Expert system for determining the type of cats and how to care them

H Mustafidah¹, R Amin¹ and V A N Fatimah²

¹ Informatic Department, Universitas Muhammadiyah Purwokerto, Purwokerto, Indonesia
² Medical Faculty, Universitas Gadjah Mada, Yogyakarta, Indonesia

*h.mustafidah@ump.ac.id

Abstract. Cats are one of the many animals kept by animal lovers in Indonesia because the cat is a very friendly animal with humans and has a funny character. Nevertheless, not all cat lovers understand exactly the type of cat that is owned even how to care especially for ras or domestic cats (kucing ras - in Bahasa), because each type of ras cat has different character and way of care. This causes the pet cat affected by various diseases to cause death. One way to overcome the incomprehension of cat lovers in taking care of it is with the help of expert systems that have proven reliability in helping solve problems that require solutions as an expert in his field. This expert system was developed using forward chaining method. By answering any questions asked by the system about the characteristics of the cat owned, users will get answers about the type of cat they have and the way of good and right care.

1. Introduction

Expert system is one of the evolution of computer technology, especially the field of artificial intelligence (AI). AI with its software support has greatly assisted human work. In addition to expert systems, Artificial Intelligence application development has been widely penetrated into other areas which are case-based reasoning, fuzzy logic, and artificial neural networks. AI-based systems have been developed primarily for diagnostic, classification, and prediction purposes [1-9]. Expert system as one of the area in AI, is a computer program that can imitate the thought process and expert knowledge to solve a specific problem [10].

An expert system is a computer program that simulates the judgment and behavior of a human or organization that has expert knowledge and experience in a particular field. This system contains a knowledge based that contains accumulated experience and a set of rules to apply basic knowledge for each particular situation. An expert system processes knowledge rather than data as on a conventional computer. Implementation of expert systems is widely used for the benefit of society because it is viewed as a way of storing expert knowledge in a certain field into a program, so as to make decisions and make intelligent reasoning. Some expert systems have been developed to help solve problems or assist human work. In previous research, expert systems were developed to assist in learning, diagnosing skin diseases, as well as overcoming problems in the field of fisheries either in diagnosing the disease or in determining the needs of fish feed [11-22].

Humans have different kinds of hobbies, among which are carrying of various types of animals. Cats are one type of animal that is highly favored by many people. The cat lover community is called cat
lovers. Cats or Latin language *felis* is a type of carnivorous animal. The word cat usually refers to a "cat" that has been benign, but can also refer to "giant cats" like lions, tigers, tigers and so on. Cats have very adorable characteristics and interesting personality for every cat lovers. Many cat contests are held at various events in every corner of the world by showing the cute, graceful, and unique. Today there are many types of cats from different races spread in Indonesia so that cat lovers find it difficult to determine the race of cats they need, even how to care for them. There are many cats race (better known by domestic cats) in the world, but in Indonesia itself the famous domestic cat there are only a few like Persia and Anggora. This type of cat is very popular in Indonesia because of its elegance and beauty. But the concern of the domestic cat is its existence which now only one percent of all cats in the world. One percent is obtained from cats that have a genuine "pedigree" breed that has a family tree and has a birth certificate so it is called that a pedigree cat is a cat that is really a domestic cat [23].

Many problems faced by cat lovers, one of them on how to care their cats. There is still a lot of cat lovers who do not understand how to care for their pet cat so the cat suffers from various diseases such as skin disease, digestive pain, and others. Besides the danger of toxoplasma virus can also endanger the health of cat lovers. With regard to cat diseases, expert systems have been developed to diagnose cat diseases [24], do therapeutic or vaccine efficacy [25, 26]. But this is not enough to provide a solution to the problems experienced by cat lovers. Problems can be overcome by the development of expert systems to determine the type of domestic cats, so cat lovers can choose the right domestic cat. Therefore, in this study has been developed an expert system to determine the type of domestic cat and how to care them.

2. Method
This expert system is developed through the flow stages as in figure 1.

![Flowchart of developing expert system](image)

Figure 1. Flowchart of developing expert system.

Figure 1 shows an expert system development flow. The first step taken is the acquisition of knowledge. Knowledge is acquired from a variety of reference sources and experts, such [27]. The knowledge gained is represented in the form of a rule (in the form of IF premise THEN conclusion). The premise contains facts about the characteristics of cats, whereas the conclusion is in the form of a cat type that corresponds to its characteristics. The next step is to develop a shell. Shell (core of expert system program) developed using programming language PHP (Hyper Text Preprocessor), MySQL, Xampp and Bootstrap [28, 29].
The final step in developing this expert system is implementation. The implementation stage is done after the system is installed and used by the user.

In the system development, the database design is done using 3 tables namely cat table (table 1), character table (table 2), and rule table (table 3).

**Table 1.** Cat type.

| Field    | Type    | Length | Action         |
|----------|---------|--------|---------------|
| Cat_id   | Int     |        | AUTO_INCREMENT|
| Cat_name | varchar(255) | 255   |               |

**Table 2.** Cat’s character.

| Field    | Type    | Length | Action         |
|----------|---------|--------|---------------|
| Char_id  | Int     |        | AUTO_INCREMENT|
| Char_name| varchar(255) | 255   |               |

**Table 3.** Rule.

| Field    | Type    | Length | Action         |
|----------|---------|--------|---------------|
| Rule_id  | Int     |        | AUTO_INCREMENT|
| Cat_id   | Int     |        |               |
| Char_id  | varchar(255) | 255   |               |

Table 1 contains data on cat id and cat type, while table 2 contains cat characteristic data. Table 3 contains data of rules relating data on cats and corresponding cat characteristics.

### 3. Results and discussion

Expert system is expressed as a sophisticated system in performing the task as an expert. By internal composition, expert system is said to be:

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\text{EXPERT SYSTEM} = \text{KNOWLEDGE} + \text{INFERENCE ENGINE}
\]

Knowledge is information/data that comes from a valid source which is something that is processed in memory. Knowledge is an evidence/fact (called "symptom") and a conclusion or hypothesis. In this case, knowledge is represented in the form of rules. The number of rules in accordance with the number of domestic cats that are commonly kept by cat lovers in Indonesia, as many as 9 types (table 4). Along with the inference engine (as the brain in the system), this knowledge is traced and triggered to produce solutions to problems solved. This expert system uses forward chaining as in figure 2.

![Figure 2. Forward chaining in determining the solution.](image)

The system started from a set of facts and a set of rules. It tried to find a way of using those rules and facts to deduce a conclusion or come up with a suitable course of action. Steps of applying forward chaining:
- Take the facts in the fact database and see if any combination of these matches all the antecedents of one of the rules in the rule database.
- When all the antecedents of a rule are matched by facts in the database, then this rule is triggered.
- When a rule is triggered, it is then fired, which means its conclusion is added to the facts database.
- If the conclusion of the rule that has fired is an action or a recommendation, then the system may cause that action to take place or the recommendation to be made.

Table 4. Rule Types of domestic cats commonly taking care of in Indonesia.

| No. | Characters | Type of cat | Image |
|-----|------------|-------------|-------|
| Rule 1 | Body Big AND Hair Long AND Eye Sharp AND Neck Medium AND Earlobe Wide AND Leg Medium AND Nose Pointed | Maine Coon | ![](image1) |
| Rule 2 | Body Big AND Hair Long AND Eye Sharp Neck Short AND Earlobe Small AND Leg Short AND Nose Flat | Persia Himalaya | ![](image2) |
| Rule 3 | Body Big AND Hair Long AND Eye Round AND Neck Short AND Earlobe Small AND Leg Short AND Nose Flat | Persia Peaknose | ![](image3) |
| Rule 4 | Body Medium AND Hair Short AND Eye Round AND Neck Short AND Earlobe Small AND Leg Short AND Nose Flat | Exotic shorthair | ![](image4) |
| Rule 5 | Body Medium AND Hair Short AND Eye Sharp AND Neck Medium AND Earlobe Medium AND Leg Medium AND Nose Pointed | Russian Blue | ![](image5) |
| Rule 6 | Body Medium AND Hair Long AND Eye Sharp AND Neck Medium AND Earlobe Wide AND Leg Medium AND Nose Pointed | Anggora | ![](image6) |
| Rule 7 | Body Medium AND Hair Short AND Eye Sharp AND Neck Medium AND Earlobe Medium AND Leg Medium AND Nose Pointed | Siamese | ![](image7) |
| Rule 8 | Body Medium AND Hair Short AND Eye Round AND Neck Short AND Earlobe Small AND Earlobe Can be folded AND Nose Flat | Scotishfold | ![](image8) |
| Rule 9 | Body Medium AND Hair Unavailable AND Eye Sharp AND Neck Medium AND Earlobe Wide AND Leg Medium AND Nose Pointed | Sphynx | ![](image9) |

In its implementation to determine the type of domestic cat, in this application is done consultation between the system and the user. The consultation process begins with questions about the characteristics of the cat that the user must answer. Furthermore, the system will provide answers to the type of cat in accordance with the user's answer and how to care.

Consultation is the most important session in an expert system (figure 3). In this session, the system asks the first characteristic of a cat body style that has a large or medium body. Both of these cat body sizes are the usual domestic cat body size. And so on until the question of the system ends on the character of the nose.
Based on the chaining performed as illustrated in figure 2, when the user answers the question of cat's body shape with the answer "big", then the next system asks questions about cat fur (hair) that has variants of long, short, or not available. In this case example, the user answered it long. The question continues up to the nose pointed, so the solution given is the type of Maine Coon cat (figure 4). In addition to the system provides answers to the type of cat, the system also provides information on how to care for the cat type.

Based on figure 4, according to the characteristics of cat owned by the user, then how to care for cats as well as Maine Coon is how to feed, grooming, brushing, entertaining, and how to maintain its health. This way of care will greatly determine the survival of the cat even determine its beauty.

The consultation session will provide the solution result to the user if the given characteristic is in accordance with the evidences in the rule. But if there is one or some characteristics that are not in accordance with the evident in the rule, it will appear that the data not found. This means there is no type of cat that matches the features given by the user. For example, when the user gives the answer of the feature "Body: Big, Hair: Long, Eye: Sharp, Neck: Medium, Earlobe: Wide, Leg: Short, Nose: Pointed", then there is no cat type that has these characteristics.

4. Conclusion
Expert system to help the user determine the type of domestic cat can be used as an alternative solution to know the type of domestic cat based on its characteristics. In addition, this expert system also provides information on how to care for cats so that no unwanted things happen to the pet cat. The selection of
feature categories in this system as a question to the user is only based on custom, not yet based on scientific evidence. In the next research suggested the selection of characteristics as the root of the question set based on the value of the gain on its character attributes, for example using the algorithm ID3 or C4.5.

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