this study is that the system that is built can help health workers at Posyandu Tanjung Garbus Kp in diagnosing Malnutrition in Toddlers quickly and accurately based on data on symptoms and diseases caused. Suggestions from research are that the system built should be developed with an Android-based system so that it is more flexible and efficient in its use facilitate academics in determining thesis supervisors. Data used in research. This was obtained from the Puskesmas. Object research in the form of data on poor nutritional status in children aged 0-10 years.

Reference


