Classification of Milk Fish Quality using Fuzzy K-Nearest Neighbor Method Based on Form Descriptor and Co-Occurrence Matrix

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Abstract. Milkfish is a type of fish that lives in fresh water. Caught milkfish will be sorted at fish processing companies and will be a variety of milk, fish products in the form of cooked or in the form of fresh fish. A manual separation system of milkfish often experiences errors in the separation of fish species so that it takes a long time in the process of separating these types of fish, because it is very dependent on the skills of employees or employees. Errors in the separation of milkfish based on their size will cause a failure in the production section because it will affect the difference in the maturity level of a product, which will result in errors in the process of cooking the fish, which has an impact on the loss in the financial sector of a company. In order to maintain the quality of milkfish and speed up the sorting of milkfish, it is necessary to create a system that can help workers and employers in distinguishing the quality of milkfish based on their size. So the writer will create a system "Image Quality Classification of Milkfish Using Fuzzy K-Nearest Neighbor Method Based on Descriptors of Forms and Co-occurrence Testing was carried out using 45 images of milk fish. From the test results based on the shape feature and the co-assurance matrix produces 100%, which is in accordance with the form feature requirements and the co-insurance matrix as the reference data.

1. Introduction

Milkfish is a type of fish that lives in fresh water, milkfish has a round shape elongated and has silvery white skin. Milkfish are cultivated in a way filling. Caught milkfish will sorted at fish processing companies and will become a variety of milk, fish products in the form already cooked or in form fresh fish. Most milkfish processing producers sell it in the form of fresh milkfish with soft bones that have a large market prospect[1]. A company in the field of processing fish needs an automation system used as a tool to separate type milkfish. This is caused because of the system manual separation of milkfish often there was an error in the separation of fish species so that it takes a long time in the process of separating these types of fish, because highly dependent on employee skills or
the employee. Error in separating fish milkfish based on the size will cause failure in the production section because it will affect the level difference maturity of a product, which will result the occurrence of errors in the process of cooking fish this, which has an impact on internal losses the financial sector of a company. In the image a fish, in addition to being needed Form features also need a local feature as a tool to distinguish the types of fish visually have similar shapes So that can maintain the quality of milkfish and accelerate the sorting of milkfish, it is necessary a system that can help workers and employers in distinguishing the quality of fish milkfish based on their size which classifies milkfish images with digital image representation. Measurement and sorting of fish based on fish quality both in terms of size and freshness can be accessed through an image processing approach to obtain fish quality data and sorting process automatically[2]. Through digital image approach the quality of fish is not only from freshness and size but also that identifies differences in fish quality between those treated with pesticides and natural without treatment[3]. Computer vision system can be used for automated and on-line evaluation of fish freshness, based on the use of simple regression and artificial neural network approaches[4]. A great variety of automatic object detection and image denoising algorithms is currently known and proposed a new method for underwater image preprocessing for fish localization and detection in submarine underwater[5]. The aim of this research is proposed Classification of Milk Fish Quality using Fuzzy K-Nearest Neighbor Method Based on Form Descriptor and Co-occurrence matrix. The gray level co-occurrence matrix (GLCM) is used to extract texture feature from the input image. The GLCM assigns a distribution of each gray level pairs of neighboring pixels in an image[6]. The area and pixel perimeter of the milkfish image are used to represent the shape and size of the milkfish object. This system is used image processing that can identify quality of milkfish based on size and texture using the method fuzzy K-Nearest Neighbor (FKNN) classification, because of the K-Nearest Neighbor combined with fuzzy theory can provide definitions class labeling on the test data predicted.

2. Related Work
In the culinary world, milkfish is still a favorite in everything processed fish. This can be proven with the steady sale of fish meat milkfish). Classification of milkfish to determine the size of milkfish according to traders in the market that is based on size: a. Large Size Milkfish, the size of a large milkfish means fish milkfish in one kilogram just one tail. b. Medium Size Milkfish, size of medium milkfish means fish milkfish in one kilogram consists of two milkfish. c. Small Size Milkfish, size of small milkfish means milkfish in one kilogram consists of three milkfish. So it can be concluded that the size is large, medium size and small size of milkfish can be seen from the amount of milkfish purchase every kilogram. The quality of a post harvested fish is determined mainly by two important factors namely climatic conditions and holding time[7]. Research on the classification of fish based on image processing in general has been done previously with the type of fish different, namely in research who do development of an ecstasy system a new feature which integrates form and point descriptors salient for the classification of the image of tuna. The image is a representation (description), resemblance, imitation of an object. Colour, texture and size are the most important features for accurate classification and sorting image based on feature extraction[8][9]. Some algorithms based on fuzzy set theory (FST) such as fuzzy inference system (FIS) and adaptive-network-based fuzzy inference system (ANFIS) have been successfully applied in classification domain[10][11]. The FKNN is a branch of supervised learning methods, which particularly account for the similarity between the training sample data and the test data. The main advantage of using the FKNN is that despite its deterministic form (KNN), the unbiased weighting of instances is considered in the decision rule regardless of its distance to the pattern to be classified, and thus the fuzzy form has a greater accuracy[12].

3. Methodology
The system process that will be made the first step is to prepare the object to be studied namely milkfish, then photograph the milkfish using a digital camera, after being photographed the next step
is processing data using the image processing using Matlab programming language as a digital data processing medium. Then the next step is the process of image analysis to produce identifiable images or objects. The next step is preposessing, namely the process of improving and adjusting the image with the image under study as shown in figure 1. After that the next process is feature extraction, which is the process for taking area values and the perimeter functions to determine the size of milkfish. The next step is the process of calculating the co-occurrence matrix that will be used to determine the value so that the object will be used as a reference. The final step is the classification process which uses the fuzzy k-nearest neighbor method which functions to determine the type of milkfish as shown in figure 2.

![Figure 1. Preprocessing of Milk Fish](image1)

![Figure 2. Classification of Quality of Milk Fish Image](image2)

### 3.1 Preprocessing

The image of milkfish photographed by the camera (capture) using the Xperia™ E4 Dual mobile phone camera (5 mega pixels), and using Black Box media. Then the size of the camera is acquired by changing the size to 500 x 281 pixels. The image data used is 90 images consisting of 90 images, which are divided into 30 images of large size milkfish, 30 images of medium-sized milkfish and 30 images of small-sized milkfish. The initial data processing starts from the original image input, then converts it to grayscale. After that the process is continued at the edge detection of an object to find out the edge of the image to be processed, then the next process is the morphological process of an image in which there is a dilation process which functions to add pixels on the boundary between objects in an image, then proceed with the object filling process, namely the object filling operation and the last step is the operation of noise removal which functions to eliminate spots on an image.
3.2 Feature Extraction
In the feature value retrieval process there are several stages of the process, namely: First, the input image of the original image will be converted to grayscale. Gray image itself is a digital image that has one channel value in each pixel, in other words the part value RED = GREEN = BLUE. Then the next process is the segmentation process. In the segmentation process has a process that is operating morphology, this process is used to obtain objects without having a background value. The process then continued with calculating the area, perimeter and co-occurrence matrix. After that, feature value extraction is performed. To get the value to be used as a reference. While the final process of determining the feature reference is determining the range of feature features, so that a range of feature values will be obtained.

3.3 Classification
In this process classification will be carried out to find out whether it includes type 1 milkfish, or type 2 milkfish, or any type of milkfish type 3. The classification uses fuzzy k-nearest neighbor method. After extracting textures using a co-occurrence matrix that produces features such as ASM (Angular Second Moment), Contrast, Correlation, Variance, IDM (Inverse Different Moment), and Entropy. Then classification will be done using fuzzy k-nearest neighbor algorithm. The main advantage of using fuzzy knn classifier is that, it doesn't assign a hard crisp membership that is used in the original knn. The “fuzzification” process ensures voting from different samples belonging to more than one classes, using the membership function, that may be considered as a weighted voting.

4. Result
Evaluation to get the test results is done by inputting the RGB image, then converted to HSV image, after that the process is continued at RGB channel separation, then normalizes R G B. After normalization is done, then the normalization value of R G B. is obtained. The process is then continued by calculating Area da perimeter values on RGB normalization. After obtaining the results, the process is continued, if the terms and conditions of the area and perimeter are met, then it will continue in the next process, otherwise if the terms and conditions of the area and perimeter are not met, then the inputted image is declared not milkfish. After the terms and conditions are met, the process is continued on converting from the RGB image into the Grayscale image. Then proceed with the segmentation process, in the segmentation process there are subprocess which are morphological operations, this process is intended to get objects without having a background value. The next process uses the Co-occurrence Matrix method which produces the value of ASM (Angular Second Moment), Contrast, Correlation, Variance, IDM (Inverse Different Moment), and Entropy, the next process is to do calculations using fuzzy K-Nearest Neighbor method to find out milkfish identified. Whether the input image is classified as milkfish size 1, size 2 or size 3.

![Image](image.png)

**Figure 3.** Testing Result
5. Conclusion
In this research using feature testing is used to determine the type of milkfish whether large, medium or small. Fuzzy K-NN can identify the type of milkfish based on feature characteristics, with each accuracy value. For K = 3 by 100% as shown in figure 3. Identification of milkfish in this study can be continued for research on fish species, types of animals, plants and other types. For further research it is recommended that you add more types of milkfish. Further research can be carried out by research to be able to use other descriptors, matching similar values can use other methods such as fuzzy K-Means and Artificial Neural Network.

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