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Expert System for Diagnosing Cataract Using Forward Chaining Method

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Abstract

Current technological developments have undergone many very rapid changes, along with human needs that are increasingly numerous and complex . Computers that were originally only used by academics, are now widely used in various fields, such as business, health, education, games and so on. This encourages experts to further develop computer technology so that it can help human work or even exceed human work capabilities. An expert system is a system that seeks to adopt human knowledge into computers that are designed to represent the ability to solve problems like an expert. With this expert system, ordinary people can solve their problems or just look for quality information that can only be obtained with the help of experts in their fields. This research will be carried out using the *forward chaining method* , the Forward Chaining method is one of the two methods that are often used in making expert systems. By using the *Forward Chaining method* . obtained a value of similarity with previous cases of disorders experienced by cataract patients. This Expert System program is implemented in the PHP programming language with a Web-based MySQL database. As the final result, the conclusion is that this system is easy to use (user-friendly) and easy to develop and useful for those who want to know about cataracts.

Keywords: Expert System, *Forward Chaining*, Cataract Disease, Expert.

1. Introduction

Current technological developments have undergone many very rapid changes, in line with the increasing number and complexity of human needs. Computers that were originally only used by academics, are now widely used in various fields, such as business, health, education, games and so on. This encourages experts to further develop computer technology so that it can help human work or even exceed human work capabilities. This information is the result of data processing so that it becomes an important form of message for the recipient and is used as a basis for making decisions that can be felt as a result, directly or indirectly.

This system is designed to model the ability to solve problems or can only be obtained with the help of experts in their fields . Application of expert systems in the health or medical field. To provide solutions to diseases that require the expertise of a specialist in that field [1]. (Budiman Permana Putra, et al, 2021). With the title "Expert System in Diagnosing Eye Diseases Using the Forward Chaining Method" explains that Forward chaining is also called a reasoning that starts from the bottom up because reasoning is based on facts at the lower level leading to conclusions at the upper level based on fact tracing techniques that begin with facts that are already known, after that match the facts with the IF from the IF-THEN rules, if there are facts that match the IF, then the rule is executed. When a rule is executed, a new fact (THEN) is entered into the database [2].

An expert system is a computer system based on integrated knowledge into an existing basic information system, so that it has the ability to solve a problem in a certain field intelligently and effectively [3]. This system is designed to model the ability to solve problems or can only be obtained with the help of experts in their field [4]. Application of expert systems in the health or medical field. To provide solutions to diseases that require the expertise of a specialist in that field [5]. Expert systems are a field of study in Artificial Intelligence that have existed for several decades [6].

Forward chaining is one of two methods that are often used in making expert systems. Forward chaining is tracking that starts with information from an expert and combines it into a rule to reach a conclusion or goal. This forward tracking is perfect for dealing with problems that started with an initial capture of information and want to move on to a final solution. This is all done as the whole process goes forward sequentially. A good expert system really depends on the quality of the knowledge of experts that can be implemented into their knowledge [7].

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Previous research is the Diagnostic Expert System for Softlens Using the Forward Chaining Method. Softlens or contact lens is a tool that can help vision function. The purpose of this study is to simplify the consultation process so as to minimize the risk of eye problems that may occur. The data entered is data or information that is implemented in the development of this expert system, namely disease data and symptom data. The results of the study, namely from testing the system that had been carried out with sample data of 10 patients, were compared with the results of expert diagnoses to obtain a system accuracy value of 80% [8].

The next journal is entitled Web-Based Expert System Using the Forward Chaining Method for Early Diagnosing Tuberculosis in East Java. In this study it has a simple interface display, then table data does not explain the types of diseases and symptoms specifically and only uses disease codes and symptom codes. The results of the research are based on testing the system accuracy of 93.33 % of 15 test data [9]

The next journal is entitled Expert System for Web-Based Bone Disease Diagnosis Using the Forward Chaining Method. The results of this study are that this expert system application has a good category in terms of appearance, convenience, and system performance so that this expert system application can be used by the general public easily [10]. The next journal is entitled Application of an Expert System for Early Diagnosis of Gastric Disease Using the Forward Chaining Method. The results of this study are able to provide results in the form of a diagnosis and how to treat stomach disease quickly and precisely [11]

The application of the Forward Chaining method to diagnose eye disease by understanding how the Forward Chaining Expert System works, which mimics the human way of solving a more specific problem with precise and fast steps, therefore a study was conducted entitled Expert System in Diagnosing Cataracts Using the Forward Method . Chaining.

2. Research methodology

The research framework is the sequence of activities to be carried out in a study. The sequence of steps to be made in this study can be seen in Figure 1 below :

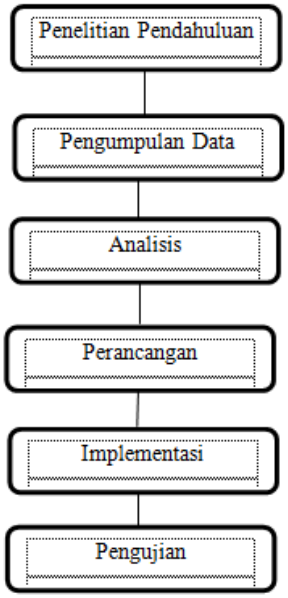


Figure 1. Research Framework

This research phase describes the steps in recording data and collecting several reports needed to be used as guidelines in making this research, as follows:

2.1 Preliminary Research

This preliminary research is the first step in conducting a research. Preliminary research was carried out by reading books, journals, articles related to the disease and conducting interviews with a doctor who is an expert in his field. Preliminary research also browsed the internet and found out what kind of expert system application to make to make it easier for people to determine cataracts.

2.2 Data collection

In carrying out this research, data collection was carried out by collecting data from journals, articles, books and the author conducted direct interviews with Dr. Harmen. SpM who is an ophthalmologist at the hospital. Eyes – Regina Eye Center, Padang City. The author gets some important information related to the research being carried out.

2.3 Analysis

The analysis stage is the most important stage in designing a system, because it is at this stage that performance evaluation, identification of existing problems, system design and the steps needed for the desired design are carried out to the expected analysis stage.

2.4 System planning

At the expert system design stage with the web-based Forward Chaining method as the output of the system to be run.

2.5 System Implementation

System implementation is the stage of laying the system so that it is ready to operate. Implementation aims to confirm the design capital, so that users can provide input to the development of dental disease applications. At this stage the design of this application is done using the programming language PHP (Hypertext Preprocessor) and MySQL database.

2.6 Testing

From the process of implementing the application, it can be implemented, after it can run, then testing the program that has been produced and carrying out repairs or development of the program if there are errors and deficiencies in the program.

3. Results and Discussion

3.1 Forward Chaining

Calculation steps in the *forward chaining method* To build a dental expert system for diagnosis are as follows:

1. Determine the type of disease data

The knowledge base contains data on cataracts. After collecting data with experts, information on some disease data was obtained. The following is cataract eye disease data in table 1:

Table 1. Disease Data

No	Disease code	Disease Name
1	P001	Secondary Cataract
2	P002	Senile Cataract
3	P003	Complicated Cataract
8	P004	Traumatic Cataract

From the table above it can be seen that there are 4 cataract data with codes ranging from P001 to P08.

2. Determine symptom data

The following is knowledge base data about the symptoms of the disease cataracts are listed in table 2

Table 2. Symptom Data

No	Symptom	Symptom Name
1	G001	Blurred vision
2	G002	Sensitive to light
3	G003	Poor visual acuity
4	G004	Color vision is faded or unclear
5	G005	Double vision (distortion)
6	G006	Hard to see at night
7	G007	The size of the eyeglass lens changes frequently
8	G008	Got diabetes
9	G009	Smoky View
10	G010	Pain in the eyes
11	G011	See halos around lights
12	G012	Infection
13	G013	Long term use of steroids

Symptoms of cataract disease obtained as many as 13 symptoms with each symptom given a code from G001 to G013 as in the table above.

3. Disease Relationship Data with Disease Symptoms

From the data on the type of disease and the symptoms of the disease, a relationship can be made according to the data obtained in the field. The relationship between disease and symptoms will be explained in Table 3.

Table 3 . *Certainty Factor* Condition Value

Disease Code	Disease Name	Symptom Code	Symptom Name
P001	Secondary Cataract	G001	Blurred vision
		G002	Sensitive to light
		G003	Poor visual acuity
		G004	Color vision is faded or unclear
		G005	Double vision (*distortion*)
		G010	Pain in the eyes
P002	Senile Cataract	G001	Blurred vision
		G005	Double vision (*distortion*)
		G006	Hard to see at night
		G007	The size of the eyeglass lens changes frequently
		G011	Seeing halos/halos around lights
P003	Complicated Cataract	G008	Got diabetes
		G012	Infection
		G013	Long term use of steroids
P004	Traumatic Cataract	G001	Blurred vision
		G002	Sensitive to light
		G004	Color vision is faded or unclear
		G005	Double vision (*distortion*)
		G006	Hard to see at night
		G009	Smoky view

4. Inference Engine (*Inference Engine)*

The next step after knowing the knowledge base is then carried out inference engine analysis. The inference engine or technique used in this expert system is to use the forward chaining method with conditional-action rules. Where in drawing conclusions it starts with the IF condition then THEN to get the conclusion of the disease suffered. Basically, the rule consists of two main parts, namely the premise or condition and the conclusion or conclusion. The rule structure logically connects one or more conditions (premises) in the IF section with one or more conclusions contained in the THEN section.

The inference engine will graphically describe the knowledge base and rules in the expert system being built. The inference method used in problem tracking in expert systems to diagnose cataracts is the forward chaining method. The forward chaining method is a search strategy that starts the search process from a set

of data or facts, from these data a conclusion is sought that becomes a solution to the problem at hand. In finding a solution, it requires completion at each stage, before one stage is completed you cannot advance to the next stage because this can affect the achievement of solutions. The important variables in cataract eyes are health and age factors. Variables that affect symptoms so that a cataract is diagnosed. The structure of an inference tree or decision tree can be seen in Figure 2:

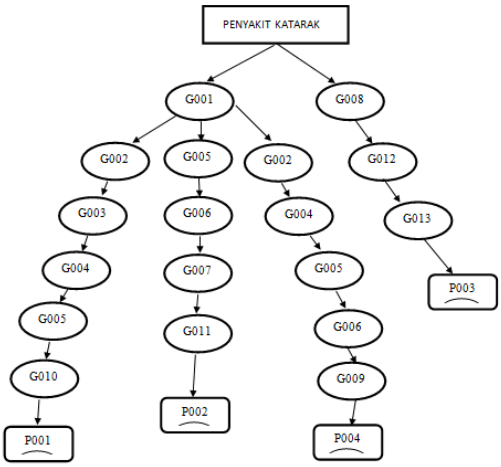


Figure 2 Decision Tree

Description :

1. Disease name

P001	Secondary Cataract
P002	Senile Cataract
P003	Complicated cataract
P004	Traumatic Cataract

2. Symptom name

G001 Blurred vision
G002 Sensitive to light
G003 Poor visual acuity
G004 Color vision is faded or unclear
G005 Double vision (*distortion*)
G006 It's hard to see at night
G007 The size of eyeglass lenses changes frequently
G008 Have diabetes
G009 Smoky View
G010 Pain in the eye
G011 Seeing halos around lights
G012 Infection
G013 Long term use of steroids

5. Rules Rules

Making rules or *rules* is used to determine the process of finding or concluding disease based on the input symptoms. Based on the decision tree image above, it can be concluded that there are several rules or *rules.* Here are the rules:

1. Secondary Cataract

Rule 1
IF Blurred vision (G001)
AND Sensitive to light(G002)
AND Decreased visual acuity (G003)
AND Faded or unclear color vision (G004)
AND Double vision (*distortion*)(G005)
AND Pain in the eye (G010)
THEN Secondary Cataract (P001)

2. Senile Cataract

rule 2
IF Blurred vision (G001)
AND Double vision (*distortion*) (G005)
AND Hard to see at night (G006)
AND The size of eyeglass lenses often changes (G007)
AND Seeing halos/halos around lights (G011)
THEN Senile Cataract (P002)

3. Complicated Cataract

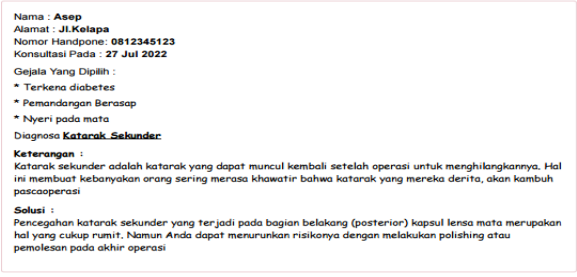
Rule 3
IF Have diabetes (G008)
AND Infection (G012)
AND Long term use of steroids (G013)
THEN Complicated Cataract (P003)

4. Traumatic Cataract

Rule 4
IF Blurred vision (G001)
AND Sensitive to light (G002)
AND Faded or unclear color vision (G004)
AND Double vision (*distortion*) (G005)
AND Hard to see at night (G006)
AND Smoky landscape (G009)
THEN Traumatic Cataract (P004)

3.2 Testing System Interfaces

System testing aims to see and evaluate whether the designed and built system is in accordance with what is desired or not, and whether the designed system experiences bugs or damage in its implementation. Testing the performance of expert systems directly can be seen in Figure 3 below:


Nama : **Asep**
Alamat : **Jl.Kelapa**
Nomor Handpone: **0812345123**
Konsultasi Pada : **27 Jul 2022**

Gejala Yang Dipilih :

* Terkena diabetes
* Pemandangan Berasap
* Nyeri pada mata

Diagnosa **Katarak Sekunder**

Keterangan :
Katarak sekunder adalah katarak yang dapat muncul kembali setelah operasi untuk menghilangkannya. Hal ini membuat kebanyakan orang sering merasa khawatir bahwa katarak yang mereka derita, akan kambuh pascaoperasi

Solusi :
Pencegahan katarak sekunder yang terjadi pada bagian belakang (posterior) kapsul lensa mata merupakan hal yang cukup rumit. Namun Anda dapat menurunkan risikonya dengan melakukan polishing atau pemolesan pada akhir operasi

Figure 3 Consultation Results Page

4. Conclusion

By designing an expert system for diagnosing cataracts using the forward chaining method, it can help diagnose cataracts. This expert system is also expected to be able to recognize the symptoms that are owned and know how to treat cataracts in the community. By collecting existing symptoms first, they are processed into output in the form of information needed by the user. With this system, it is hoped that it will make it easy for system users to find solutions and treatments for cataracts suffered by the community.

References

[1] Putra, BP, & Yunus, Y. (2021). Expert System in Diagnosing Eye Diseases Using the Forward Chaining Method. Journal of Information and Technology, 128-133. https://doi.org/10.37034/jidt.v3i3.122

[2] Suminten., & Rani. (2018). Laptop Damage Diagnostic Expert System Using Forward Chaining Method. RESTI JOURNAL. 2(3). 604-610. http://doi.org/10.29207/resti.v2i3.468

[3] Sari, M., Deficit, S. & Nurcahyo, GW (2020). Disease Detection Expert System in Children Using Forward Chaining Method. Journal of Information Systems and Technology. 2(4). 130-135.DOI: https://doi.org/10.37034/jsisfotek.v2i4.114

[4] Wisky, IA, & Akhiyar, D. (2019). Web-Based Expert System for Diagnosing Bone Diseases Using the Forward Chaining Method. Journal of Science and Technology. 19(1).DOI: http://dx.doi.org/10.36275/stsp.v19i1.126 .

[5] Nugroho, FA (2018). Design of an Expert System for Diagnosing Heart Disease with the Forward Chaining Method. Journal of Informatics, University of Pamulang. 3(2).DOI: http://dx.doi.org/10.32493/informatika.v3i2.1431 .

[6] Wagner, WP (2017). Trends in expert system development: A longitudinal content analysis of over thirty years of expert system case studies. Expert systems with applications, 76, 85-96. https://doi.org/10.1016/j.eswa.2017.01.028

[7] Amperawansyah, R., & Putri, DP (2022). Selection of Smartphone Type According to Needs Using Forward Chaining and Decicion Tree Methods. INOVTEK Polbeng-Informatics Series, 7(1), 156-168. https://doi.org/10.35314/isi.v7i1.2402

[8] Ramadhani, TF, Fitri, I., & Handayani, ETE (2020). Web-Based ISPA Disease Diagnostic Expert System with Forward Chaining Method. JOINTECS. 5(2),81-90.DOI: https://doi.org/10.31328/jointecs.v5i2.1243 .

[9] Supartini, W., & Hindarto, H. (2016). Web-Based Expert System Using Forward Chaining Method for Early Diagnosing Tuberculosis in East Java. Kinetic: Game Technology, Information Systems, Computer Networks, Computing, Electronics, and Control, 147-154. https://doi.org/10.22219/kinetik.v1i3.123

[10] Wisky, IA, & Akhiyar, D. (2019). Web-Based Expert System for Diagnosing Bone Diseases Using the Forward Chaining Method. J. Science and Technology. J. Science and Applications. Technol. Ind, 19(1), 46. https://doi.org/10.36275/stsp.v19i1.126

[11] Samsudin, S., & Indriani, R. (2018). Application of Expert System for Early Diagnosis of Gastric Disease Using Forward Chaining Method. Systemation: Journal of Information Systems, 7(1), 30-37.