THE IDENTIFICATION OF FISH EYES IMAGERY TO DETERMINE THE QUALITY OF FISH MEAT BASED ON FUZZY LOGIC METHOD

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ABSTRACT

The quality of sorting fish meat is required before processing because the fish whose quality is bad will affect the quality of the good fish if processed simultaneously. The classification process manually not only need a long time but also produces the inconsistent product quality. In this research, the selection of fish as an object because the fish which sold in modern and traditional market is dies, so that people do not know the quality of the fish that will be purchased. Because of that, this research tries to classification of the fish meat freshness automatically using HSV color features and Grayscale with classification method using fuzzy logic. Using fuzzy logic method is because it was considered to be able to resolve the problems are not linier. The fish image of the results of image acquisition will go through the process of preprocessing is a Contrast stretching processes, cropping and scaling, after that the fish eyes imagery will be through the feature extraction process, features that is used is a HSV color feature and Grayscale. The final process is classification using Fuzzy Logic method. The classification of the freshness of fish meat are fresh fish, fish that good enough and the fish in a bad condition are using samples of each 50 fish and using 3 types of fish. That are kembung, tongkol, and bandeng fish. The parts of fish that researched is eye. On the fish eye, the eye color is changes when fish is in a bad condition. From the results of the classification program using the GUI method can be determined the classification result process with accuracy of the overall system in kembung fish is 93%, bandeng fish is 89%, and tongkol fish is 88%. The classification result of the freshness of fish meat using a fish eye imagery based on fuzzy logic method has a good result.
Keywords: *HSV, The freshness of fish, Fuzzy Logic, Matlab*

1. INTRODUCTION

The fish as one of the results of fisheries is one of the ingredients that no stranger again for the Indonesian people. Many consumers who did not know the quality of fish purchased from the traditional market as well as from modern markets because of ignorance will be the condition of the quality of fish that will be purchased. One factor to determine the quality of fish meat can use freshess. The parameters to determine the freshness of fish consists of physical factor, chemical and microbiological factor.

The fresh fish has a bright appearance and not grim, flesh fresh fish flexible enough if bent and will soon return to the original shape when released. Changes in the freshness of the fish will cause a real change in the brightness of its eyes on the fish in a good condition the eyeball fish still on the following conditions and the condition of the fish eyes is still clean and bright eyes will be dull because of the blood that began to enter into the eyes as a result of the outbreak blood vessels that there is in the eyes of the fish. In this research, the part that is used as the sample is its eyes. To determine the freshness of fish are physically can use organoleptic test. HSV color used for the color types such as color change that was arrested by man.

2. THE FRAMEWORK OF THE RESEARCH

System flow chart research design can be seen in the Figure (3.2).

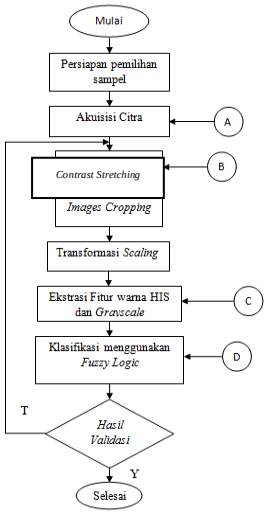


Figure 1 Flowchart of Research Design

2.1 Preparation Sample Selection

The selection of the samples that will be used in this research by tests organoleptic, on this test is intended to determine the quality of meat fish manually. This test is done by 6 peoples from Fisheries Laboratory Assistant of Sultan Ageng Tirtayasa University that have been given the materials and practices regarding Organoleptic Test. This test is done with how to fill the assessment sheet Organoleptic. Each fish will be observed and given a score on each of the physical condition of each fish by 6 the examiners, and will take the average value from score on each specification of each obtained score will determine the quality of the flesh of the fish is in such a condition what and see the changes occur on the condition of the eyes of the fish to appoint them score shows that the fish is in good condition. Relent to show the condition of the fish in the state of being and 4-1 to show the fish in a state of decay

2.2 Image Acquisition

The acquisition of the image is the early stages to get digital image. This stage begins from the object that will be taken his image, preparation tools, and on image digitalization. The image acquisition process is done using a digital camera. During the acquisition image process, the fish eyes samples are put on the sample box measuring 49 cm x 35 cm x 35 cm on the central position of the box and the camera put on above the sample box at a distance of 46 cm at an angle of 90° from samples of fish. The use of the sample box so that the camera can be placed in the same position and has not changed. The eyes of the fish that is used as the image data taken in the form of type JPEG file (*Joint Photographic Experts is Group*). Taking of the image is done when the fish in the fresh condition, good enough condition, and bad condition.

2.3 Preprocessing

Preprocessing stage is to increase the possibility of their success on the next digital image processing stage. On the stage of preprocessing that is used is the process of improving the quality of the image in the form of.

2.3.1 Contrast Stretching Processes

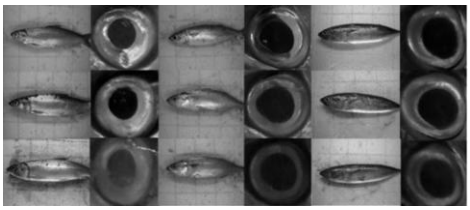
Contrast stretching processes aimed to increase the sharpness of the colors on the image so that the different colors is attained in the samples more clearly. Because the user distance far enough taking the results from the acquisition of the image especially in its eyes a little dark so that when the feature extraction process, the different colors that obtained less good. Using contrast stretching processes, hopefully can produce the different color for feature extraction process and further classification.

Setting the Contrast stretching processes by changing the point of coordinats (r1,s1) and (r2,s2) is the point of control of the level of the spread of gray levels.

2.3.2 Croppin

Cropping is the process of cutting the image on the specific coordinates on the image area. The aim is to take the eyes of the early image as a whole. To cut the part of the image used two coordinates, namely the coordinates of the beginning which is the beginning of the coordinates for the image of the results of the cutting and the coordinates of the end that is the point of the coordinates of the end of the image of the results of the cutting.

Two coordinats will mark a wide area in the eyes of the fish that will be separated. Results cropping process can be seen in Figure 2

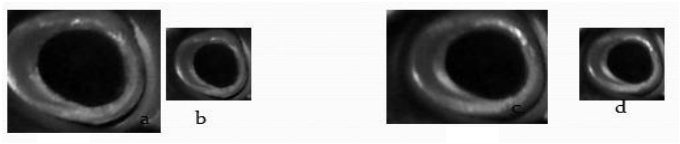


a b c

Figure 2 the process of Cropping Fish eyes a) milkfisn, b) fish flatulence, c)fish corn

2.3.3 Scalling

Scaling is intended to zoom in or zoom out the image in accordance with the desired scale factor, this research on the process of Scaling used for standardization of data that aims to equate the dimension of the image of the input that varies by changing the size of the images become 100×100 pixels so that at the time of the feature extraction process feature extraction results obtained on each sample is derived from the number of pixels the same.

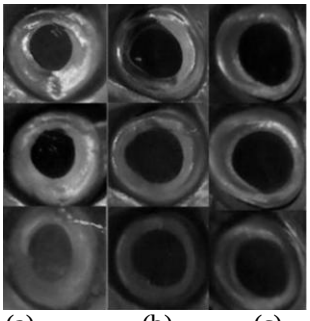


a c

Figure 3 a) the result image of cropping process with the image size is 198 x 186 pixels
b) the result image of scaling process with the image size is 100 x 100 pixels
c) the result image of cropping process with the image size is 216 x 180 pixel
d) the result image of scaling process with the image size is 100 x 100 pixels.

2.4 Feature Extraction

Feature extraction is a taking of the characteristics of a feature / objects that later characteristics information obtained will be analyzed for classification process. features that is used is a feature of the color to the process of classification. The value of the characteristic feature that is used is the Mean Hue, Mean Saturation, Mean Value and Mean Grayscale. Color feature selection because in the eyes of the fish changes is changing the color of the condition still fresh fish that have bright colors until the fish in the condition of the foul with the condition of the eyes become red and dull. HSV color is used because the color is the same as that was arrested by indra man Hue here used to see the color change that occurs on the decline in the quality of the freshness of the meat of the fish from fresh circumstances, and foul, because in the process of decay has the eyes of the fish will experience a change in the color of red that caused the entry of blood into the organ of the eyes of the fish while the saturation and value is used to view the changes the brightness of the eye. Their Grayscale used because when the image of the eyes of the fish that experienced decay has Their Grayscale value will be higher. On the feature extraction process used on samples of the milkfish is the Mean Hue, Mean Saturation, Mean Value and the Mean Their Grayscale, on fish samples flatulence features the color that is used is the Mean Hue, Mean Saturation and Mean Value and in the ears of fish samples using color features Mean Hue, Mean Saturation and Mean Value.



(a) (b) (c)

Figure 4 a) a sample of the image of the eyes of the bandeng fish b) samples of the image of the eyes of the fish bloated c) samples of the image of the eyes of the fish of the corn.

From figure 4 can be seen in the color change that occurs in the eyes of the fish at the fish in the fresh condition, medium and corrupt.

2.5 The Classification Using Fuzzy Logic

To get the results from the classification of the image of this fish used fuzzy logic to form a final decision. The steps stage classification using Fuzzy Logic.

2.5.1 Fuzzification

Fuzzification is the process to change the variable non-fuzzy (variable numeric) becomes fuzzy variables (variable for). The input value in the form of Mean Hue, Mean Saturation, Mean Value and the Mean Their Grayscale converted into variables for data processed to membership function using the curve shoulder. on the system there are 4 inputs namely Mean Hue, Mean Saturation, Mean Value and the Mean Their Grayscale This is done by willss cription be variables for a low, medium and high. 1 Then the output is a category variable for described in 3 classification of namely fresh fish, fish and fish rot. To determine the range of values for variables obtained from the results of the color feature extraction Mean Hue, Mean Saturation, Mean Value and the Mean Their Grayscale. From the results of estraksi feature, the value of fresh fish, and foul joined and arranged from the smallest nilia until the greatest value of each color features and is divided into 3 parts equally, the purpose of the division was to create a grouping of the variables for a low, medium and high.

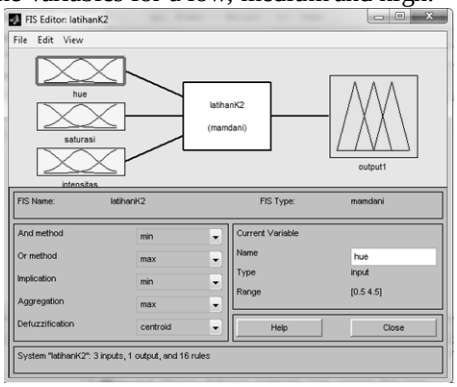


Figure 5. Fuzzy Inference System

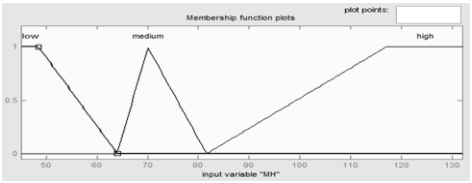


Figure 6. Membership function Mean Hue Bandeng Fish

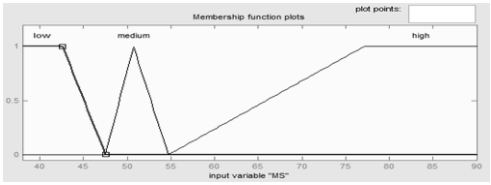


Figure 7 Membership function Mean Saturation Bandeng Fish

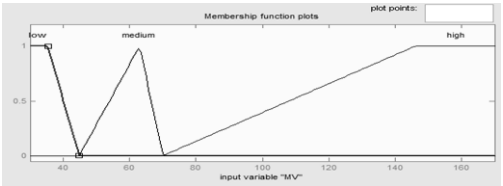


Figure 8 Membership function Mean Value Bandeng Fish

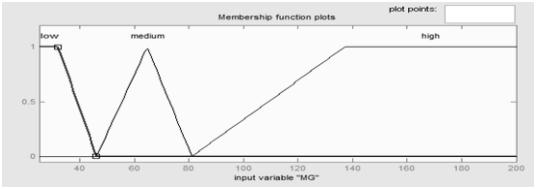


Figure 9 Membership function Mean Grayscale Bandeng Fish

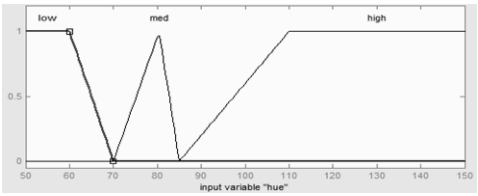


Figure 10 Membership function Mean Hue Kembung Fish

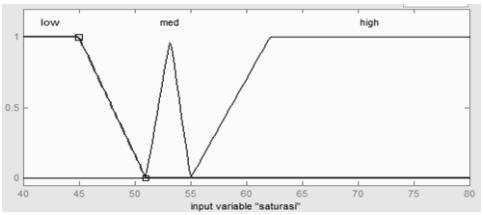


Figure 11 Membership function Mean Saturation Kembung Fish

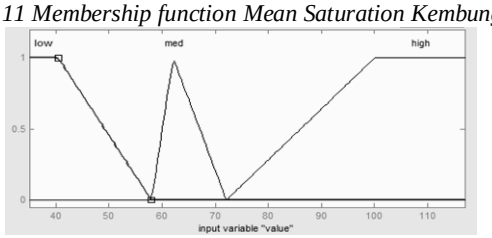


Figure 12 Membership function Mean Value Kembung Fish

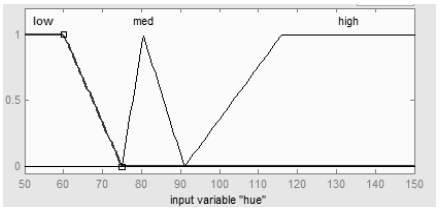


Figure 13 Membership function Mean Hue Tongkol Fish

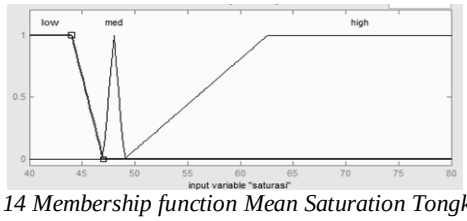


Figure 14 Membership function Mean Saturation Tongkol Fish

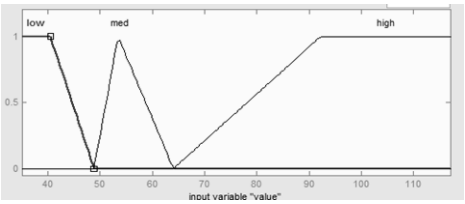


Figure 15 Membership function Mean Value Tongkol Fish

The output is divided into 3 parts fresh fish eyes and the eyes of the fish rot as shown in the Figure 16.

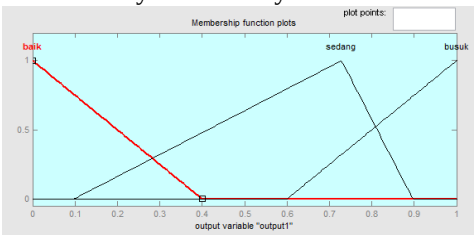


Figure 16 Membership function Output

2.5.2 Defuzzification

Defuzzification change the decision that is produced from the process of logic is still in the form of variables for a degree kenggotaan low, medium and high be numeric variables in accordance with the rule that made. Defuzzifikasi process on this research using the COA or centroid method. Centroid method takes the value of the point of the Center area of the curve. Centroid method is used because the value of the obtained fair compared to the other method.

3. RESULT AND ANALYSIS

The training data that has been processed using fuzzy method will establish a classification system that is used to test data. Data process a training conducted during the three times the experiment. The amount of data on each after is 90 image on each type of fish that consists of 30 image of good fish, 30 the image of the fish is and 30 the image of the fish rot. From the training data will be seen defuzzyfication value from each of the condition and will form a limitation defuzzyfication value that is used to determine the category of the freshness of the fish.

The Table 1 *results of defuzzycation*

Defuzzyfication	Kategori Mata Ikan
output <=0.49	Fresh Fish Eyes
>=0.501 *output* <-0.6	Moderate Fish
Output >=0.6	Rotten Fish Eyes

From 3 experiments training data such as the results in table 2, 3 and 4

The Table 2 *results of training Kembung Fish*

Kembung Fish			
The Experiment	Fresh	Moderate	Rotten
1	24	25	26
2	28	28	30
3	26	26	27
The average	25	28,7	26,3

The Table 3 *The results of the training Tongkol Fish*

Tongkol Fish			
The Experiment	Fresh	Moderate	Rotten
1	26	23	26
2	22	26	26
3	27	27	25
The average	25	25,3	25,7

The Table 4 *The results of the training Bandeng Fish*

Bandeng Fish			
The Experiment	Fresh	Moderate	Rotten
1	26	28	24
2	27	30	24
3	25	25	27

The average	26	27,7	25

From 3 experiments that have been done on kembung fish reachable values accuracy is 89%, tongkol fish is 84 % and on the bandeng fish is 87%.

The data from the training will form the rule of rule that will be used to test data. The number of test data that is used is 60 image on each type of fish with the division 20 image of good fish, 20 the image of the fish and 20 the image of the fish rot. and get the success. And the result achieved on the test data can be seen in the table 5.6 and 7.

The Table 5 *The results of the test Kembung Fish*

Kembung Fish			
The Experiment	Fresh	Moderate	Rotten
1	18	20	19
2	17	20	19
3	16	19	18
The average	17	19,7	18,7

The Table 6 *The results of the test Tongkol fish*

Tongkol fish			
The Experiment	Fresh	Moderate	Rotten
1	15	19	19
2	15	17	19
3	17	18	20
The average	15,7	18	19,3

The Table 7 *The test result Bandeng Fish*

Bandeng Fish			
The Experiment	Fresh	Moderate	Rotten
1	17	18	20
2	16	15	19
3	19	19	19
The average	17,3	17,3	19,3

From 3 experiments that have been done on fish flatulence reachable values of accuracy 92%, fish ears of 88 percent and on the milkfish 89%. The results were obtained due to a mapping error on the results of esktraksi color features test data that meets the conditions of a rule classification that one.

Validation data is used to see whether this system can be used by the image in addition to the training data and testing. The diguakan validation data on the milkfish and fish flatulence numbered 15 image that consists of 5 good fish image, 5 the image of the fish is and 5 the image of the fish rot. while on the ears of fish using only 9 image that consists of 3 image of fresh fish, 3 the image of the fish is and 3 the image of the fish rot. the result of the validation data can be seen in the table 8, 9 and 10.

The Table 8 *The result of the validation Kembung fish*

Kembung fish			
The Experiment	Fresh	Moderate	Rotten
1	4	5	5
2	3	5	5
3	3	5	5
The average	3,3	5	5

The Table 9 *The result of the validation Tongkol Fish*

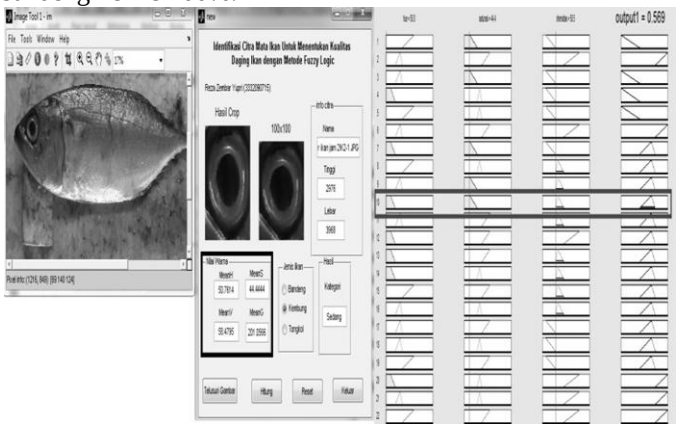
Tongkol Fish

The Experiment	Fresh	Moderate	Rotten
1	2	3	3
2	1	3	3
3	2	3	3
The average	1,7	3	3

The Table 10 *The result of the validation Bandeng Fish*

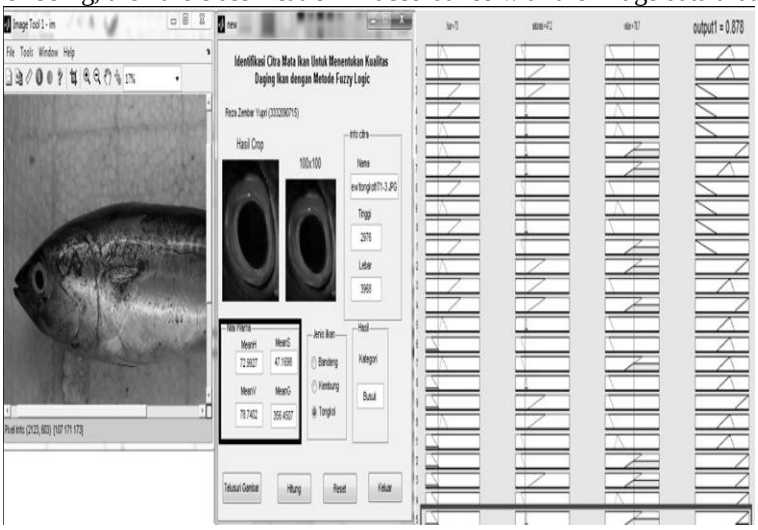
Bandeng Fish			
The Experiment	Fresh	Moderate	Rotten
1	4	5	5
2	4	5	5
3	4	5	5
The average	4	5	5

From 3 experiments that have been done on kembung fish flatulence reachable values accuracy is 88%, tongkol fish is of 85 %t and on the bandeng fish is 100%.



Pictures 17 The result of the validation on the classification Program The class is being

Image of 16 shows the image of the fish bloated with medium quality. Results of the extraction of features on the image of the black box indicates the value of the Mean hue of 50,76 that meet sayarat Membership function low, Mean saturation of 44,44 that meet sayarat Membership function low and Mean Value of 58,47 that meet sayarat Membership function medium that meets the conditions in the rule 10 mengahasilkan number of 0,569 output is shown in the red box. From the results of the determination of the deffuzzyfication on table 4.13 shows that the result is in the category of being, then the classification in accordance with the image data that is used.



Pictures 4.18 The result of the validation Classification Program on fresh Class

Figure 4.17 shows the image of the fish bloated with fresh quality. Results of the extraction of features on the image of 4.20 who voiced a black box with the value of the Mean hue of 72.99 that meet sayarat Membership function low Mean saturation of 47.16 that meet sayarat Membership function medium and Mean Value of 78.74 that meet sayarat Membership function high, who qualify on rule 15 mengahasilkan number of 0.878 output is shown in the red box. From the results of the determination of the deffuzzyfikasi on table 4.13 shows that the result is in the category of foul, then the classification is not in accordance with the image data that is used. Because on the image of the fish training ears of the value of the rule on when the Mean Hue low, Mean Saturation medium and Mean Value high formed the condition of the fish rot.

4. CONCLUSIONS

Succeeded in making the system identification of the image of the eyes of the fish to determine the quality of the flesh of the fish with the method Fuuzy Logic to 3 fish species to changes in fresh condition, and foul using color features.

From test results classification of the freshness of the meat of the fish that has been done can be calculated accuracy using the effectiveness of the system on the fish bloated obtained the results on the condition of fresh fish sensitivity 73% , specificity 92% and accuracy 85% , on the condition of the fish is specificity sensitivity 92%, 98% and accuracy 97% , and on the state of the corrupt specificity sensitivity 87%, 98% and accuracy 93%. On milkfish, fish fresh conditions obtained sensitivity 77% , specificity 92% and accuracy 87%, fish condition is obtained sensitivity 79% , specificity 94% and accuracy 88%, and fish rot conditions obtained the 93 percent specificity sensitivity 98% and accuracy 97%. In the ears of fish obtained first on the condition of fresh specificity sensitivity 67%, 89% and accuracy 80%, the condition is sensitivity 87%, 98% and accuracy specificity 93%, and on the condition of the corrupt specificity sensitivity 94%, 98% and accuracy 97%.

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