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Expert System For Early Detection Of Breast Cancer With The Forward Chaining Method

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ABSTRACT

Breast cancer will be easier to overcome if it is known as early as possible to the importance of self-awareness to perform a routine inspection of BSE. The study presented aims to design a web-based application in the health field in the early detection of breast cancer. Penelian expert system method on this is to use forward chaining to represents the rule and reasoning into a coherent system based on physical symptoms entered. In this system also gets a percentage probability of 72.7%, so it can be quite good. In addition the system can produce two outputs in the form of possibility, the output is both benign and malignant.

1. Introduction

Breast cancer is a malignant tumor that forms in the breast tissue. Malignant tumors are cancer cells growing collection quickly into the surrounding tissue or spread to more distant parts of the body. The disease is almost found in every woman, but men can also be affected by this disease. This type of cancer most common in women in addition to the possibility of 1 in 8 women in the world suffer from this disease [1]. Treatment of breast cancer it takes a long time and requires patience and discipline to take medicine from the doctor's recommendation to reduce the side effects and drug administration should be based on prescription to ensure that the drug in accordance with the respective stages of breast cancer. Therefore,early detection of this cancer is very important for further medical treatment. However, of all the most important is the readiness of the costs necessary to carry out the treatment and healing. In some cases such as top-level stages require other medical procedures such as surgery, kemotrapi, or radiology for it is important to know as early as possible so that breast cancer can be handled well and recovered as usual [2].

Because of the above it is necessary to have an expert system with the help of computerized technology that is able to adopt the expert or specialist capabilities such as artifical intelligence. While the expert system will display a person's chances of breast cancer by physical symptoms that he was fed. By utilizing the Internet, enables patients in the early detection of breast cancer anywhere and anytime regardless of time, distance, and costs.

2. Theory

2.1. Breast cancer

Breast cancer is a malignancy of cancer cells in breast tissue derived from epithelial duct or lobule. Breast cancer can be interpreted also as one of the most common types of cancer Indonesian society. Based Pathological Registration Based in Indonesia, KPD main ranks with the relative frequency of 18.6%. Cancer Data in Indonesia in 2010, according to data Histopathology, Cancer Registration Agency Pathology Specialist Doctors Association of Indonesia (Certified) and the Indonesian Cancer Foundation (ICF). It is estimated that the number of events in Indonesia is 12 / 100,000 women, whereas in the US is about 92 / 100,000 women with higher mortality rates at 27 / 100,000 or 18% of total deaths throughout the woman there. This disease can also be inflicted on men - men with a frequency of approximately 1% in Indonesia, more than 80% of cases are found at an advanced stage or level such that it is difficult to cure. Therefore it is necessary to an understanding of the prevention, early diagnosis, curative and palliative treatment and good rehabilitation efforts that services the patient can be optimally [3].

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2.2. Expert System

Definition of expert systems are often associated with the notion of artificial intelligence today. Although there are significant differences, but the ability of both programs to provide action or response to a problem more intelligently and humanely make them worth juxtaposed.

One expert said the expert system "a collection of systems that make up the software, or software in computers designed for use facts, engineering, and science in decision-making on issues that normally can only be resolved by an expert or experts in the field" of such understanding could be taken conclusion that yng software expert system is designed to solve complex problems that can only be done to experts in the field energy [4].

2.3. Forward Chaining

Forward Chaining is a method of finding or conclusion based on the data or facts to make a conclusion as to the output of a system.

3. Research methods

In designing this system used flowchart diagrams and use cases to simplify the reasoning process of the system, so it can be expressed as the flow of the program.

3.1. Flowchart and Use Case Diagram.

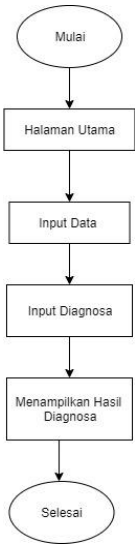

Fig 1. Flowchart manual method forward Chaining

In the picture above is a flowchart diagram with forward chaining method describes how a user (user) make the diagnosis, the diagnosis of disease begins when users answer questions about symptoms, the system will process so that a diagnosis.

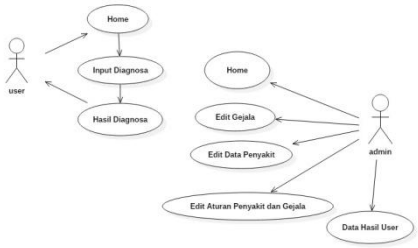

Fig 2, Use Case manual methodforward Chaining

In the picture above use case describes the first users will be exposed to the home page and then view the first input of the symptoms, it will hereinafter be aiming at the results page, while admins can edit the data of the disease, symptoms, rule, and the user can view the diagnostic results.

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3.2. Decision trees

In this study, researchers used a decision tree to determine a diagnosis based on symptoms rutut or sequentially.

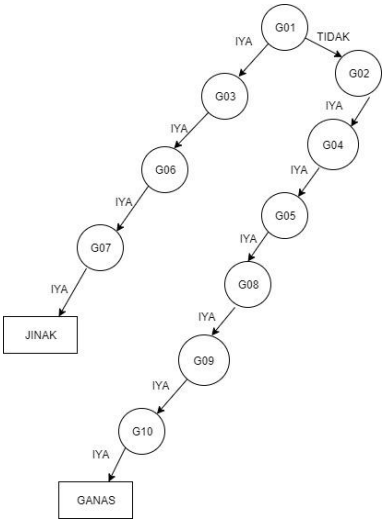

Fig 3, Decision trees

3.3. System planning

In the design of this system required a valid facts from specialists or experts in their field and made into tables symptoms.

Table 1.
Physical Symptoms of Breast Cancer

KD	Physical symptoms	Disease
G01	Changes in the shape / size of the breast, such as breast Asymmetrical	Benign
G02	Putting suddenly very red swollen	Malignant
G03	Appears lump in the armpit	Benign
G04	Pain / back pain sustained	Malignant
G05	Extreme weight loss up to 5kg more	Malignant
G06	Lump in the breast when touched vague and painful smar	Benign
G07	Putting issued a colorless liquid	Benign
G08	Breast size is shrinking as wrinkle	Malignant
G09	Breast red, swollen, and warm to the touch	Malignant
G10	Changes in the shape of the nipple was sunken into	Malignant

In table 1 above can be seen each symptom and disease specifications.

Table 2
Disease

KD	Disease
P01	Benign
P02	Malignant

In the two tables contained code to integrate with the disease until the symptoms table into a table 3 table rules.

Table 3
rule

NO	SYMPTOMS	P1	P2
1	G01	1	-
2	G02	-	1
3	G03	1	-
4	G04	-	1
5	G05	-	1
6	G06	1	-
7	G07	1	-
8	G08	-	1
9	G09	-	1
10	G10	-	1

In Table 3 above numeral 1 means have a relationship and a blank column means it has no relation to the symptoms.

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3.4. inference Engine

Inference engine is based on a knowledge base or an existing rule to rejuvenate reasoning in advanced stages (forward chaining).

a. IF G1 (yes) AND G3 (yes) AND G6 (yes) AND G7 (yes) THEN BENIGN
b. IF G1 (yes) AND G3 (yes) AND G6 (yes) AND G7 (not) THEN FINE
c. IF G1 (yes) AND G3 (yes) AND G6 (not) THEN FINE
d. IF G1 (yes) AND G3 (not) THEN FINE
e. IF G1 (not) AND G2 (yes) AND G4 (yes) AND G5 (yes) AND G8 (ya) AND G9 (yes) AND G10 (yes) THEN CRUEL
f. IF G1 (not) AND G2 (yes) AND G4 (yes) AND G5 (yes) AND G8 (ya) AND G9 (yes) AND G10 (not) THEN FINE
g. IF G1 (not) AND G2 (yes) AND G4 (yes) AND G5 (yes) AND G8 (ya) AND G9 (not) THEN FINE
h. IF G1 (not) AND G2 (yes) AND G4 (yes) AND G5 (yes) AND G8 (not) THEN FINE
i. IF G1 (not) AND G2 (yes) AND G4 (yes) AND G5 (not) THEN FINE
j. IF G1 (not) AND G2 (yes) AND G4 (not) THEN FINE
k. IF G1 (not) AND G2 (not) THEN FINE

4. Results and Discussion

4.1. interface Applications

Fig 4. Home User

Pictured above is the starting point for the user application, contains the basic knowledge of breast cancer.

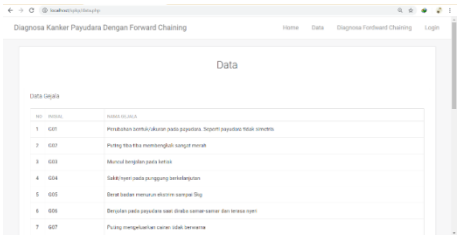

Fig 5. Data User Disease

In the above picture the user can see and know the rules of the system by looking at the specifications of the symptoms and the disease.

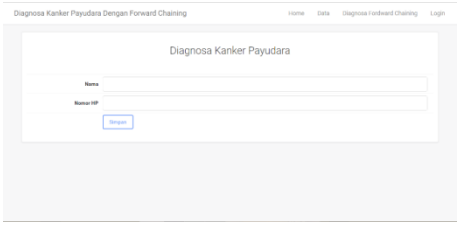

Fig 6. Personal Data User

Before diagnosing user will fill in personal data such as names and phone numbers.

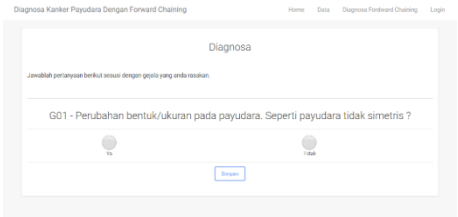

Fig 7. Diagnosis User

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Then the diagnosis pages the user must answer questions about symptoms experienced by atapu not.

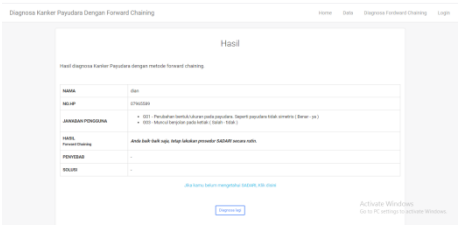

Fig 8. Results of Diagnosis User

After the user answers the question "yes" or "no" on the system, the diagnostic results will be displayed as shown above, the result there is a link about "what it is realized" to allow users to search for tau.

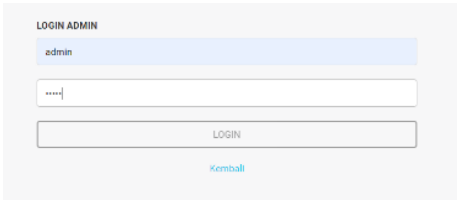

Fig 9. Login Admin

As the picture above are logged admin, admin can add, delete, or modify the symptoms and diseases, as well as rules on the system.

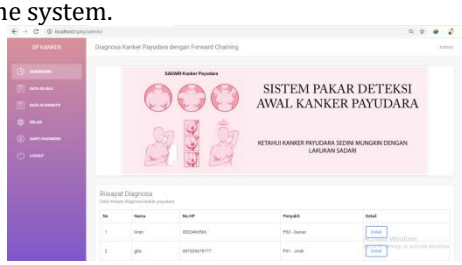

Fig 10. Home Admin

In the picture above we can see the data of patients affected by the disease, the picture teletak on the dashboard.

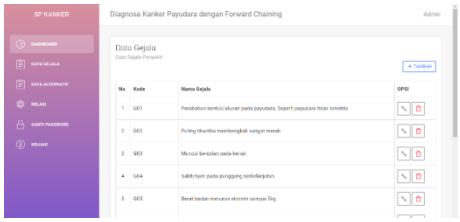

Fig 11. Symptoms Admin

In the picture above explains that the admin can change, add, or remove the symptoms.

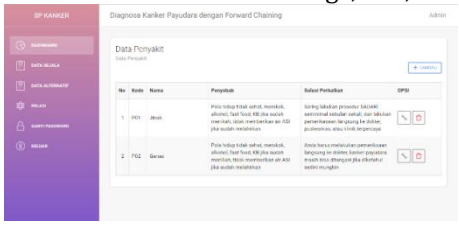

Fig 12. Data Admin Disease

In this disease the data page admin can add, delete, and add data illness.

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Fig 13. Rule Admin

In this section menjelakan that admin can edit the rule corresponding crimped facts that exist.

4.2. Testing Applications

Testing applications is done by experts or doctors involved in the process of making this application in order to collect the facts are there. In the present study testing is done in two ways based on the symptoms and inference engine.

a. accuracy Symptoms

Testing with symptom data accuracy is made to ensure the correctness of data on the system level and the expert, so we need a comparison of data accuracy symptoms.

Table 4

Sample Testing

NO	SYMPTOMS	DISEASE	ACCURACY	
			SYSTEM	DOCTOR
1	Changes in the shape / size of the breast, such as breast Asymmetrical	BENIGN	1	1
2	Appears lump in the armpit	BENIGN	1	1
3	Lump in the breast when touched vague and painful smar	BENIGN	1	1
4	Putting issued a colorless liquid	BENIGN	1	1
5	Putting suddenly very red swollen	MALIGNANT	1	1
6	Pain / back pain sustained	MALIGNANT	1	1
7	Extreme weight loss up to 5kg more	MALIGNANT	1	1
8	Breast size is shrinking as wrinkle	MALIGNANT	1	1
9	Breast red, swollen, and warm to the touch	MALIGNANT	1	1
10	Changes in the shape of the nipple was sunken into	MALIGNANT	1	0
TOTAL DIAGNOSIS			10	9
DIFFERENCE			1	

Based on testing by experts found the value of a match and not skewer with physical symptoms and expert systems, the probability value is as follows.

A probability value system accuracy;

$$\frac{9}{10} X\ 100\% = 90\%$$

Inaccuracies probability value system:

$$\frac{1}{10} X\ 100\% = 10\%$$

Physical symptoms of a probability value above we can conclude that the value of the accuracy of the system's physical symptoms by 90%.

b. Inference accuracy Egine

On the accuracy of this inference engine needs to be done to determine the level of accuracy of the system with the value of an expert.

Table 5.

Data analysis Inference Engine

No.	Inference Engine	System	Specialists	Analysis
1	IF G1 (yes) AND G3 (yes) AND G6 (yes) AND G7 (yes)	Benign	Benign	Corresponding
2	IF G1 (yes) AND G3 (yes) AND G6 (yes) AND G7 (not)	Alright	Benign	It is not in accordance with
3	IF G1 (yes) AND G3 (yes) AND G6 (not)	Alright	Alright	Corresponding
4	IF G1 (yes) AND G3 (not)	Alright	Alright	Corresponding
5	IF G1 (not) AND G2 (yes) AND G4 (yes)	Malignant	Malignant	Corresponding

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No.	Inference Engine	System	Specialists	Analysis
	AND G5 (yes) AND G8 (ya) AND G9 (yes) AND G10 (yes)			
6	IF G1 (not) AND G2 (yes) AND G4 (yes) AND G5 (yes) AND G8 (ya) AND G9 (yes) AND G10 (not)	Alright	Possible Life-Threatening	It is not in accordance with
7	IF G1 (not) AND G2 (yes) AND G4 (yes) AND G5 (yes) AND G8 (ya) AND G9 (not)	Alright	Possible Life-Threatening	It is not in accordance with
8	IF G1 (not) AND G2 (yes) AND G4 (yes) AND G5 (yes) AND G8 (not)	Alright	Alright	Corresponding
9	IF G1 (not) AND G2 (yes) AND G4 (yes) AND G5 (not)	Alright	Alright	Corresponding
10	IF G1 (not) AND G2 (yes) AND G4 (not)	Alright	Alright	Corresponding
11	IF G1 (not) AND G2 (not)	Alright	Alright	Corresponding

From Table 5 above we can calculate the total system accuracy and inaccuracy of systems based inference engine.

Accuracy:

Formula = Total Inference Engine - Analysis Does Not Match

Total = 11-3 = 8

The percentage of accuracy = $\frac{8}{11}\ x\ 100\% = 72{,}7\ \%$

Inaccuracy:

Formula = Total Inference Engine - Match Analysis

Total = 11-8 = 3

Percentage inaccuracies = $\frac{3}{11}\ x\ 100\% = 27{,}3\ \%$

Based on the accuracy of the system with the inference engine can be concluded that the system has an accuracy rate of 72.7% and 27.3% inaccuracy. From both these tests the researchers used the test results to the inference engine for the feasibility of the system, so the system can still be quite good.

5. Conclusion

It can be concluded from this study, there are several important points, namely;

a. This expert system accuracy value of 72.7% with the inaccuracies of 27.3%. so that this expert system can be quite good. Values are based on the value of diagnosis experts are or not the test is done by matching the value of symptoms and diagnosis expert.
b. Application of this web-based expert system can facilitate the patients and prospective patients to perform a physical examination by the symptoms he was experiencing.
c. Doctors and specialists with access to an admin can view patient data indicated on the admin page, making it easier for subsequent patient management.

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