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# Expert System Detection of Cataract Using Production Rules

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**ABSTRACT**

Eyes are one of the five very important senses. If the eye is disturbed, it will inhibit human activities. Eye detection as early as possible will help the public to know the disease. However, patients often cannot consult an ophthalmologist because the doctor cannot be found. The cataract detection expert system was built to help the public and eye doctors to detect cataracts at an early stage. Cataract is one of the eye diseases that causes blindness. Cataracts have symptoms of blurred vision, sensitivity to light, difficulty seeing at night and other symptoms. These symptoms were processed using the IF-THEN production rule and reasoning using conjunctive syllogisms and ponent mode to determine the diagnosis of the type of cataract suffered by the patient. This expert system is able to predict cataract disease accurately. Based on Azwar's criteria and testing by ophthalmologists as experts and 30 users, it shows that the system built tends to be moderate.



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## 1. Introduction

Eyes are one of the five senses that have a function to see an object. Eyes have an important role in daily human activities, for example enjoying the beauty of nature and interacting with the surrounding environment. If the eye is disturbed it will interfere with human activities. Eyes that are sick if not treated immediately may lead to blindness, such as cataracts. Cataract is a condition where there are white patches like clouds and over time will cover the eye lens that was black to white. The exact cause of cataracts is not known, but the disease is associated with age. Age can not be a measure of the cause of cataracts but the presence of free radicals that affect eye health. Indonesia is the country with the highest cataract sufferers in Southeast Asia.

Meanwhile, based on 2004 data from the Eye Disease Prevalence Research Group, it is estimated that by 2020, the number of people with eye disease and blindness in the world will reach 55 million people. Currently, there are 45 million blind people in the world, 60% of whom are in poor or developing countries. According to data from the Ministry of Health of the Republic of Indonesia in 1996, the blindness rate in Indonesia reached 1.5% or more than 2 million blind or blind people in Indonesia. This figure is quite high in Asia. For comparison, in Bangladesh the blindness rate is 1%, in India 0.7%, and Thailand 0.3%. From this survey conducted by the Ministry of Health of the Republic of Indonesia, the main cause of blindness in Indonesia is cataract (0.78%), followed by glaucoma (0.12%), refractive error (0.14%), and other diseases related to old age. (0.38%).

The large number of cataract sufferers in Indonesia is directly proportional to the number of elderly people in 2000 which was estimated at 15.3 million (7.4% of the total population). In

Indonesia, people with cataracts tend to have cataracts 15 years earlier than patients in the tropics. Approximately 16% to 22% of people with cataract surgery are under 56 years of age. There is also a mention, 20%-24% cataract blindness suffered by the productive age group. (www.sentulcity.co.id, 2012) The data above can be concluded from year to year the number of cataract sufferers in Indonesia is increasing. The increasing number of cataract sufferers is not proportional to the number of ophthalmologists. With the development of technology now, many things that are done manually can be done instantly and faster.

Expert system itself is a system that seeks to adopt human knowledge to computers, so that computers can solve problems as experts usually do. For this research, an expert system can help people detect cataracts quickly without having to go to an eye specialist. Based on the data above, there is still a lack of public awareness in the importance of maintaining eye health. Early detection of cataracts is very important to prevent the disease from getting worse. The expert system for detecting cataracts is expected to help the public in detecting cataracts quickly and easily. Types of Cataracts In General Cataracts are divided into three groups, including:

a. Nuclear

   Nuclear is a phase of cataract disease which is characterized by changes in color due to the decreasing level of focus of the eye lens, either objects or light. At the beginning of this type of cataract the ability to read is still able, but over time it will lose this ability because the eye lens will turn yellow and form a white stain in the center of the lens. After entering the next stage, the ability to see will deteriorate so that the light seen becomes brown. And the more severe stages will be difficult to distinguish colors so that objects and light will look blue or purple.

b. Cortical

   This type of cataract is the second phase of the above type of cataract. For the cortical type, the formation of stains on the outer layer of the eye lens runs very slowly. But then the stain will begin to cover the middle layer of the eye lens and the white stain on the eye lens will become more visible, thus interfering with the flow of light entering the center of the lens. Cortical sufferers will experience glare when they see light.

c. Subcapsular

   This type of cataract begins with the formation of a blurry area under the lens or behind the lens, which is one of the pathways of light to the retina. This type of cataract is included in the cataract stage with a fairly severe condition, because in addition to reducing the ability to see, this type of cataract is able to reduce the eye's ability to read even in bright enough light so that the glow of the light received is like a circle of light when seeing light at night. .

Production Rules Production rules or production systems are used to make reference to inference systems, rule-based systems and in the case of solving human behavior problems as well as in simple production. The production rule is represented by a set of rules in the form: IF[condition] THEN[condition] This rule can be said to be an implication relationship of two parts, namely the premise part (if) and the conclusion part (then). If the premise part is fulfilled then the conclusion part is also true.

## 2. Method

The application of an expert system for detecting cataracts uses a knowledge base of production rules and decision making with deductive reasoning which consists of the ponen mode and the conjunctive syllogism. Applications are made to help the public and doctors to detect cataracts as early as possible. To collect data in the form of symptoms and the name of the type of cataract to support the application, there are several steps that must be done. The first is to find information about cataracts, symptoms and names of types of cataracts. Second, conducting interviews with ophthalmologists related to cataracts. After data collection is carried out, it is entered into the design of making a cataract detection application. Then proceed with the implementation of making cataract system applications based on the information they already have. The test in this study was to distribute questionnaires to ophthalmologists and the public. Tests were carried out to find out that this application can detect cataracts with production rules.

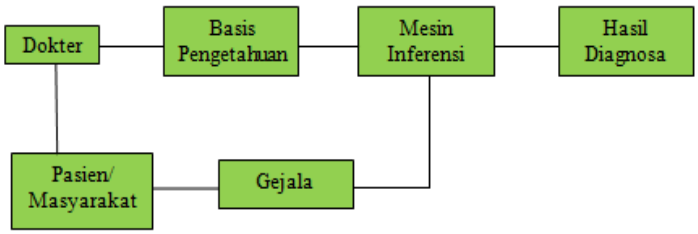


**Figure 1.** Research Framework

## 3. Results and Discussion

### 3.1 Main page

On the Main Page select login as Admin. A page like the one shown below is made in order to differentiate or facilitate the program's functions based on the user.


**Figure 2.** Main page

### 3.2 Admin Login Page

For Admin Login, the program is designed by setting the username and password in the program, if the password and username are correct, the program will go directly to the home page

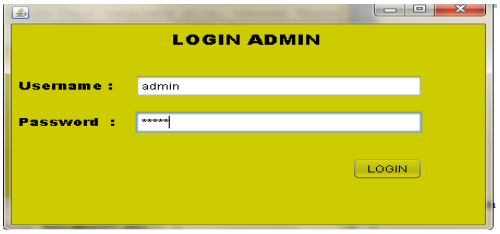


**Figure 3.** Admin Login Page

### 3.3 Home

After logging in, you will enter the home page which distinguishes the admin and visitor menu on the cataract menu, in the admin there is a cataract sub-menu. Cataract updates and cataract info while visitors only have a cataract detection and info menu.


**Figure 4.** Home View

### 3.4 Add Data

The add data button is used to add symptoms and add types of cataracts. First added are the symptoms. The symptom contains the symptom code and the name of the symptom. The program created is designed to select the symptoms first and then continue by adding the code and type of cataract.

For example, adding nuclear cataracts that have symptoms: changes in light focus, blurred vision, blemishes on the eyes and reduced vision. Add the code and name of each symptom. If the data is successfully added, a notification of the data has been successfully added will appear. Enter the symptom code G1 with the name changing the focus of the light. Then select the add button.

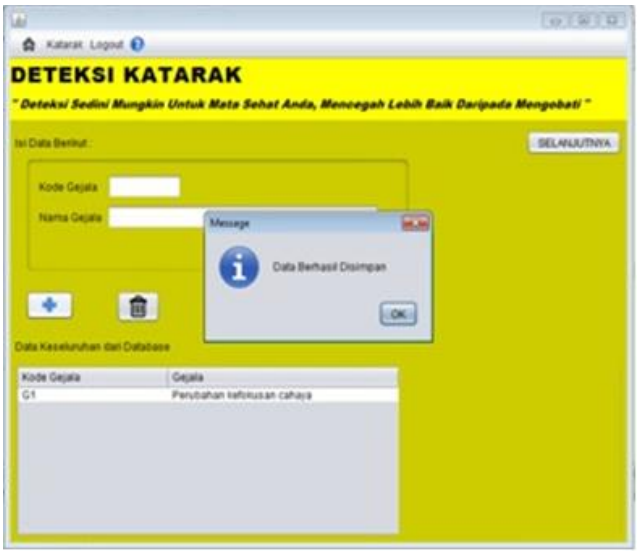


**Figure 5.** Added Successfully

Input data with symptom code G2 with the name symptom of vision becoming foggy. Select the add button and the data is successfully added to the database.


**Figure 6.** Enter G2


**Figure 7.** G2 Added Successfully

As an example of the symptoms that are felt and which will be selected in table 1 (top table) are changes in the focus of light, vision becomes yellow, stains on the lining of the eye and the ability to see becomes yellow. The selected symptoms will appear in table 2 (bottom table). If there is an incorrect symptom selected, then just click on the wrong symptom in table 2 which will automatically be deleted

### 3.5 Clear Data

Delete data is a function to delete cataract data for both symptoms and types of cataracts. The data to be deleted is the symptom with the name of the stain on the eye lens with the symptom code G3. When the selected symptom is clicked, data such as the symptom code and symptom name will appear in the JtextField.

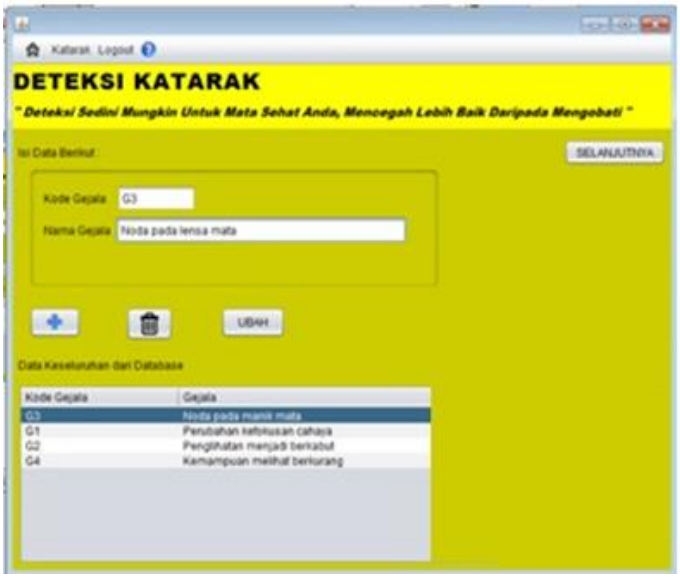


**Figure 8.** G3 Will Be Removed

After selecting the delete button a warning will appear "Are you sure the data is deleted?". With a choice of yes or no.

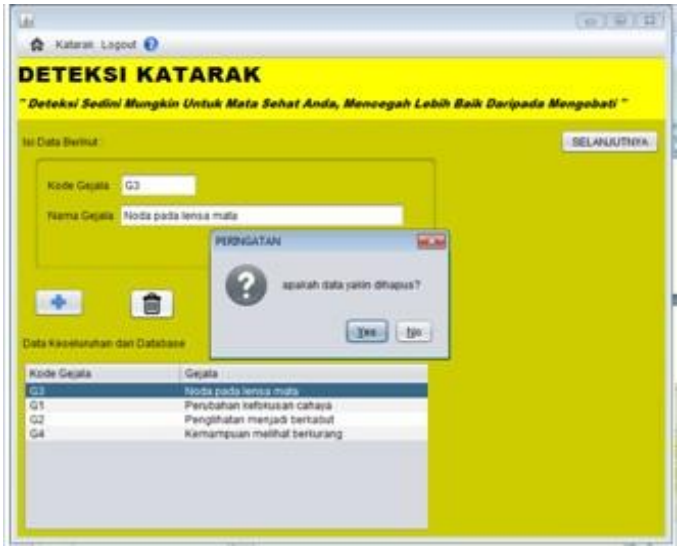


**Figure 9.** Data Warning Message Will Be Deleted

As an example of the symptoms that are felt and which will be selected in table 1 (top table) are changes in the focus of light, vision becomes yellow, stains on the lining of the eye and the ability to see becomes yellow. The selected symptoms will appear in table 2 (bottom table). If there is an incorrect symptom selected, then just click on the wrong symptom in table 2 which will automatically be deleted.

### 3.6 Support

Visitors are the public or patients who use cataract detection applications. The appearance of the application for visitors is not much different from the admin view. The difference between the appearance of the admin and the community is that the admin can log in and update the symptom and tartar data, while visitors can't or can only use it as detection. The rest of the features of the menus of the two users are the same. In this application the important menu is cataract detection. The cataract detection menu serves as a detector for the cataract that a person is currently suffering from.

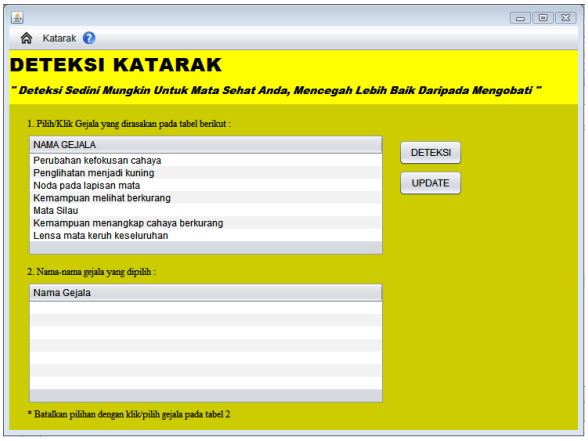


**Figure 10.** Cataract Detection Menu Display

As an example of the symptoms that are felt and which will be selected in table 1 (top table) are changes in the focus of light, vision becomes yellow, stains on the lining of the eye and the ability to see becomes yellow. The selected symptoms will appear in table 2 (bottom table). If there is an incorrect symptom selected, then just click on the wrong symptom in table 2 which will automatically be deleted.


**Figure 11.** Cataract Detection Menu Display

If all the symptoms that are felt are selected then select Detection. In the diagnosis display, the previously selected symptoms appear, the cataract you have and the presentation of a person with cataracts.

## 4. Conclusion

From the results of tests and analyzes that have been carried out, it can be concluded that by using the production rule, it is able to predict cataract disease correctly. Suggestion, The application program created in this study is used to assist doctors and the general public in detecting eye diseases, especially cataracts. However, this cataract detection application program still requires a lot of development. Therefore, the authors provide several suggestions, including: From the symptoms of cataracts in this study, which are known to be incomplete for each type of cataract. The decision table is only temporary in the sense that over time the symptoms of a type of cataract can change.

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