Eligibility determination of *Qurban* animals using K-Nearest Neighbor

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Abstract. The *Qurban* is one of the most important worship services for Muslims. Choosing an eligible *Qurban* animals according to the shari'ah (law) of Islam and health is the main thing. This study aims to utilize technology in determining the eligibility of *Qurban* animals both based on the Islamic law and health. The K-Nearest Neighbor (KNN) algorithm is used to determine the eligibility of *Qurban* animals based on several input parameters, including animal type, weight, age, gender, sight, health, body condition, and mental. The experimental results show that KNN is successfully implemented and is able to help determine the eligibility of animals for *Qurban* well.

1. Introduction

Current technological developments have shown remarkable progress. In this era, a technology is able to help various problems in various fields such as the fields of animal husbandry, agriculture, medicine, military, offices, companies, and others. In the field of animal husbandry and agriculture, the computer has been included in it as a tool to work on a job or to identify existing problems such as eligibility in choosing *qurban* animals. According to the language *qurban* comes from the word *qaruba*-yesqrobu-*qurban*-qurbanan which means close and closer [1]. Whereas according to the term, *qurban* means slaughtering animal with the intention of worshiping God on the feast of Eid al-Adha for Muslim.

Based on the discussions that we did with as a Practitioner in the field of *qurban* animals, concluded that often *qurban* animals on the market that you want to sacrifice do not qualify both in sharia (Islamic law) and health. So, to to solve those problem, this research build a web-based application system to determine the eligibility of *qurban* animals in Shari'a using K-Nearest Neighbor (KNN) method. This system is expected to determine whether the *qurban* animal which will be sacrificed is eligible or not, so that the people who want to do *qurban* worship are not harmed and the reward for the worship is perfect.

The previous research that similar using KNN algorithm, among others: Classification of Pearl Quality Based on Shape and Size Using K-Nearest Neighbor [2]; Identification of Slum Settlement Quality Using Case Base Reasoning and Fuzzy K-Nearest Neighbor (Case Study: Bengkulu City) [3]; Expert System to Identify of Carp Fish (Cyprinus carpio) Based on Morphological Characteristics and Behavior [4]; Classification of Herbal Leaves Using the Naive Bayes Classifier and K-Nearest Neighbor Method [5]; and Classification of Indonesian Texts in the Complaints Online Document Using the K-Nearest Neighbors and Chi-Square Methods [6].
2. Methods

The software development method that used for this research is a Prototype model. Prototype is a method in developing a system that uses an approach to make a program quickly and gradually so that it can immediately be evaluated by the user [7].

![Prototype Model](image1)

![Communication in Prototype Model](image2)

With this prototype model, the designer and user meet to objectively define the entire software, identify user and software requirements, and make a quick design or prototype of software for each requirement so that developer and user can evaluate it immediately. Figure 1 describes about Prototype life cycle, and Figure 2 describes about the communication process in Prototype, among others: listen to customer for problem analysis process; build the system according with analysis result; and direct testing where user is involved in system testing. Reliability verification of system in this research is based on the analytical, logical, conceptual, and operational check by an expert [8].

3. Result and Discussion

In this study, an system design with KNN algorithm was conducted to assist the user in determining the eligibility of *qurban* animals. Information systems are a combination between human activity and information technology that computerized [9], which is generally used to support operations and management [10], and also for decision making [11]. In many research, information system has the advantages, among others as data storage media [12], present the data and information well [13], improve productivity [14], improve user understanding [15], widely used [16], more economical [17], accurate decision support [18], accurate [19], more efficient in time process [20], and good data accessibility [21]. Information systems process the data in an structured manner [22], which are design based on user needs [23], information systems are able to solve complex problems with complex data [24], and flexible to allows re-develop into better systems [25].

3.1. K-Nearest Neighbor Algorithm

K-Nearest Neighbor (KNN) algorithm uses for classifying objects based on learning data that is closest to the object [26]. The KNN algorithm is a method that used to classify objects based on the closest training examples in the feature space [27]. KNN is basic classification method from the example of based learning or lazy learning and also includes an instance-based learning group. KNN is conducted by looking for groups of objects in training data that are closest (similar) to objects in new data or testing data [28].

The KNN algorithm is simple, works based on the shortest distance from the test sample to the training sample to determine the class. KNN has a several of advantages, which are reliable to training data that have noise and effective if the training data is large. In the training phase, this algorithm only stores feature vectors and classifications of training sample data. In the classification phase, the same features are calculated for testing data and classify the test data that have not had a class yet. The distance from this new vector to all vector training samples is calculated and the number of k pieces
closest to is taken. The new point of classification is predicted to be included in the most classification of these points. The accuracy of the KNN algorithm is strongly influenced by the presence or absence of features that are not relevant or if the weight of the feature is not equivalent to its relevance to classification [29]. KNN is an approach to finding a case by calculating the proximity between a new case and an old case based on matching the weight of a number of features that have similarity [30]. The purpose of this algorithm is to classify new objects based on attributes and training samples. KNN is a classifier that does not use any model to match and is only based on memory.

There are many ways to measure the distance between new data and old data (training data), including Euclidean distance and Manhattan distance (city block distance) which is often used is Euclidean distance, such as in equation (1):

\[
d(X, Y) = \sqrt{\sum_{i=1}^{n} (a_i - b_i)^2 + (a_j - b_j)^2} \ldots (a_n - b_n)^2
\]

Where, \( a = a_1, a_2, \ldots, a_n \) dan \( b = b_1, b_2, \ldots, b_n \) represent \( n \) attribute values of two records. The steps to calculate the KNN algorithm are among others:

a. Determine Parameter K (the nearest amount).
b. Calculate the square of the euclidean distance (query instance) of each object against the given sample data.
c. Then sort the distance into groups that have the smallest Euclidean value (sort the result of number b ascending).
d. Collect category Y (Nearest Neighbor Classification) based on the value of K or take the data of the nearest neighbor.
e. By using the majority Nearest Neighbor category then a new data class (prediction) will be produced. The best k value for this algorithm depends on the data. In general, high k values will reduce the effect of noise on classification, but make the boundary between each classification even more blurred. A good k value can be selected with parameter optimization, for example by using Simple Unweighted Voting

3.2. Application Testing

For testing the implementation of the KNN method on the application of determining the eligibility of qurban animals, several stages are carried out in the calculation process that accordance with KNN algorithm. The flowchart of KNN method is described in Figure 3.

![Figure 3. Flowchart of KNN method](image-url)

For example, the case is taken as follows: An animal officer wants to know the sheep with the ID ADNQ099 is eligible or not to be qurban animal by the comparative conditions of the sheeps with IDE ADNQ0033, ADNQ0042, ADNQ0060, ADNQ0066, and ADNQ0070 (presented in Table 1 and
Table 2). New case ADNQ099 will be counted and compared the closeness value with comparative samples.

| Parameters                  | New Case | Comparative Samples |
|-----------------------------|----------|---------------------|
|                             | ADNQ099  | ADNQ0033 | ADNQ042 | ADNQ060 | ADNQ066 | ADNQ070 |
| Type                        | Sheep    | Sheep    | Sheep   | Sheep   | Sheep   | Sheep   |
| Weight                      | 21       | 20.3     | 19      | 23.8    | 19      | 20.3    |
| Age                         | >=12 month | >=12 month | >=12 month | >=6 month | >=12 month |
| Sex                         | male     | male     | female  | male    | male    | male    |
| Blind Eyes                  | no       | no       | no      | no      | no      | no      |
| Health                      | no       | no       | no      | no      | no      | no      |
| Limp                        | no       | no       | no      | no      | no      | no      |
| Thin                        | no       | no       | no      | no      | no      | no      |
| Complete Ear                | yes      | yes      | yes     | yes     | yes     | yes     |
| Broken Tail                 | No       | no       | no      | no      | no      | no      |
| Crazy                       | no       | no       | no      | no      | no      | no      |
| Complete Teeth              | yes      | yes      | yes     | yes     | yes     | yes     |
| Complete Horn               | yes      | yes      | yes     | yes     | yes     | yes     |
| Bleeding                    | No       | no       | no      | no      | no      | no      |
| Slimy Nose                  | no       | no       | no      | no      | no      | no      |
| Dilute Dirt                 | no       | no       | no      | no      | no      | no      |
| Turning Eyes                | no       | no       | no      | no      | no      | no      |
| Pale                        | no       | no       | no      | no      | no      | yes     |
| Feather Fall Out            | no       | no       | no      | no      | no      | no      |
| Wounded Nails               | No       | no       | no      | no      | yes     | no      |
| Appropriateness             | -        | ?        | eligible | not eligible | eligible | not eligible | eligible |

Furthermore, from the simple experiment in Table 1 and Table 2 are obtained the results of proximity between qurban animals, which are then sorted by the highest value (presented in Table 3). From the result of proximity distance value in Table 3, ADNQ099 is eligible to be qurban animal because its distance value is close with ADNQ070, ADNQ060, and ADNQ033.
3.3. User Interface
The example of user interfaces of the system to determine the eligibility of *qurban* animal are described in Figure 4 and Figure 5.

![Figure 4. KNN Calculation Form](image1)

![Figure 5. Report of Eligibility Result](image2)

4. Conclusion
The system is designed to facilitate a person in determining the eligibility of *qurban* animals. The performance of the KNN method in the process of determining the eligibility of *qurban* animals runs well and optimally, suitable for use in determining which involves a lot of data. For further research, the authors recommend determining eligibility with more and varied data such as cattle, camels, etc. for *qurban* animals; empty (truncate) the database on the value of proximity and calculation results periodically because if the data is not deleted then when entering the same and similar data there can be a failure in the process of calculating the feasibility; and update the previous animal check feature using id_hewan with barcode scanning or so on.

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