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Analysis of the Naïve Bayes Method in Classifying Formalized Fish Images Using GLCM Feature Extraction

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ABSTRACT

Fish is one of the foods that are high in protein so that many Indonesians consume fish as protein intake for health. Fish can be found in any waters including Indonesian marine waters, so that some of the Indonesian people work as fishermen. This causes the number of fish catches to increase and the fishermen have to sell the fish quickly in at least one day because the fish will rot easily if not consumed immediately. This has led some traders to cheat by mixing formaldehyde with fish that are not sold out. This action is very detrimental to consumers, so they must be more vigilant in choosing or buying fish on the market. One way for consumers to recognize formaldehyde fish is a technology that can distinguish fresh fish or formalin fish based on the image of the fish, Naive Bayes and GLCM (Gray Level Co-Occurrence Matrix) by using this method the accuracy of this system can reach up to 70%.

Keyword : Fish, Formalin, Classification, Naive bayes, GLCM (Gray Level Co-Occurrence Matrix).

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1. INTRODUCTION

The vast area of Indonesian waters is one of the marine and marine sectors that has great potential and is superior in the main movement of the economic development of the Indonesian people. The availability of abundant natural resources in the territory of Indonesia creates tremendous economic potential, so that it will produce products and services with high competitiveness, as long as they can be managed properly and appropriately (Rizka, Juni 2017). In contrast to the existing land areas in Indonesia, the availability of natural resources is increasingly limited, especially in land acquisition, this is the impact of the implementation of development. Along with the increasing population of Indonesia, making Indonesia a developing country with a very large population.

Catching fresh fish on a fisherman ship is the most important and very decisive first step of the next fresh fish customer, when the fish is removed from the water, the quality of the fresh fish can be determined. From the abundance of fish catches of fishermen, fish stocks in the market are increasing. This invites fish sellers to spend their fish sales (Rizal M. , Jul-Des 2017). This is so that the fish does not rot. From this occurrence, fish traders have to turn their minds so that they do not experience losses due to the fish they sell not being sold completely. So that the traders mix fresh fish with formaldehyde so that the fish can last a long time so that there is no loss as a result of the fish they sell are not sold as a whole.

With this, consumers experience a huge loss because the fish they buy is no longer fresh fish but fish that has been mixed with formalin. Even though formaldehyde is not good for health. If consumed in the long term and in a large capacity, it will make health worse, especially causing disease in humans.

Therefore, to be able to assist the public in recognizing fresh fish or fish that have been mixed with formalin, technology is created that can classify fish with formalin based on the image of the fish.

This technology was created using the Naive Bayes method and GLCM, while the Naive Bayes method was used as a classification of fish images. Naive Bayes is a machine learning method that uses probability calculations. This algorithm utilizes probability and simple statistical methods with the assumption that one class and another are independent (Lowd, 17 January 2005). The feature extraction used is GLCM (Gray Level Co-Occurrence Matrix) which is a method using statistical calculations in image texture extraction which considers the spatial relationship of pixels in the image (Sudibyo, Kusumaningrum, Rachmawanto, & Sari, April 2018). Pattern recognition using GLCM feature extraction has been carried out, such as research by Pariyandani et al (Pariyandani, Larasati, Wanti, & Muhathir, November 2019) classifying formalized fish images using the KNN (K-Nearest Neighbor) and GLCM (Gray Level Co-Occurrence Matrix) methods with a dataset of 500 images consisting of from 250 fresh fish images and 250 formalin fish images with an accuracy rate of 92%.

So this study uses the naïve bayes method and feature extraction of the GLCM (Gray Level Co-Occurrence Matrix) which is expected to help the wider community in classifying formalized fish images with fresh fish images. So that it helps the community, especially mothers, to help choose fish that is good for consumption so that it does not cause disease if consumed for a long time and to awaken naughty fish traders, the existence of a formalized fish image classification system will reduce fraud between fish traders and consumers.

2. LITERATURE REVIEW

A. Fish

Fish are organisms that are classified as vertebrates and have a very wide variety of species. Fish are animals that live in large water pools. Fish can be found anywhere in the waters such as brackish waters, freshwater and marine waters (Dewi, J.Harsindhi, & Sukandar, Maret 2018).

The availability of abundant natural resources, especially in water areas, makes the majority of Indonesians work as fishermen. Sea waters are one of the potential areas with a large number of commodity types, including fish, shellfish, sea cucumber, crab, squid, shrimp, seaweed and so on. Fish is a sea catch that is well known by all people (Rizka, Juni 2017). This is because fish is mostly known and consumed by upper economic communities to lower economic communities. This is because the price of fish is quite affordable for all customers compared to other protein sources, such as beef, chicken, milk and eggs. Fish and other fishery products are relatively affordable animal source foods (Rizal M. , Jul-Des 2017).

Fish is a food with a high protein source that makes many consumers need this food. Fish are animals that are very much found in Indonesian waters. This is because Indonesia is a marine country that produces many fish species living in Indonesian waters (Sarwanto, Wiyono, Nurani, & Haluan, 2014). This makes Indonesian fish catch quite a lot so that it can meet the protein needs of the Indonesian nation.

B. Formalin

Formalin is a chemical compound whose chemical formula is H2CO, where this substance is a highly reactive aldehyde gas formed by incomplete oxidation or combustion of hydrocarbons (Rendyansyah, Eftika, & Passarella, 2018). Formalin has uses, among others, as the manufacture of resins and textiles, as a disinfectant and as a fixative or preservative for objects in the laboratory. Formalin is a poisonous gas that is colorless, formalin is also readily dissolved in water and is generally distributed as a 37% solution in water, while a solution of formalin with 10% in water is used as a desifectant and species preservative in the laboratory (tatuh,Rorong & Sudewi, 2016)(Handayani & Mutiara, 2020).

Formalin is a clear, colorless solution, but has an offensive odor. Formalin can be used to preserve small animals to humans. However, some people use formaldehyde to preserve food ingredients so that they last longer. Whereas the use of formaldehyde to preserve food is clearly prohibited because of the effect that will be generated if humans consume this substance (Trisnawati & Setiawan, Januari 2019). The United States Environmental Protection Agency (EPA) and the International Institute for

Cancer Research (IARC) state that formalin is carcinogenic, that is, it can lead to cancer. In the environment, formaldehyde can be found in cigarette smoke, car exhaust, smoke from fires and in the atmosphere (Trisnawati & Setiawan, Januari 2019). If the formaldehyde in the air exceeds the permissible level of 0.1 ppm (parts per million), half of the individuals are at risk of experiencing symptoms including burning sensations in the eyes, nose and throat, not only that the effect of this formalin can cause nausea, dizziness and experiencing skin irritation if exposed to this formalin directly (Puspawiningtyas, Pamungkas, & Hamad, Maret 2017)(Singgih, April 2019).

C. GLCM (Gray Level Co- occurrence Matrix)

GLCM (Gray Level Co-occurrence Matrix) is a method that functions to analyze the texture or feature extraction (Haba & Pelangi, 2020). In 1973 Haralick proposed the Gray Level Co-Occurrence Matrix (GLCM) as texture extraction from an image. To explain the spatial pattern the GLCM uses 28 features (G.Kanagaraj & Kumar, February 2020). The GLCM (Gray Level Co-occurrence Matrix) technique is the oldest technique for analyzing texture or feature extraction. The gray level of the GLCM has 2 parameters, namely direction and distance (Lusiana, Al Amin, Hartono, & Kristianto, 2019). The feature extraction of the GLCM is carried out in 4 angular directions which include the respective angle intervals of 45° namely 0°, 45°, 90°, 135°. So that GLCM is a technique for obtaining statistical values from the second order, this is the initial process of creating a matrix work area and determining the value. angles and the closest distance (Rizal, Gulo, Della, Napitupulu, Gultom, & Siagian, Agustus 2019) (Muhathir, Mawengkang, & Ramli, 2017) GLCM was developed by Robert Haralick, where this method is very often used, so the following are the steps in performing feature extraction using GLCM (Nabella, Sari, & Wihandika, Februari 2019)(Ahsani, Sari, & Adikara, Maret 2019).

a. Convert from RGB image to grayscale
b. Determine the value of the maximum intensity on a grayscale image
c. Forming a co-occurrence (CM) matrix in the directions of 0°, 45°, 90°, and 135° with a maximum intensity value size of 1
d. Calculates the element value of each matrix where the value of each matrix element states the number of neighbors, the frequency of occurrence of the sequence of values i, j
e. Perform normalization by dividing the value of each matrix element by the number of values from the matrix. Normalization is done to eliminate dependence on image measurement values
f. Counting the GLCM features on each co-occurrence (CM)

As for the GLCM (Gray Level Co-occurrence Matrix) method, there are 4 calculated features, namely (Sudibyo, Kusumaningrum, Rachmawanto, & Sari, April 2018)(Pristanti , Mudjirahardjo, & Basuki, April 2019) :

a. Contrast
   The contrast value shows that as the intensity variation between images, the higher the contrast value, the more varied the intensity value in the image.
b. Energy
   This feature is used to see the level of texture uniformity, where the higher the energy value, the higher the level of texture homogeneity.
c. Entropy
   From this entropy value, it can provide information on coarse and fine texture features from the image extraction that has been carried out. The higher the entropy value, the coarser the resulting texture on the image
d. IDM (Inverse Different Moment)
   IDM (Inverse Difference Moment) is a feature used for measurement that defines the intrinsits level variation of pixel pairs in an image to be tested.

D. Naive Bayes

Naive Bayes is one of the most efficient and effective inductive learning algorithms for data mining and machine learning. This is due to the competitive performance of Naive Bayes in the classification process even though it uses the assumption of independence. The assumption of

independence (there is no link between attributes) in the actual data rarely occurs, but even though the assumption of independence of these attributes is violated, the performance of the naive bayes classification is quite high, this is proven in various empirical studies (Syarli, April 2016) (Muhathir & Santoso, 2020).

The naïve bayes method was proposed by a scientist in the 18th century named Thomas Bayes (Salvador & Perez-Pellitero, 2015) (Annur, Agustus 2018). This method is an approach method for an uncertain thing which is measured by probability, so that the Bayes method will produce the category label with the highest probability value (Salvador & Perez-Pellitero, 2015)(A.Zaidi, Cerquides, J.Carman, & I.Webb, 2013). Naïve Bayes is also a very popular classification method and is included in the ten best algorithms in data mining (McCann & G.Love, December 2011).

Naive Bayes is a simple probabilistic classification method. In this method calculates a set of probabilities by adding the values of the frequencies and the combination of values from the existing dataset (Narayana, Arora, & Bhatia, 2012). Naïve Bayes is a method that uses a branch of mathematics with probability theory to seek from the greatest possible probability of classification, by looking at the frequency of each classification in the training data (Saritas & Yasar, Maret 2019). In this method, each attribute is considered to have no relation with one another or is called independent, but this method requires training data before classification (Siregar, Mei 2018)(Guntur, Santony, & Yuhandri, 2018) (Devita, Herwanto, & Wibawa, September 2018). The advantage of the Naive Bayes method is that it only requires a small amount of training data to determine the mean and variance parameters of a variable required for the classification process (Calders & Verwer, 2010)(Satya, Hidayat, & Sutrisno, Oktober 2018). Here is a step up from the naïve Bayes method.

The steps in the naïve Bayes method are as follows (Lowd, 17 January 2005)(Fadlan, Ningsih, & Windarto, Juni 2018):

a. Read training data
b. Calculate from sums and probabilities
   - If there is numeric data, then determine the mean and deviation value of each parameter indicating the numerical value
   - If the data is not numeric, then calculate the probability value for each of the same categories, by means of the appropriate amount of data from the same category then divided by the number of data so that it can determine the probability value.
c. Obtain values from the mean, standard deviation and probability tables
d. Calculating the test data, but if there is numeric data look for the value of the gaussian distribution of each feature. If there is no numeric data then go to the next step
e. The final probability of each class, enter and calculate all probability data into the same class
f. Final probability, multiplying the probability of each class by the probability of the end of each class

E. METHOD

A. DataSet

The research data used includes images of fresh fish and fish that have been given a mixture of formaldehyde for their preservation. Where the image size used is 480x640 which is taken using a cellphone camera.

B. Research Steps

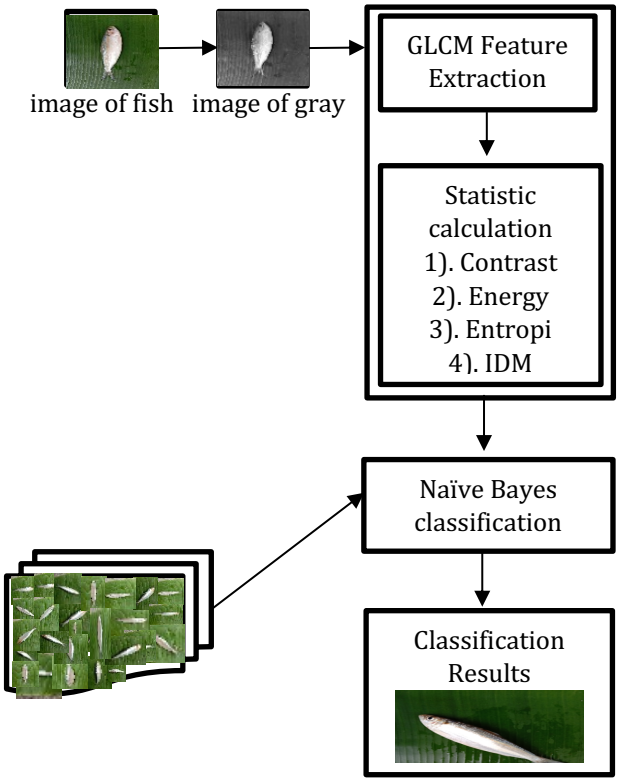

Figure 1. Research Steps (Muhathir, Rizal, Sihotang, & Gultom, 2019) (Muhathir, Sibarani, & Al-Khowarizmi, 2020)

F. **RESULTS AND DISCUSSION**

A. Sample

The sample in this study used images of fresh fish and images of fish that had been mixed with formalin. Where the number of each fish image (fresh fish image and fish image mixed with formaldehyde) consists of 250, so the total number of samples used is 500 fish images. Where of the total sample, 60% is used for training samples and 40% is used for testing samples. Where in Figures 2 and 3 are part of the sample used in this study.

Figure 2 Fresh Fish

Figure 3 Fish with Formalin

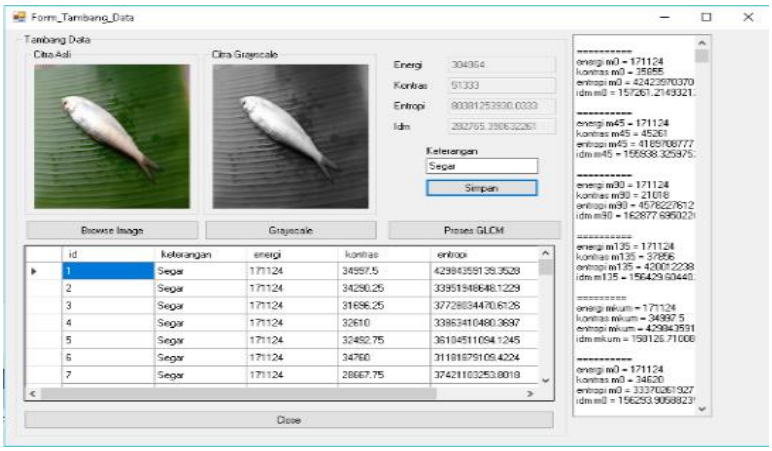

Figure 4. Fish Image Pattern Training Process

B. Fish Image Classification Process

Figure 5. Fish Image Pattern Classification Process

Table 1 : Results of the Fish Image Pattern Classification Test

	Fresh	Formalin
Fresh	246	4
Formalin	146	104
Accuracy	175	

Table 2 : Results of the Accuracy Test for the Classification of Fish Image Patterns

	Fresh	Formalin
Fresh	98.4	1.6
Formalin	58.4	41.6
Accuracy	70	

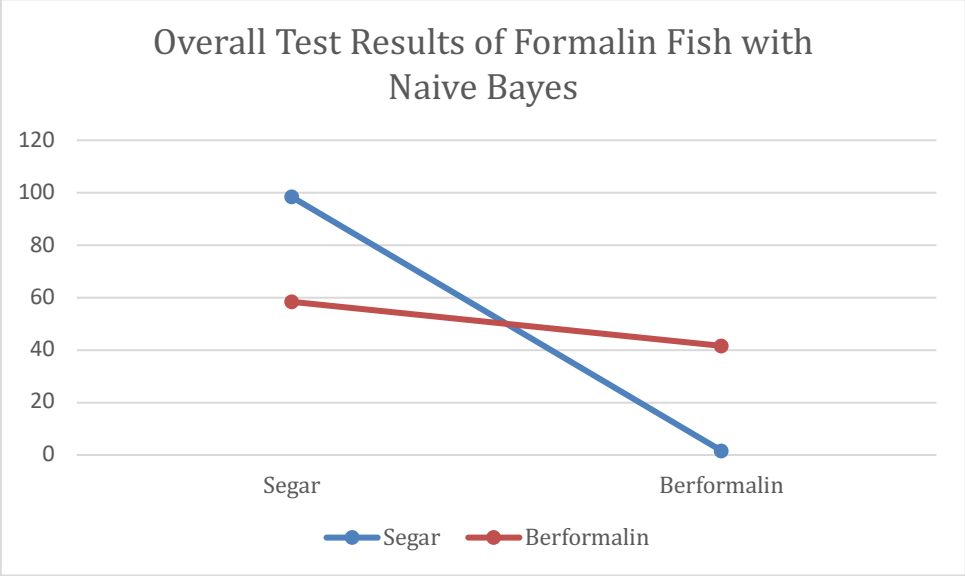

Figure 6. Test Results of Formalin Fish Using the Naïve Bayes Method

C. Discussion result

Figure 3.5 shows the results of a formalized fish test using the Naïve Bayes method and the extraction of the GLCM (Gray Level Co-occurrence Matrix) feature. Where the image of fresh fish was identified as the image of fresh fish by 98.4%, while the image of fresh fish was identified as the image of fish with formaldehyde by 1.6% and the image of fish mixed with formaldehyde was identified as the image of fresh fish by 58.4%, Meanwhile, the image of fish mixed with formaldehyde was identified as the image of fish mixed with formalin by 41.6%. With the total accuracy of the test the fish taste pattern is 70%.

G. CONCLUSION

From the results of the above research, it can be concluded that the use of the Naïve Bayes method and the extraction of the GLCM (Gray Level Co-occurrence Matrix) feature in classifying formalin-shaped fish images is good enough in recognizing the image of the fish that is the object of this study. This is evident from the results of research which shows the accuracy rate of testing fish image patterns by 70%.

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