

Expert System for Lymph Glands Detection Using Hybrid Method

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Abstract

Lymph nodes are a type of disease of the smallest tissue structure that spreads to all parts of the body where these parts have a role as forming immunity (immunity). These lymph glands become one of the fortresses of defense in the human body, where the body has approximately 600 lymph nodes but there are some parts that are only palpable normally in healthy people, one of which is the lower jaw, mandible and armpits Introduction. This research is designed to make it easier for users to carry out the consultation process with experts to determine the early condition of the lymph nodes. The system is designed to carry two methods, the forward chaining method to track every symptom experienced by the patient according to the conditions when consulting the system, then proceed to use the certainty factor method to determine the percentage of confidence the patient experiences the condition/symptom, this is done to provide an accuracy value to the results. obtained. This expert system provides early education to system users in the early management of lymph node disease. The initial discussion of the system trial found that the accuracy value of using the system for the user reached a value of 80%, the confidence value stated that the user was detected by lymph nodes.

Keywords: Lymph nodes, Expert System, Hybrid

1. Introduction

Health is a form of a person's physical well-being, optimal mental health of someone who will have a bad impact, and a person's habits in the social environment. It is also indicated by stating a person is free from things related to disease[1]. Illness is an abnormal condition experienced by an individual that negatively affects part or all of it [2]. It is the conditions must be known early and properly cared for. The supporting process to pay attention to conditions like this is with the help of a system in the form of an expert system, which involves directly experts who have expertise in a particular field [3]. One of the diseases mentioned is the lymph glands, a type of

disease of the smallest tissue structure that spreads to all parts of the body where these parts have a role in forming immunity [4]. These lymph glands become one of the defenses in the human body, where the body has approximately 600 lymph glands but there are some parts that are only palpable normally in healthy people, one of which is the lower jaw, mandible and armpits[5]. The system has many cells where one of its functions is to inhibit free radicals that will later cause various diseases [6]. The lymph node is one of the centers used for processing various information, detecting tissue and responding in a distributed manner. The large number of immune cells that will be produced by these lymph nodes causes the

glands to widen [7]. The difference in these conditions can be seen in Figure 1 [8].

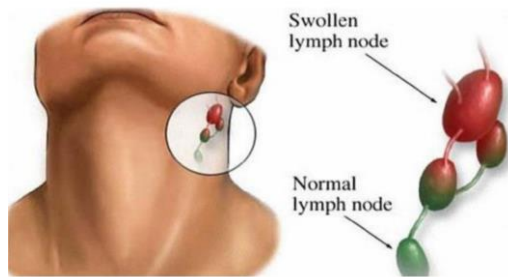


Figure 1. Lymph nodes

Early consultation about this disease is needed to treat it from the start and provide early therapy to patients as a form of prevention [9]. This is done by providing a system in the form of an expert system by involving experts in the field of internal medicine to provide direct knowledge in the form of providing facts, symptoms and types of diseases that will be raised by these lymph glands [10], [11]. It is become the reasons why this research is important is the lack of time needed by patients to discuss with experts directly and the amount of costs incurred in the consultation process. The expert system is built using the forward chaining method by tracing every symptom found when the patient consults using the system then to confirm the value of the accuracy of the knowledge obtained is measured by providing a certainty value through the certainty factor. The process of giving the value of certainty is carried out by carrying a value for each symptom given by the expert, the value will be calculated between the expert value and the user value so that the system provides a level of accuracy regarding the lymph node detection expert system more accurately and clearly according to the conditions required, experienced by the patient. The results of this study will provide education to users in understanding and knowing early on the condition of the lymph glands so that they can be treated quickly without waiting. The system provides initial information that can be used as the first reference for users when consulting with the expert at the next time.

2. The Method of Research

The research is realized based on several stages that are determined in the research, where these stages will explain the research scheme clearly to produce a conclusion or new knowledge as desired by the user. The framework is structured in such a way as to facilitate the research cycle so that it is as expected as shown in Figure 2.

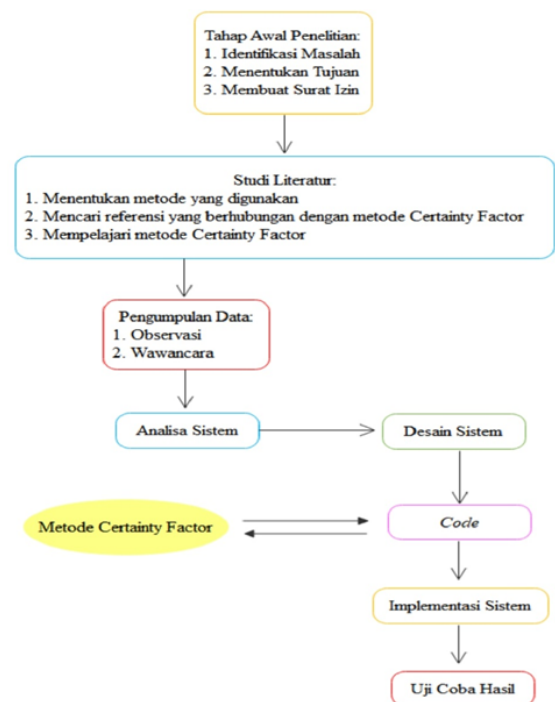


Figure 2. Research Framework

Figure 2 describes the stages of research before reaching conclusions, where the process is carried out by identifying matters related to the lymph nodes through several agendas such as communicating directly with experts so that information is obtained in the form of symptoms, types of lymph node disease to the process of determining the value of each [12]. Each of these symptoms have a process to be done carefully to avoid mistakes in determining the rules that lead to conclusions later.

The research was built by carrying forward the forward chaining method in the form of tracing each symptom in a structured manner in order to clearly know the patient's condition [13]. The method will start from finding facts based on the patient's condition where the facts are the result of consultations that have been obtained from experts [14], [15] Followed by using the premise which will be adjusted to the facts that are already known by using certain rules. The facts provided by the user are used to conduct tests using rules that end in a conclusion based on the facts. Starting from the left, namely (IF) which is a matching fact or statement, which is a fact (premise) of information where facts are input for the computer. Next, it will be directed to the conclusion (THEN) [16], [17].

The next process of each fact answered by the system user will be given a value in the form of a percentage which will later be calculated with the percentage of users and experts [18]. The process is carried out using the certainty factor method. The Certainty

Factor method shows a measure of certainty about the symptoms to determine the condition experienced by the patient [19]. The Certainty Factor provides a clinical indicator that is used as a reference by MYCIN whose function is to show the magnitude of the obtained certainty [19]. One of the advantages of this method is that it is able to provide a confidence value for a condition as a benchmark that is used as a comparison in making conclusions in the process of early detection of hemangiomas. The process is carried out with the following formula [20], [21]:

$$CF(H,E) = CF(E)*CF(rule) = CF(user)*CF(expert)$$

The formula states that CF (H,E) is a Certainty Factor (certainty factor) in the hypothesis h is influenced by evidence (symptoms). MB (H,E) represents a measure of confidence (confidence level) which is expressed as a measure of the confidence of hypothesis H influenced by evidence (symptoms) E. MD (H,E) is expressed as a measure of disbelief (level of uncertainty) which represents a measure of distrust of the hypothesis H is influenced by symptoms E. H is a hypothesis or conclusion generated (between 0 and 1) while E is stated as evidence or an event or fact (symptom) [22], [23].

3. Results and Discussion

That research uses data obtained from secondary sources such as general practitioners, midwives and then direct communication with experts engaged in internal medicine [24]. The data processed in this study amounted to 38 data from the symptoms presented and several types of diseases associated with these symptoms. As a knowledge base, experts also convey about solutions to some of these diseases. The expert also gave MB (Measure belief) and MD (Measure disbelief) values for each symptom as shown in table 1.

Table 1 Value Of Measure Belief And Measure Disbelief

No	MB and MD values	Information
1	0	There isn't any
2	0.2	Don't know
3	0.4	Little Sure
4	0.6	Sure enough
5	0.8	Certain
6	1	Very confident

The expert also explained about some of the symptoms that include several lymph node diseases as shown in table 2.

Table 2. Symptoms of Lymph Node Disease

No	Disease Code	Information
1	GP001	Body temperature over 38C
2	GP002	Swelling/lump in the neck area
3	GP003	Dizziness/Headache
4	GP004	Body shivers
5	GP005	Pain in the chest
6	GP006	Pain in the back
7	GP007	Pain in the bone
8	GP008	Pain in the abdomen
9	GP009	Fever accompanied by influenza / flu
10	GP010	Easily tired
11	GP011	There is a lump / swelling in the cheek area
12	GP012	A lump/swelling in the armpit
13	GP013	There is a lump / swelling in the leg area
14	GP014	There is a lump / swelling in the thigh area
15	GP015	Rashes in areas of the body where there are lumps or all over the body
16	GP016	Bleeding during defecation
17	GP017	Bleeding through the nose
18	GP018	Pale face
19	GP019	Have a history of congenital disease
20	GP020	Anemia
21	GP021	Experiencing drastic weight loss
22	GP022	Experiencing a reduction in appetite
23	GP023	Difficulty in breathing
24	GP024	Have indigestion
25	GP025	No pain is expressed in the lump / swelling
26	GP026	The lump/swelling feels more supple
27	GP027	Itchy throat
28	GP028	It's hard to get phlegm out
29	GP029	The lump is easy to move
30	GP030	Cough that doesn't stop (Prolonged)
31	GP031	Pain experienced in the lower back
32	GP032	Blocked urine flow
33	GP033	The lump that is owned bursts and oozes blood and pus
34	GP034	Vomit
35	GP035	Excessive sweating at night
36	GP036	Severe bleeding (Having a high number of periods or prolonged nosebleeds)
37	GP037	seizures
38	GP038	Neuropathy

These symptoms become a reference in reading the temporary condition of patients with lymph nodes. There are several types of lymph node disease that commonly occur, including those in table 2.

Table 3. Types of Lymph Node Disease

No	Disease Code	The type of disease
1	KP01	Mild Adenopathy
2	KP02	Acute Adenopathy
3	KP03	Lymph node tuberculosis
4	KP04	Non-Hodgkin Lymphoma (LMNH)
5	KP05	Hodgkin Lymphoma

We needed another table to become in the expert system using the forward chaining method and this certainty factor is the weight table of each of these symptoms which will later be processed by calculating each weight obtained from the provisions given by the expert with the standard weight submitted by the system user. The table of weights for each of these symptoms is shown in table 3.

Table 4. MB and MD Values from Experts

No	Code Disease	Information	Weight
1	GP001	Temperature body more from 38C	0.3
2	GP002	There is swelling / lump in the neck area	0.6
3	GP003	Dizziness / Pain Head	0.5
4	GP004	Body chills	0.4
5	GP005	Painful on chest _	0.6
6	GP006	Painful on back	0.6
7	GP007	Painful on part bone	0.7
8	GP008	Painful on part stomach	0.4
9	GP009	Fever Accompanied by influenza/flu	0.4
10	GP010	Easy feel tired	0.5
11	GP011	There is lump / swelling cheek diarrhoea	0.8
12	GP012	There is lump / swelling in area armpit	0.8
13	GP013	There is lump / swelling in area limbs	0.8
14	GP014	There is lump / swelling in area thigh	0.7
15	GP015	Rash in area existing body _ lump or all over body	0.8
16	GP016	Go out blood during	0.5
17	GP017	Go out blood through nose	0.2
18	GP018	Face pale	0.3
19	GP019	Own history disease default	0.6
20	GP020	Anemia	0.4
21	GP021	Experience decline heavy body drastic	0.5
22	GP022	Experience subtraction lust Eat	0.2
23	GP023	Difficulty moment breathe	0.5
24	GP024	Own disturbance digestion	0.4

No	Code Disease	Information	Weight
25	GP025	No stated painful on lump / swelling	0.5
26	GP026	Lumps / swelling feels more springy	0.4
27	GP027	Throat itchy	0.2
28	GP028	Hard times emit sputum	0.4
29	GP029	lump easy if moved	0.5
30	GP030	Non -existent cough stop (Extended)	0.4
31	GP031	Experienced pain _ on part back lower	0.6
32	GP032	Genre urine clogged	0.6
33	GP033	The lump you have broken And emit blood as well as pus	0.9
34	GP034	Vomit	0.3
35	GP035	Sweat excessive at night day	0.2
36	GP036	Bleeding severe (Experienced amount period at high volume or nosebleed prolonged)	0.5
37	GP037	seizures	0.5
38	GP038	Neuropathy	0.7

The trial of process was carried out on patient X with the age of 48 years whose condition at the time of consulting with the patient system complained of several conditions including difficulty breathing at night, itchy throat, the patient had a fever with a temperature of 39.3 C, decreased urination volume and had lumps. (swelling) around the thigh, this condition has been experienced for more or less 3 months. After tracing the various symptoms experienced by patient X, the system will direct the standard value to the symptoms experienced by the patient. The intended value standards are as follows:

Table 5. Standard User Value System

No	Code Disease	Information	Weight
1	GP001	Temperature body more from 38C	0.6
2	GP023	Difficulty breathe	0.5
3	GP027	Throat itchy	0.5
4	GP023	Blocked urine flow	0.4
5	GP014	There is a lump / swelling in area thigh	0.8

Based on the value given by the user of the system, a search is carried out using the certainty factor method in the form of multiplying each symptom weight given by the expert with the symptoms submitted by the user to find the accuracy value of trust regarding lymph node disease experienced by the patient. The process is carried out using the following equation:

$$CF[H,E]1 = CF[H]1 * CF[E]1$$

$$= 0.3 * 0.6$$

$$= 0.18$$

$$CF[H,E]2 = CF[H]2 * CF[E]2$$

$$\begin{aligned}
 &= 0.5 * 0.5 \\
 &= 0.25 \\
 CF[H,E]3 &= CF[H]3 * CF[E]3 \\
 &= 0.2 * 0.5 \\
 &= 0.10 \\
 CF[H,E]4 &= CF[H]4 * CF[E]4 \\
 &= 0.5 * 0.4 \\
 &= 0.2 \\
 CF[H,E]5 &= CF[H]5 * CF[E]5 \\
 &= 0.7 * 0.8 \\
 &= 0.56
 \end{aligned}$$

Then the combination process is carried out based on each symptom experienced by system users. Like the following formula:

$$\begin{aligned}
 CF_{combine} \quad CF(H,E)_{1,2} &= CF[H,E]1 + \\
 &CF[H,E]2 * (1-CF[H,E]1) \\
 &= 0.18 * 0.205 \\
 &= 0.385
 \end{aligned}$$

$$\begin{aligned}
 CF_{combine} \quad CF(H,E)_{old,3} &= CF[H,E]old + \\
 &CF[H,E]3 * (1-CF[H,E]old) \\
 &= 0.385 * 0.06 \\
 &= 0.445
 \end{aligned}$$

$$\begin{aligned}
 CF_{combine} \quad CF(H,E)_{old,4} &= CF[H,E]old + \\
 &CF[H,E]4 * (1-CF[H,E]old) \\
 &= 0.445 * 0.11 \\
 &= 0.56
 \end{aligned}$$

$$\begin{aligned}
 CF_{combine} \quad CF(H,E)_{old,5} &= CF[H,E]old + \\
 &CF[H,E]5 * (1-CF[H,E]old) \\
 &= 0.56 * 0.24 \\
 &= 0.8
 \end{aligned}$$

The process provides a measurement value of patient X which is stated to be 80% experiencing lymph node disease with the type of Non-Hodgkin's Lymphoma with a confidence value of Confident. It is necessary to do further consultation with experts in order to get the desired action where for this condition generally the expert will give the first action in the form of Biopsy, Radiotherapy, Chemotherapy and combination therapy.

The procedure in the expert system is carried out first with the patient being directed to the initial display of the system with various information that can be found by the patient including activities for consultation, information about lymph nodes and brief knowledge of the expert system and the use of the system as shown in Figure 2.



Figure 2. Overview of the system's main display

The process that the user will be directed to the consultation activity, where here the user is asked to provide a Yes or No statement to the condition experienced, which is the first step to trace the condition of the patient who will be consulted.



Figure 3. Tracing system with forward chaining

The process in Figure 3 symbolizes how forward chaining works which traces each symptom experienced by the patient sequentially, then proceeds to provide a value statement in the form of a percentage of each symptom experienced by the patient as shown in Figure 4.



Figure 4. Confidence percentage value

Each patient knows his body's health condition by providing a confidence value that the patient feels the condition asked by the system, a process like this is called a certainty factor by involving several weights and questions. All the conditions experienced by patient X earlier will be calculated with the established formula so that it will provide new knowledge or conclusions as shown in Figure 5.

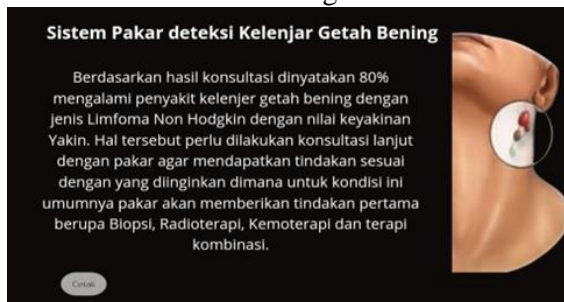


Figure 5. Conclusion

The conclusion has explain that patient X has lymph nodes with the type of non-Hodgkin's lymphoma with a confidence value of Confident, where the accuracy of the system states that patient X has 80% of lymph node disease with the conditions mentioned above. The expert system designed is able to provide a clear picture of the patient's condition, so that the patient has sufficient time to get therapy or further action with an expert.

4. Conclusion

The process of processing facts and symptoms that exist in the system is able to lead to several things that can be concluded including:

1. The resulting system is able to provide early knowledge about lymph nodes
2. The system provides accurate information with a high accuracy value so that it can be used as a starting material for further consultations with experts
3. The expert system for early detection of lymph nodes is able to help people who find it difficult to find experts to find out the conditions experienced by patients. The system is offered using the forward chaining method and this certainty factor is able to provide clarity to the patient about the initial conditions experienced with a confidence value in the form of a percentage. One of the test data here when using the system is able to provide a value of 80% with a level of confidence Convinced that the patient has a lymph node condition.

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