Classification Of Egg Quality Using The K-Nearest Neighbor Algorithm In Machine Learning

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ABSTRACT

In addition to meat, fish, and milk, one of the staple foods consumed by the community is chicken eggs. Egg quality assessment is separated into two categories: exterior (egg shell) and interior (egg contents). However, the evaluation method used in this investigation is focused on evaluating the external quality of eggs. Pre-processing, feature extraction, classification, and evaluation are steps taken in the image processing method used to classify chicken eggs. Classification methods that can be used include the K-Means Clustering and K-Nearest Neighbor (KNN) methods and improved KNN. Based on the findings in the study, the KNN improvisation method can be used to classify chicken egg quality, with a test accuracy value of 91.67%.

Keywords: Digital image, Egg exterior quality, Classification, KNN method algorithm.

INTRODUCTION

Indonesian people really need eggs as animal protein[1]. Apart from meat, fish and milk, one of the staple animal ingredients consumed by the public is chicken eggs. Based on quality, there are two types of chicken eggs, namely good quality and bad quality. Complete amino acids, lipids, vitamins, minerals, even lutein are all found in high quality chicken eggs[2]. Parent quality, feed consumed, chicken health,*week production*, and temperature all affect egg quality [3].

As one of the most widely consumed animal products, the quality of eggs must be given more attention.[4], Eggs must be sorted to assess their quality before they can be sold and eaten by the general public. Egg quality assessment is separated into two categories: exterior (egg shell) and interior (egg contents). However, the evaluation method used in this investigation focused on evaluating the external quality of the eggs. Shell size, shell color, and egg size are some of the factors that determine egg quality based on external evaluation. Pre-processing, feature extraction, classification and evaluation are the steps carried out in the image processing method used to classify chicken eggs. The application of image processing technology and classification techniques as egg sorting methods is expected to provide the best results, so that this procedure can be developed based on previous research[5]. Classification methods that can be used such as

the K-Means Clustering and K-Nearest Neighbor (KNN) methods. Research on the application of the K-Means Clustering method such as Classification of Chicken Egg Quality Using the K-Means Clustering Method[2]However, the test results obtained an accuracy of 75% with 20 test images and found 5 errors in data identification. Meanwhile, the application of the K-Nearest Neighbor method such as the Implementation of the K-Nearest Neighbor Algorithm for Identification of Orchid Flower Images[6], with an accuracy rate of 86.7%.

The KNN approach uses distance to indicate similarity, which is used to assess the relationship between samples. Since some samples with the same distance will almost certainly not be selected as neighbors in many cases especially in large data, the choice of parameter k will have a significant impact on the KNN classification results. Meanwhile, sorting in kNN turns into a computational challenge when dealing with large data. Based on experimental data, the improved KNN approach can achieve three times faster time efficiency than the original KNN method. The improved KNN outperforms KNN by 13% in terms of accuracy.[7].

To determine the performance of the improvised method in classifying chicken egg quality, a performance analysis process of the method is needed.Therefore, the researcher will conduct research related to the application of the improved KNN method in carrying out the chicken egg classification process. To carry out the texture extraction process from the input chicken egg image, the method that will be used is the Segmentation Based Fractal Co-Occurrence Texture Analysis method.[8]Meanwhile, to carry out the color extraction process, the Color Moments method will be used[9].

The problem is how to evaluate the performance of the improved KNN method in carrying out the process of identifying the quality of chicken eggs with the previously mentioned background.

The formulation of the problem in this study is how to evaluate the performance of the improved KNN method in carrying out the process of identifying the quality of chicken eggs with the background mentioned previously.

And the limitations of the problems in this research are as follows:

1. Input images have *.JPG and *.PNG formats.
2. The input image size is limited to a minimum of 100 x 100 pixels.
3. The number of datasets used was 100.
4. The qualities of chicken eggs discussed include:
    a. Size: large and small.
    b. Texture: big and dirty.

5. Percentage comparison between training and test dataan is 70% and 30%.

The purpose of this research is to implement the improved KNN method in classifying chicken egg quality so that the performance of this method can be known. And the benefits obtained after completing this research:

1. Knowing the performance of the improved KNN method.
2. To be a reference material for learning and research in the classification process.

LITERATURE REVIEW

Types of research

This research is a type of quantitative research using experimental methods. This research was carried out by collecting data via the internet, then the data was processed and analyzed to obtain conclusions.

Tools and materials

Related journal papers and books provide research materials for this study. The instruments used in this study to ensure its success are as follows:

1. Software Requirements.

   This program was created using the following software:

   a. Windows 10 Operating System.
   b. Microsoft Visual Studio C# 2013.

2. NeedAbout Hardware

   The following are the computer specifications required to run the software:

   a. Ryzen 7 4800H from AMD.
   b. 16GB DDR4 RAM.
   c. RTX 2060 6 GB GPU (115w .ver).

METHODS

Work procedures

The following is a description of the steps included in this research work procedure:

Figure 1. Work Procedure.

1. Preliminary Stage

   This research begins by looking for research references that are relevant to the research to be conducted, the references collected are in the form of a collection of previous research.

2. Problem Determination Stage

   Determining the formulation of the problem that occurs in the process of classifying chicken eggs. In addition to identifying the formulation of the problem, this research also determines the limitations of the problem in this study which focuses on the scope of the study.

3. Data Collection Stage

   This stage is carried out by collecting data from the internet regarding images of chicken eggs.

4. Analysis Stages

   This process performs analysis on the dataset related to chicken egg images.

5. Testing Phase

   At this stage, the data that has been collected will be tested using the improved KNN method.

6. Report Stage

   The final stage is creating a report which is written in accordance with the requirements contained in the research writing guidelines.

DISCUSSION

The working process of improvising the KNN method in classifying chicken egg quality can be described as follows:

1. Training process by entering a dataset.

   The flowchart design of the training process in carrying out the chicken egg quality classification process can be described in Figure 2.

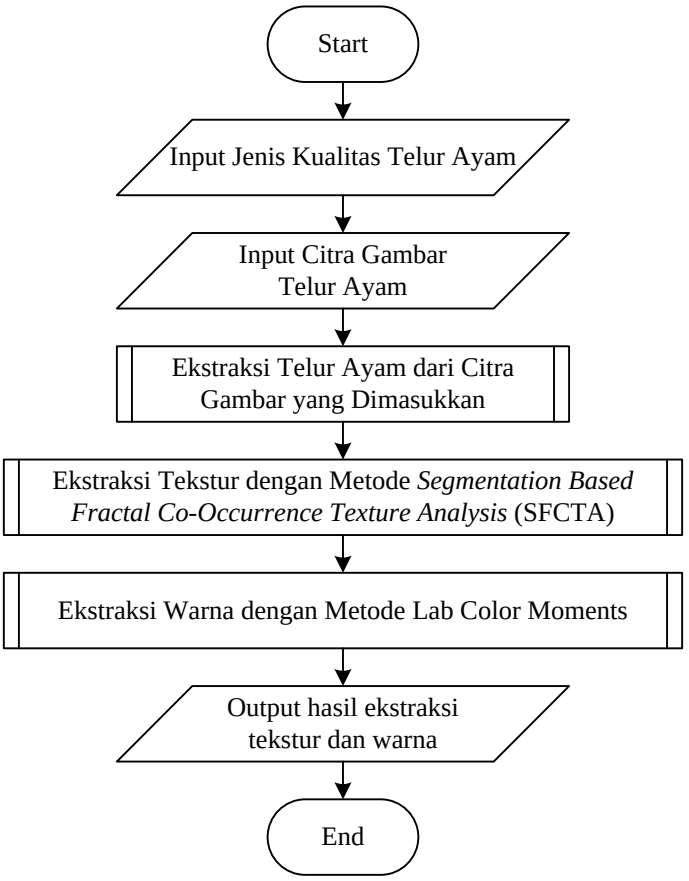

Figure 2. Training Process

An example of the display of training results using the application created can be seen in the following image:

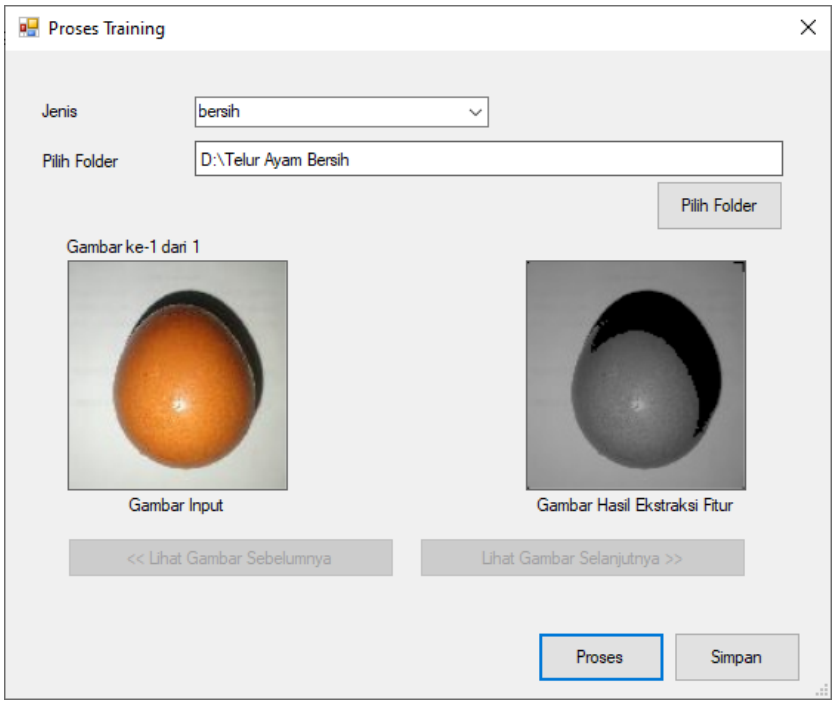

Figure 3. Application display for the training process

2. The testing process to carry out the classification process.

   The flowchart design of the testing process in carrying out the chicken egg quality classification process can be described in Figure 4.

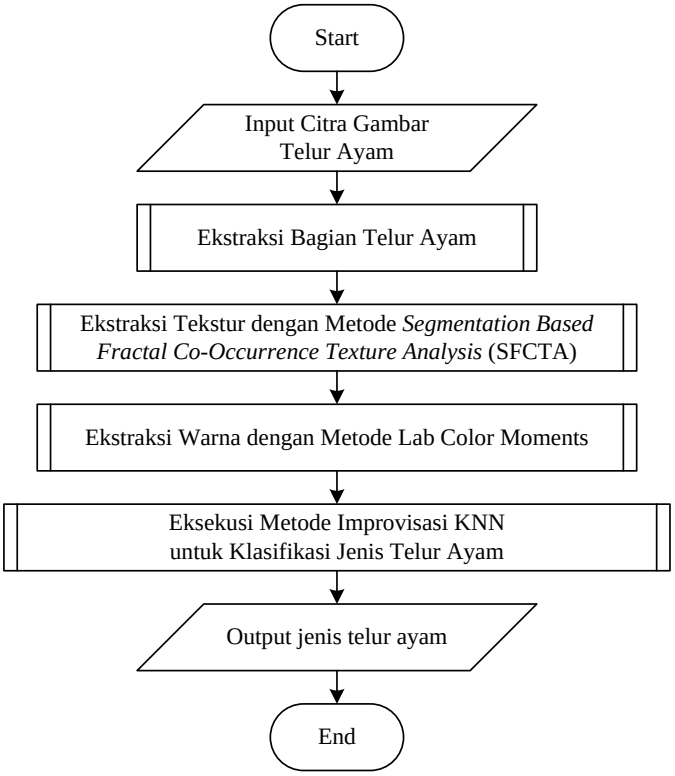

Figure 4. Testing Process

An example of a display image of the testing process can be seen in the following image:

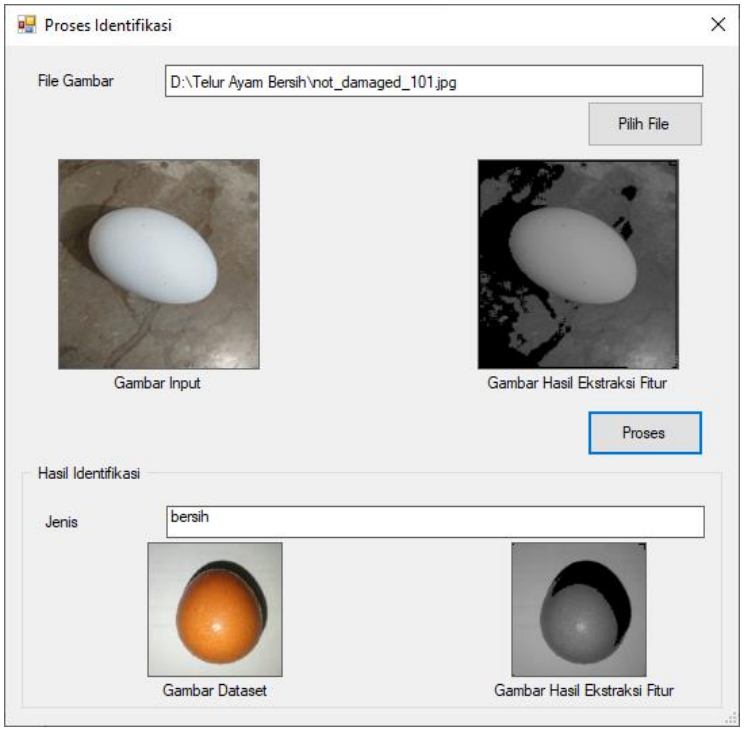

Figure 5. Example of application display from the testing process

The following is an explanation of the working methods of the supporting functions used in this study:

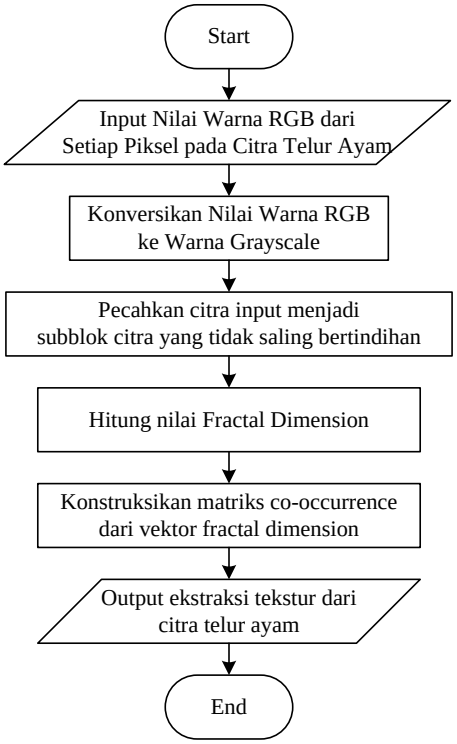

Figure 6. Flowchart of Texture Extraction with Segmentation based Fractal Co-occurrence Texture Analysis (SFCTA) Method

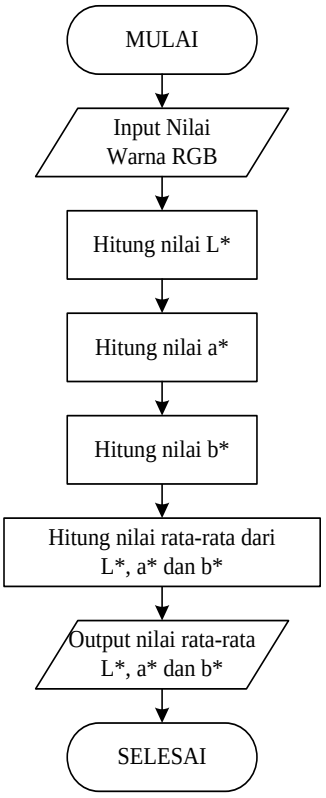

Figure 7. Color Moments Lab Flowchart

The formulation of the Lab color moments method is as follows:

$$L^\star = 116\, f\left(\frac{Y}{Y_\mathrm{n}}\right) - 16$$
$$a^\star = 500\left(f\left(\frac{X}{X_\mathrm{n}}\right) - f\left(\frac{Y}{Y_\mathrm{n}}\right)\right)$$
$$b^\star = 200\left(f\left(\frac{Y}{Y_\mathrm{n}}\right) - f\left(\frac{Z}{Z_\mathrm{n}}\right)\right)$$

Where:

$$f(t) = \begin{cases} \sqrt[3]{t} & \text{if } t > \delta^3 \\ \frac{t}{3\delta^2} + \frac{4}{29} & \text{otherwise} \end{cases}$$
$$\delta = \frac{6}{29}$$

Based on Illuminant D65 with normalization Y = 100:

$$X_\mathrm{n} = 95.0489,$$
$$Y_\mathrm{n} = 100,$$
$$Z_\mathrm{n} = 108.8840$$

Meanwhile, based on the Illuminant D50:

$$X_n = 96.4212,$$
$$Y_n = 100,$$
$$Z_n = 82.5188$$

Several types of images with different types of chicken eggs in the image will be used for testing. The types of chicken eggs registered in the database will be grouped by size (i.e. large or small) and cleanliness (i.e. clean or dirty). The classes of chicken egg quality that will be identified are as follows:

1. If the egg size is large and the texture is clean, the quality is good.
2. If the egg is large and the texture is dirty, the quality is not good.
3. If the egg is small and the texture is clean, the quality is good.
4. If the size is small and the texture is dirty, the quality is not good.

The process that will be carried out in this test is to input 4 images for each type of chicken egg quality. The data contained in the dataset is 10 pieces for each type of chicken egg quality.

RESULTS

The results obtained from the identification procedure are shown in Table 1.

Table 1. Test Results for Classification of Chicken Egg Quality

Quality Original Chicken Eggs		Chicken Egg Quality Prediction		Information
Size	**Texture**	**Size**	**Texture**	
Big	Clean	Big	Clean	Succeed
Big	Dirty	Big	Dirty	Succeed
Small	Clean	Small	Clean	Succeed
Big	Dirty	Big	Dirty	Succeed
Small	Clean	Small	Clean	Succeed
Big	Clean	Big	Clean	Succeed
Big	Dirty	Big	Clean	**Fail**
Big	Dirty	Big	Dirty	Succeed
Big	Clean	Big	Clean	Succeed
Big	Clean	Big	Clean	Succeed
Big	Dirty	Big	Dirty	Succeed
Big	Clean	Big	Clean	Succeed

From the tests carried out above, the following data is produced:

11/12 * 100% = 91.67% is the accuracy

Inaccuracy: 1/12 * 100 % = 8.33 %

Reporting Research Results

From the results of the tests carried out, the following information was produced:

1. The KNN improvisation method can be used to carry out the process of classifying the quality of chicken eggs, with a test accuracy value obtained of 91.67%.
2. The number of datasets will affect the accuracy of the results of chicken egg quality classification using the KNN improvisation method, although a larger dataset can cause the execution process to take longer.

CONCLUSION

Finally, based on the discussion in the previous chapters, this study can draw the following conclusions:

1. By using various input photos of chicken eggs, the KNN Improvisation Method can be used to identify various types of chicken egg quality.

2. The KNN improvised method can be used to carry out the process of classifying chicken egg quality, with a test accuracy value obtained of 91.67%.

3. The number of datasets in the system determines how accurate the classification results produced by the KNN algorithm are.

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