

# unplug Knowledge based information system for detecting early eye diseases

*by Mochamad Alfian Rosid*

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**Submission date:** 09-Jan-2024 12:13PM (UTC+0700)

**Submission ID:** 2268246003

**File name:** Sumarno\_2021\_IOP\_Conf.\_Ser.\_Mater.\_Sci.\_Eng.\_1098\_052102.pdf (713.46K)

**Word count:** 2974

**Character count:** 15330

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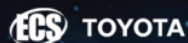
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# Knowledge based information system for detecting early eye diseases

S Sumarno\*, M A Rosid and A Irawan

Program Studi Informatika Universitas Muhammadiyah Sidoarjo, Jalan Raya Gelam  
250 Candi Sidoarjo Jawa Timur, Indonesia

\*sumarno@umsida.ac.id

**Abstract.** The eyes are very important senses in human life. If the eyes experience interference, it will be fatal to human life. Although each type of eye disease has its own specific characteristics and symptoms, early detection with a deeper recognition of eye disease symptoms should be done. Knowledge-based information systems are systems that attempt to convert human knowledge into computers so that computers can solve problems as is usually done by experts. produce conclusions or goals. The aim of this study is to design applications for early detection of fourteen types of eye diseases. This detection uses a knowledge-based system that uses the Forward Chaining method. This study produced an output in the form of the possibility of the disease the user suffered based on fifty-three selected symptoms. This system indicates how much confidence the user has in the symptoms of possible eye diseases.

## 1. Introduction

As is known, the eye is a very important thing in human life to be seen. With human eyes can enjoy the beauty of nature and can interact with the surrounding environment well. If the eyes experience interference, it will be fatal to human life. Thus, the eyes are members of the body that need to be maintained health. With the rapid development of information technology in the medical field today, it has utilized information technology to help improve better services. The work of doctors who are very busy, so that technology and medical experts collaborate to produce the field of computer-based systems and are used to help patients know the disease from an early stage and experts in diagnosing various diseases such as heart, kidney, stroke, cancer, teeth, skin, up to the eyes.

### 1.1. Knowledge-based information system

Knowledge-Based Information System (expert system) is a computer application program that seeks to mimic the reasoning process of an expert in solving specification problems. Data stored in the database will accurately inform patient complaints and can conclude the type of eye disease suffered by the patient. In general, an Expert system is a system that seeks to adopt human knowledge into computers, so that computers can solve problems as is usually done by experts. A good expert system is designed to solve certain problems by imitating the work of experts. With this expert system, being able to solve a problem that is quite complicated can actually only be solved with the help of experts. For experts, this expert system will also help its activities as a very experienced assistant. Transfer expertise from an expert to a computer and then transfer it back to someone who is not an expert. This system process requires four activities, namely (1). Additional knowledge (2). Knowledge



representation (to computers), (3). Conclusion of knowledge, (4). and transfer of knowledge to users. Knowledge stored on a computer is called a knowledge base.

There are two types of knowledge, namely facts and procedures (usually in the form of rules). One feature that must be possessed by an expert system is the ability to think. If expertise is stored as a knowledge base and a program is available that can access the database, then the computer must be programmed to make conclusions. This inference process is packaged in the form of motor inference (inference machines) Most commercial expert systems are made in the form of rule-based systems, where knowledge is stored in the form of rules. The rules are usually in the form of IF-THEN. Another feature of the expert system is the ability to provide advice or recommendations. This ability distinguishes expert systems from conventional systems. Motor Inference Engine inference is the part that contains the mechanism of thinking functions and systems reasoning patterns used by an expert. This mechanism will analyze a particular problem and then find the best answer or conclusion

### 1.2. Forward chaining

One technique that can be used in inference, namely. Forward Chaining, matching facts or statements starting from the left (IF first). In other words, reasoning starts from the facts first to test the truth of the hypothesis or also called forward reasoning. This model is different from conventional programming, for example rules do not have to be in a certain order. An example of a rule based system is as follows,

- R1 = If A and C Then E
- R2 = If D and C Then H
- R3 = If B and E Then F
- R4 = If B then C
- R5 = If F Then G.

The basis of rules in this problem is a collection of rules that are interconnected with each other. These rules or rules are represented in the form of IF-Then conditions. This statement links the premise (IF) and the conclusion part (Then). If the premise in the rules of production can have more than a proposition, the propositions are linked using the logical AND operator. Expert system model for diagnosis of eye diseases in humans using the forward chaining method. In Figure 1 it is shown that the data is taken from existing references about various types of eyes and existing problems that are stored in a knowledge database called the base, while the facts are the facts that exist due to eye diseases that are Correlated with a database of expert knowledge or references that have been taken, for the use of rules, because this knowledge system uses the concept of backward system theory.

There are fourteen types of eye disease, (1). Dacryocystitis is an infection of the lacrimal sac (2). Glaucoma, is a type of eye disease that gradually causes eye vision to be reduced. (3) Cataract, is a type of eye damage that causes webbed and nearsighted lenses. (4). Conjunctivitis, is inflammation of the conjunctiva. (5) Vernal conjunctivitis, caused by allergic factors. (6) Endophthalmitis, is inflammation of the entire inner eye lining. (7) Blepharitis, is inflammation of the eyelids due to excessive oil production from the oil glands. (8) Corneal ulcer, is an infection of the external cornea. (9) Episcleritis, is inflammation that occurs between the sclera and conjunctival tissue in the eye. (10) Swelling of the Eye Socket. (11). Orbital cellulitis as a serious infection involving muscle and fat located in the orbit. (12) Keratomalasia, (Xeroftalmia, Xerotic Keratitis) is a condition in which the cornea becomes dry and cloudy due to lack of vitamin A. (13). Herpes simplex infection in the cornea is one of the causes of corneal damage. (14). Shingles (HZ) is a reactivated form of the varicella zoster virus (VZV), the same virus responsible for chickenpox.

Published research results are very important as a rationale and consideration in conducting research. Computer-based information systems for example by Peng Zhang, Leyang Xue, An Zeng, Predictability of diffusion-based recommendation systems [1], and by Kajal Jaisinghani, Maharashtra, Artificial Intelligence Using Forward Chaining and Backward Chaining [2] as well as several other research examples. Forward Chaining methods such as Kurnia Muludi, Radix Suharjo, Admi Syarif, Fitria Ramadhani [3], then by B. Herawan Hayadi, Adolf Bastian, Kasman Rukun, Nizwardi Jalinus,

Yaslinda Lizar, Asriwan Guc [4], also by many others. Forwarding Chaining Research Method, 2019 by Atikah Ari Pramesti, Riza Arifudin, Endang Sugiharti and by Jamaludin, Haryanto, Yulia Karlina Hasim, Dental Research Expert System and diagnosis using Android-based Forward Chaining [5,6], 2018 as well as by I Santosa, L Romla, S. Herawati, Diagnosis of Expert System for Cataract Eye Using Fuzzy [7], in this study discusses building a knowledge-based application system that can link the initial disease types with the forward chaining method. In this study there are four types of diseases, Dacryocystitis, Glaucoma, Cataract, Conjunctivitis, Conjunctivitis Vernalis, Endophthalmitis, Blepharitis, Corneal Ulcer, Episcleritis, Socket Eye Swelling, Orbital Cellulitis, Keratomalasia, Herpes simplex in reminder and methods used in Forward Chaining.

## 2. Methods

The method used in designing this information system consists of four stages, namely, literature study, problem formulation, problem solving, objectives and conclusions. Literature study is reviewing relevant literature, gathering data and information, analyzing problems and designing. Data is taken from reference books and journals. This data will be processed as input data and will become a knowledge database. Input data in the form of fourteen types of eye diseases and fifty-three types of symptoms, along with their outputs then the results of diagnoses and recommended solutions.

At the design stage using Chaining inference forward, the data used is shown in table 1 and the type of disease uses the symptom code G\_01 to G\_53 as follows:

G\_01 Fever, G\_02 Ejecting pus in the corner near the nose, G\_03 Excessive tears, G\_04 Swollen lower eyelid, G\_05 Red eye, G\_06 Eye aches / aches, G\_07 When Looking at a Light Source, a rainbow appears around the light source, G\_08 Headache, G\_09 Swollen Eyes, G\_10 Blurred vision gradually becomes normal, G\_11 Flashes continuously, G\_12 Blurred Vision, G\_13 Visual acuity is reduced, G\_14 G\_14 Contrast sensitivity disappears, G\_15 Blinding light, G\_16 See the circle around the light, G\_17 Objects that are seen are yellowish, G\_18 Change glasses often, G\_19 Double vision in one eye, G\_20 Eyes excrete, G\_21 The eyes feel itchy, G\_22 Watery eyes, G\_23 Sensitive to light, G\_24 A scab forms on the eyelid when you wake up in the morning, G\_25 Vision loss, G\_26 Eyeballs festering, G\_27 Eyes feel hot, G\_28 There is a wound on the eyelid, G\_29 Eyelashes fall out, G\_30 When I wake up my eyelids are hard to open, G\_31 Disturbance of vision, G\_32 On the cornea visible yellowish white pus spots, G\_33 Inflammation of a small portion of the eyeball, G\_34 Part of the eye area is rather prominent, G\_35 Yellow eyes, G\_36 The shape of the cornea protrudes like a cone, G\_37 Eyes have nearsightedness, G\_38 Occurs more than a few days and the eyes feel more severe pain, G\_39 G\_39 Eyes stand out, G\_40 Reduced Eye Movement, G\_41 Swollen eyelids, G\_42 Swollen eye ball, G\_43 Early experience night blindness, G\_44 The eyes feel dry, G\_45 Presence of wrinkles, G\_46 Turbidity and softening of the cornea, G\_47 In the conjunctiva visible dry and foamy sediments that are silvery gray, G\_48 Corneal swelling, G\_49 Open wound formation, G\_50 Formation of permanent scar tissue, G\_51 Disappeared when the eyes are touched, G\_52 Increased pressure inside the eyeball, G\_53 Has permanent glaucoma.

**Table 1.** Knowledge database of eye diseases.

Code	Type of eye disease
P_01	<i>Dacryocystitis</i>
P_02	<i>Glaukoma</i>
P_03	<i>Cataract</i>
P_04	<i>Konjungtivitis</i>
P_05	<i>Konjungtivitis Vernalis.</i>
P_06	<i>Endoftalmitis</i>
P_07	<i>Blefaritis</i>

Table 1. Cont.

P_08	Ulkus Kornea
P_9	Episkleritis
P_10	Swelling of the Eye Socket
P_11	Orbital Sellulitis
P_12	Keratomalasia
P_13	Herpes simplex infection in the cornea
P_14	Herpes Zoster Infection

### 3. Results and discussion

The decision tree produced in this study can be seen in Figure 1, and is used as a reference in formulating production rules, as well as all production rules in accordance with the inference engine.

#### 3.1. Forward chaining rules

The inference engine used by researchers is forward Chaining, by looking for the rules as in Figure 1, the system will conclude to find one of the correct antecedents (hypothesis or IF-THEN clause). When the production rules are found the decision-making machine as in the example in Figure 3b or the consequence (THEN-clausa) produces new additional information from the database provided. The database used is the eye disease type database (Table 1) and the symptom database G\_01 to G\_53, then the machine will repeat this process until the target is found.

In the decision tree of the production rules of the Forward Chaining Method, in this case the four branches of the search tree are shown with fifty-three symptom features and fourteen types of eye diseases. Where each branch will produce symptoms (G), G\_01 Fever, G\_02 The eye secretes pus around the nose, G\_03 Excessive tears, G\_04 Swollen lower eyelid, G\_05 Red eye, G\_06 Eye pain, the system defines the type of eye disease Dacryocystitis as shown in the figure 3 (conclusion). For the seconds earch G\_12 Blurred vision G\_13 Visual acuity is reduced, G\_14 contrast sensitivity disappears,

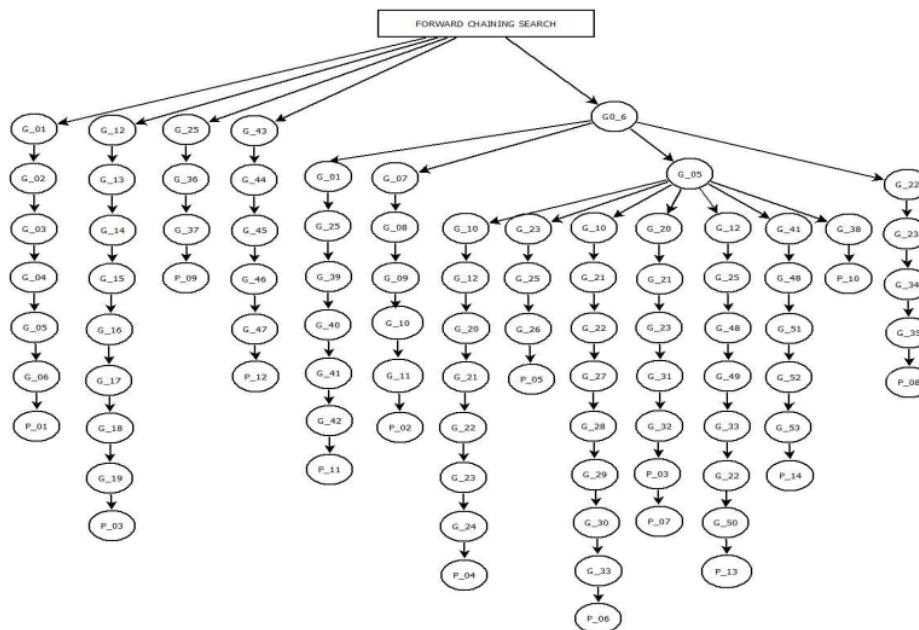


Figure 1. Decision tree with forward channing search.

G\_15 Blinding light, G\_16 See the circle around the light, G\_17 Objects that look yellowish, G\_18 often replace glasses, G\_19 double vision, G\_03 Overblown eyes then the system defines cataract eye disease, and so on.



**Figure 2a.** User test results (the machine receives questions from users).



**Figure 2b.** User test results (how the decision engine is made).

In Figure 2a and Figure 2b is one example given in the study so that shows that the knowledge-based system functions as expected. One of the symptoms produced is first the patient's body has a fever, the patient's eyes ooze pus around the nose, then the tears come out excessively, the eyelids at the bottom experience swelling, the eyes are sore and red, so the system produces a diagnosis of "Dacryocystitis" with recommended given is treating patients by compressing warm water, nasal decongestants, topical and systemic antibiotics.

#### 4. Conclusion

Based on the description that has been submitted, it can be concluded

- That designing a computer-based knowledge information system in determining the type of eye disease and its symptoms can use forward chaining and is done by designing production rules so that it is easier to make a decision tree for the type of disease.
- The design of information systems in medicine is very interesting and has been made by many previous studies in the diagnosis of various diseases. In this study, the authors want to help the public to know the symptoms of eye diseases and the types of eye diseases of patients.
- In this research there are many weaknesses, because there is not much interactive training and expert advice and also presents information as much as fourteen types of eye diseases and fifty-three symptoms.
- It is hoped that future research will be better than this research, on various sides, ranging from methods, continuing training and interaction with experts.

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