Classification of Segmented Milkfish Eyes using Cosine K-Nearest Neighbor

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***Abstract*— The classification of milkfish freshness based on the eyes is supported by the results of correct fish eye segmentation. Generally, the problems faced by segmentation results are many objects with similar characters and similar gray intensity. Segmentation with K-Means produces K layers of binary image according to the selected K cluster. As the result, many objects appear as the result of segmentation. Among all objects appear, the fish eye has a special character, where it is round black. The problem faced by classic K-Nearest Neighbor (KNN) in classification is sensitive to noise when using low K while using high K the classification performance falls to the most class that shouldn't as the result. We propose Cosine KNN (CosKNN) to solve the classic KNN problem where the classification results aren't taken from the most class of nearest neighbor. CosKNN gives soft value that represents the belonging level of each class to the testing data. To evaluate the performance of CosKNN, we use precision and recall. The experiment result shows that the CosKNN achieves high performance both precision and recall of 97.93% and 91.15%, respectively. Especially on precision performance, CosKNN achieves the highest performance compared to other methods, classic KNN and K-SVNN, while in recall performance, CosKNN achieves the highest performance for a combination of shape and color features.**

Keywords*— *segmentation, eye fish, milkfish, classification, K-Nearest Neighbor, shape feature, color feature

I. INTRODUCTION

The classification of milkfish freshness based on the eyes is supported by the results of correct fish eye segmentation. Current research on [1] fish freshness is conducted by using digital image processing to determine the freshness quality and shelf life span of the three most consumed fish in the Philippines. The detected fish are milkfish (Chanos chanos), round scad (Decapterus maruadsi) and short mackerel scad (Rastrelliger brachysoma). By using support vector machine (SVM), this research classifies the redness of the fish's eyes and gills as a measure of the fish freshness quality level. The number images of fish are 1680 images, include 720 images for milkfish, 480 images for round scad, and 480 images for short mackerel scad. The captured image are classified to 4 freshness levels and achieve 98% accuracy. In this study, the segmentation method used is a combination of histogram equalization and binary thresholding. Segmentation results still raise some noise objects in the binary image results. The next research in [2] classifies the freshness of the fish from level 1 (stale) to level 5 (fresh) based on RGB values of the eyes and gills. By using 800 images each of the eyes and gills, the system achieves 90% accuracy for milkfish. The system uses a mask to get segmented eye fish. Segmentation results do not clearly give eye segmentation results.

Good segmentation is expected to support good results recognition, such as research by [3], segment mango leaves using Otsu's thresholding in the HSV and YCbCr color spaces. The results of the study show that Cr band is more suitable for mango leaf segmentation with precision and recall of 0.995 and 0.971, respectively. The problem faced in the segmentation of milkfish eyes is many objects with similar characters and similar gray intensity. Research conducted by [4] segment the milkfish using a spatial filter to get segmented eye milkfish in the HSV color space. The results of segmentation are compared to the ground truth to get the success rate, precision achieved by 84.04% while recall was achieved by 43.08%. The problem faced by K-Nearest Neighbor is sensitive to noise especially when using low K while using high K the classification performance falls to the most class that shouldn't as the result. We propose Cosine KNN where the classification results aren't taken from the most class of nearest neighbor. We give soft value that represents the belonging level of each class to testing data. These values start from 0 to infinity according to K used.

In this research paper, the framework for segmenting milkfish eyes using K-Means Clustering and Cosinus K-Nearest Neighbor (CosKNN) classification is presented to explain how we conduct the segmentation. K-Means segmentation produces K layers of the binary image according to the selected K cluster. As the result, many objects appear as a result of segmentation. Among all the objects that appear, the fish eye has a special character, where it is round black. Based on these different characters, the authors use a classification approach to recognize the object of the correct fish eye. In this paper, we propose Cosine K-Nearest Neighbor (CosKNN) as the classification method to deal with the classic KNN problem.

K-Means as an image segmentation method is also effective to use, such as research [5] recognize plant diseased leaf, K-Means is used to segment the lesion image from each super-pixel. By using pyramid of histograms of orientation

gradients (PHOG) descriptor from three color band of each segmented lesion image and its grayscale image, the system provides a feasible solution for plant diseased leaf image segmentation and plant disease recognition. K-Means clustering also used by [6] with neutrosophy to deal with indeterminacy factor of image pixels. The approach is to transform the image into the neutrosophic set by calculating truth, falsity and indeterminacy values of pixels and then, the clustering technique based on neutrosophic set is used for image segmentation. The cluster results are then refined to be more suitable for the segmentation. This algorithm provides better results than only K-means clustering approach. In research [7] combine K-Means and mathematical morphology to conduct fish image segmentation. The best number of clusters is determined by the number of gray histogram peaks and the cluster centers data is filtered by comparing the mean with the threshold by Otsu. To get the contour of the fish body, the research use mathematical morphology especially opeing and closing. The result of the experiment, system achieve good result in separation between the fish image and the background with complex backgrounds.

To measure the validity of segmentation results, the authors conduct several tests by comparing the parameters used during segmentation, namely K from CosKNN. K-Means also uses K as the number of clusters that would produces K layer of the segmented image, where the greater the K the more objects will be produced by K-Means. In this study, we use K = 3 as the number of clusters. The features used in K-Means are Red, Green and Blue bands from the RGB color space. The K of CosKNN affects the classification results where the selection of K neighbors is a difficult problem. In the classic K-NN, if the K is too small, the prediction results will be sensitive to the presence of noise. On the other hand, if K is too large, then the closest neighbor chosen may be too much from another class which is actually irrelevant because of the distance too far [8]. The number of fish eye objects on the results of segmentation is far less than other objects, and attention to fish eyes is more important than not fish eyes, so performance measurements can't use accuracy, in this study the authors use precision and recall as evaluation metrics. The authors also conduct tests by comparing between CosKNN and the other methods, as follows: classic KNN and K-Support Vector Nearest Neighbor (K-SVNN). This test is used to prove that CosKNN achieved better performance rather than other methods.

The authors use 71 images of fish eyes with varying sizes ranging from 180x180 pixels to 655x655 pixels. The image of the fish eye has gone through the crop stage of all parts of the fish body. The image is taken in a normal environment in the morning and evening. At night there is no other lighting except the room lights. Image taking distance is 20-30 cm with normal image effects.

II. Research Methodology

A. Segmentation Framework

The segmentation framework is presented in Figure 1. The framework for segmentation of milkfish eyes using K-Means and CosKNN is explained as follows:

1. Extract Red, Green and Blue band of RGB color space

   In this first step, the authors separate Red, Green and Blue bands from RGB images. The three bands will be used as clustering features with K-Means.

2. Arrange R, G, B band to be K-Means dataset

   Each band R, G and B is one layer images, so the authors arrange for each band to act as a feature on K-Means. Suppose that [r, c] is the size of the row and column of the band, so we change the size of each band into the matrix [rxc, 1]. By combining the three band matrices into the matrix [rxc, 3] then we get the K-Means dataset with rxc data and 3 features.

3. Clustering with K-Means

   In this step, we do clustering with K-Means. The distance used to measure the similarity is Euclidean, while the number of clusters used during this study are 3 clusters.

4. Reshape K cluster to be K layer image

   The K cluster as a result of K-Means clustering will be K layer image. Each layer must be reshape into the original rxc image.

5. Morphological operation

   At each layer, the image is treated by morphological operations to reduce small and useless objects. The morphological operations used are closing and opening using strel disk with a radius of 1 pixel.

6. Shape and color features extraction

   In this step, we extract the shape and color features. In the shape feature, the authors extract circularity, major and minor axis objects, eccentricity, and major axis ratios with image width. In the color feature, the authors extract the mean and standard deviation from the gray image of each object.

7. Cosine K-Nearest Neighbor (CosKNN) classification

   This step is the final step of segmentation where extracted features are classified using CosKNN. In this study we used many variations of K, as explained in the next section.c

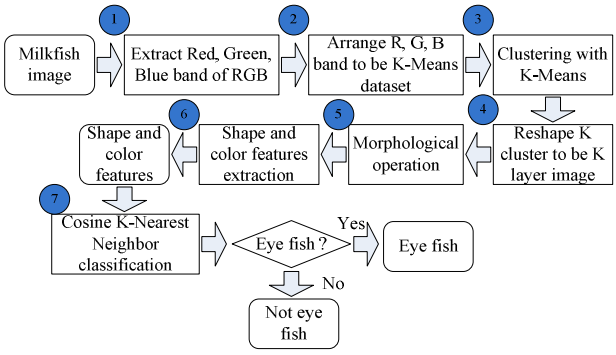


Fig. 1. Framework for milkfish segmentation using K-Means and CosKNN

B. The Dataset

We generated 71 images of fish eyes that have gone through the cropping stage of all parts of the fish body, the

image size varies from 180x180 pixels to 655x655 pixels. The image is captured in the normal morning and night environment. At night there is no help from other lights besides the room lights. Image capturing distance is 20-30 cm with normal image effects. The environment of image taking in this study is adjusted to the situation when the application would be used in a normal environment. In all images there is only one fish eye object. Examples of fish eye images used in this study are presented in Figure 2 (a) - (c).

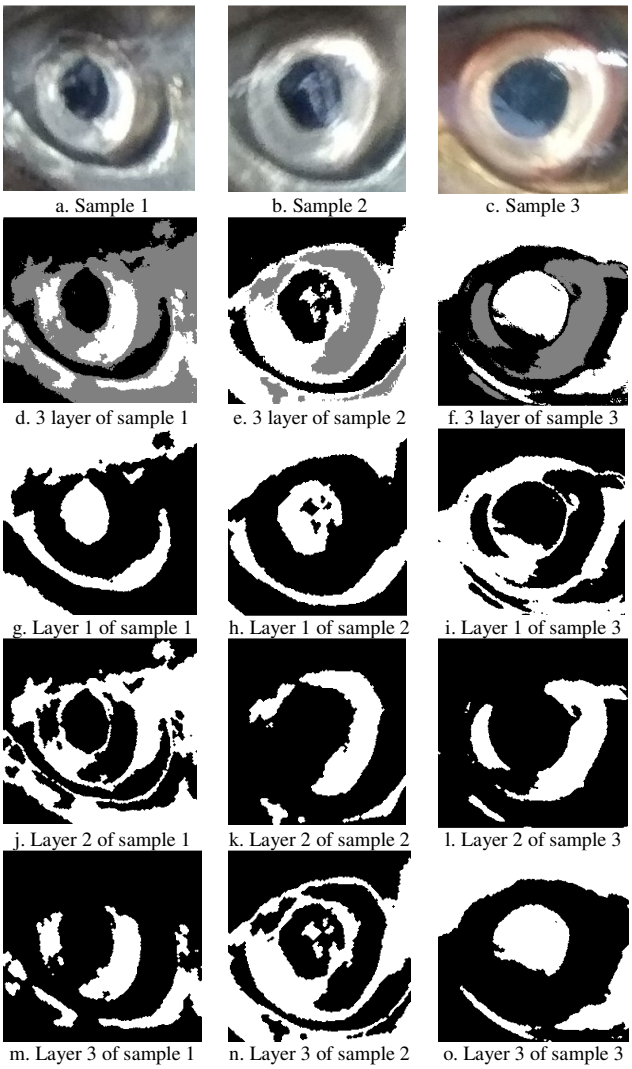


Fig. 2. Milkfish eye images and the result of K-Means clustering with 3 cluster

C. Cosinus K-Nearest Neighbor (CosKNN)

In the classic K-NN, if the K is too small, the prediction results will be sensitive to the presence of noise. On the other hand, if K is too large, then the closest neighbor chosen may be too much from another class which is actually irrelevant because of the distance too far [8]. To solve this problem we propose Cosinus KNN where we use soft values that represent ownership of each class to the test data. This soft value is highly dependent on the distance between the test data and the K nearest neighbor. To get a Cosinus value for each nearest neighbors, we involve a pair of two neighbors. So, for the 3 closest neighbors, we will get 3 pairs of neighbors. For example the 3-NN are x1, x2, and x3. Then the pair is: x_1x_2, x_1x_3, x_2x_3. Furthermore, each pair will have 2 cosine values according to the data pair. The cosine values are then added together according to each class.

Suppose the class of the data set is C=c_1, c_2, …, c_n, where n is the number of classes. While $X = x_1, x_2, x_i, \ldots, x_k$ is the nearest neighbor chosen from the training data, k is the number of nearest neighbors. Then for the nearest neighboring pair x_i and x_j will have the cosine value as follows:

$$Cos(x_i x_j) = 1 - \frac{d_i}{\sqrt{d_i^2 + d_j^2}} \qquad (1)$$

$$Cos(x_j x_i) = 1 - \frac{d_j}{\sqrt{d_i^2 + d_j^2}}$$

Where d is the distance of training data to test data. $Cos(x_1 x_2)$ will belong to the c_i class according to the class owned by x_1. For example, the pair of closest neighboring and class as follows: (x_1,c_1), (x_2,c_2), (x_3,c_1). Then the cosine value for the pair x_1x_2 is:

$Cos(x_1 x_2) = 1 - \frac{d_1}{\sqrt{d_1^2 + d_2^2}}$ will belong to the class c_1,

and

$Cos(x_2 x_1) = 1 - \frac{d_2}{\sqrt{d_1^2 + d_2^2}}$ will belong to the class c_2.

Next, to accumulate all cosine values of the R test data in the class c_j , we use (2):

$$SumofCos(\mathrm{R}, c_j) = \sum_{i=1}^{n} Cos(x_i), c_i = c_j, j = 1,\ldots,n \qquad (2)$$

The $SumofCos(\mathrm{R}, c_j)$ is a soft value that ranges in [0,∞]. A value of zero (0) means that none of the nearest neighbors has a class c_j. The greater K used, the greater this value corresponds to the number of cosines calculated.

III. Results and Discussions

We apply testing the CosKNN by classifying 71 segmented fish eye images with K-Means clustering, we use K-fold Cross Validation with K = 3, meaning that 2/3 part of the data is used as training data while 1/3 part as the testing data. For CosKNN classification, we use varies of K as follows: 3, 5, 7, 9, 11, 13, 15, 17 and 19. In each K, we evaluate using precision and recall. Next, we get the average precision and recall from all of them.

The segmented image with K-Means clustering is presented in Figure 2 (d) - (o), the clustering result of sample 1 is presented by image (d), while each layer is presented by Figure 2 (g), (j) and (m). In Figure 2(d) we present code of layer 1, 2 and 3 by black, grey and white respectively. Then,

each code is presented by binary image in Figure 2 (d), (j) and (m). Similarly for samples 2 and 3.

The results of the CosKNN classification on sample 1 images are presented in Table I. The RM2M column is the ratio of Minor Axis Length and Major Axis Length. Real Label is a sign whether the object is a fish eye or not (1 means eye fish, 0 means not). The Result column is the classification result by CosKNN with selected features, we divide it into 3 types as follows: S (Shape feature), C (color feature), and S + C (Shape and Color feature). There are 25 objects divided into 3 clusters, fish eye objects is attended to cluster 1, on all types of features, all predict as fish eyes correctly both shape, color and shape + color. There are no objects other than fish eyes that are recognized as fish eyes. So, all segmentation results are perfect.

The results achieved by the image sample 2 are presented in Table II, there are 16 objects divided into 3 clusters, the fish eye object is attended to cluster 1, on all feature options, shape features and shape and color combinations successfully predict correctly. While the color feature is failed to predict as a fish eye (zero value). The color feature also incorrectly predicts one object as a fish eye. So, the results of this segmentation only succeed in the shape and combination of shape and color features.

TABLE I. THE RESULT OF COSKNN CLASSIFICATION FOR IMAGE SAMPLE 1

No.	Cluster	Circularity	RM2M	Eccentricity	RM2W	Average	Stadev	Real Label	Result		
									S	C	S+C
1	1	0.11	0.92	0.39	1.14	83.67	23.24	0	0	0	0
2	1	0.48	0.51	0.86	0.36	75.71	19.39	0	0	0	0
3	1	0.85	0.74	0.67	0.32	70.75	22.27	1	1	1	1
4	1	0.53	0.54	0.84	0.11	112.86	5.03	0	0	0	0
5	2	0.42	0.40	0.92	0.18	189.18	25.98	0	0	0	0
6	2	0.75	0.88	0.47	0.07	183.42	11.58	0	0	0	0
7	2	0.30	0.31	0.95	0.30	189.96	11.27	0	0	0	0
8	2	0.37	0.48	0.88	0.25	197.55	16.92	0	0	0	0
9	2	1.99	1.00	0.00	0.01	173.34	1.68	0	0	0	0
10	2	1.99	1.00	0.00	0.01	169.12	2.44	0	0	0	0
11	2	0.94	0.54	0.84	0.05	177.27	2.32	0	0	0	0
12	2	0.32	0.43	0.90	0.52	219.10	26.77	0	0	0	0
13	2	0.21	0.37	0.93	0.57	201.16	27.24	0	0	0	0
14	2	1.99	1.00	0.00	0.01	158.77	5.83	0	0	0	0
15	2	0.27	0.38	0.92	0.18	184.10	9.80	0	0	0	0
16	2	1.64	0.68	0.73	0.02	161.04	3.58	0	0	0	0
17	2	0.89	0.57	0.82	0.02	173.55	4.93	0	0	0	0
18	2	2.39	0.68	0.73	0.01	100.49	8.00	0	0	0	0
19	3	0.09	0.24	0.97	1.30	149.52	24.10	0	0	0	0
20	3	0.25	0.62	0.79	1.01	147.99	47.00	0	0	0	0
21	3	0.70	0.28	0.96	0.04	150.13	9.24	0	0	0	0
22	3	1.93	0.84	0.55	0.01	151.69	12.86	0	0	0	0
23	3	1.07	0.44	0.90	0.03	154.22	11.69	0	0	0	0
24	3	1.22	0.79	0.62	0.02	98.86	3.44	0	0	0	0
25	3	0.13	0.24	0.97	0.36	148.14	17.54	0	0	0	0

TABLE II. THE RESULT OF COSKNN CLASSIFICATION FOR IMAGE SAMPLE 2

No.	Cluster	Circularity	RM2M	Eccentricity	RM2W	Average	Stadev	Real Label	Result		
									S	C	S+C
1	1	0.34	0.29	0.96	1.22	76.82	22.54	0	0	1	0
2	1	0.14	0.34	0.94	1.37	98.80	15.69	0	0	0	0
3	1	0.64	0.56	0.83	0.11	78.39	22.92	0	0	1	0
4	1	0.64	0.81	0.59	0.41	82.94	25.08	1	1	0	1
5	1	1.99	1.00	0.00	0.01	127.67	1.13	0	0	0	0
6	2	0.56	0.77	0.64	0.98	159.00	52.68	0	0	0	0
7	2	0.10	0.24	0.97	1.34	145.89	27.80	0	0	0	0
8	2	0.20	0.11	0.99	0.24	138.27	37.37	0	0	0	0
9	3	0.39	0.33	0.94	0.32	201.81	11.11	0	0	0	0
10	3	0.52	0.51	0.86	0.18	193.10	20.67	0	0	0	0
11	3	1.99	1.00	0.00	0.01	185.63	0.67	0	0	0	0
12	3	1.05	0.73	0.68	0.03	180.10	4.52	0	0	0	0
13	3	1.23	0.89	0.46	0.04	173.02	13.38	0	0	0	0
14	3	0.27	0.45	0.89	0.86	225.52	20.34	0	0	0	0
15	3	0.43	0.22	0.98	0.11	173.98	10.05	0	0	0	0
16	3	0.36	0.27	0.96	0.34	198.01	22.69	0	0	0	0

TABLE III. THE RESULT OF COSKNN CLASSIFICATION FOR IMAGE SAMPLE 3

No.	Cluster	Circularity	RM2M	Eccentricity	RM2W	Average	Stadev	Real Label	Result		
									S	C	S+C
1	1	0.06	0.83	0.56	1.18	157.60	23.84	0	0	0	0
2	1	1.41	0.62	0.79	0.01	105.91	0.43	0	0	0	0
3	1	1.41	0.62	0.79	0.01	161.84	8.98	0	0	0	0
4	1	1.99	1.00	0.00	0.01	99.82	1.44	0	0	0	0
5	1	1.69	0.81	0.59	0.01	110.65	2.03	0	0	0	0
6	2	1.23	0.61	0.79	0.02	133.68	22.35	0	0	0	0
7	2	0.91	0.50	0.87	0.02	191.00	1.13	0	0	0	0
8	2	0.49	0.31	0.95	0.05	192.15	1.53	0	0	0	0
9	2	1.99	1.00	0.00	0.01	191.10	0.21	0	0	0	0
10	2	0.34	0.16	0.99	0.25	207.85	8.40	0	0	0	0
11	2	0.41	0.37	0.93	0.38	212.21	11.46	0	0	0	0
12	2	1.34	0.58	0.81	0.02	192.63	0.37	0	0	0	0
13	2	0.65	0.40	0.92	0.04	193.19	0.56	0	0	0	0
14	2	0.19	0.42	0.91	0.84	232.54	19.31	0	0	0	0
15	2	0.47	0.17	0.98	0.05	104.61	8.13	0	0	0	0
16	2	0.78	0.28	0.96	0.03	86.59	18.03	0	0	0	0
17	3	0.33	0.27	0.96	1.28	75.87	16.00	0	0	0	0
18	3	0.18	0.13	0.99	0.50	117.00	7.20	0	0	0	0
19	3	0.61	0.84	0.54	0.40	82.72	15.83	1	1	0	1
20	3	0.66	0.43	0.90	0.04	125.83	1.28	0	0	0	0
21	3	1.93	0.84	0.55	0.01	136.92	5.54	0	0	0	0
22	3	1.40	0.75	0.67	0.02	105.57	13.88	0	0	0	0
23	3	1.10	0.50	0.87	0.02	83.22	11.66	0	0	0	0
24	3	0.29	0.48	0.88	0.52	93.80	17.36	0	0	0	0
25	3	1.25	0.53	0.85	0.02	131.25	1.12	0	0	0	0
26	3	0.72	0.49	0.87	0.03	131.29	3.06	0	0	0	0
27	3	1.03	0.47	0.88	0.02	97.35	15.27	0	0	0	0

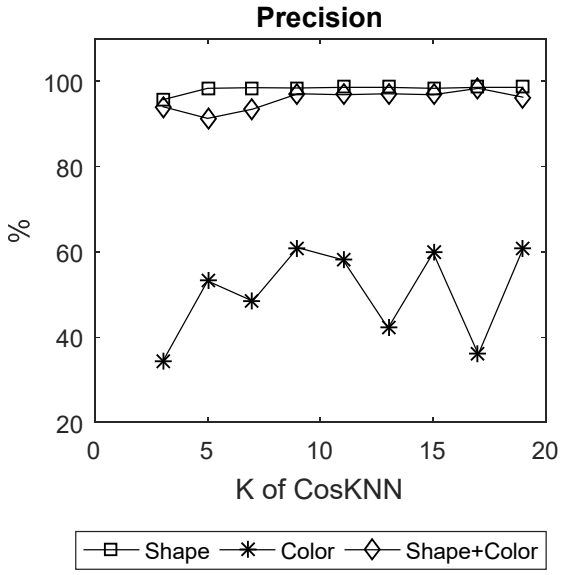
The results achieved by the image sample 3 are presented in Table III, there are 27 objects divided into 3 clusters, the fish eye object is attended to cluster 3, on all feature choices, shape features and shape and color combinations successfully predict correctly. While the color feature is failed to predict as a fish eye (zero value). There are no objects other than fish eyes that are detected as fish eyes. So, the results of this segmentation only succeed in the shape and combination of shape and color features.

We apply testing with the K option used by CosKNN. We choose K as follows: 3,5,7,9,11,13,15,17 and 19. By testing each K option in 71 images and Cross Validation, we get precision and recall. We compare the precision and recall performance of each feature shape, color and combination of shapes and colors. The results are presented in Figure 3.

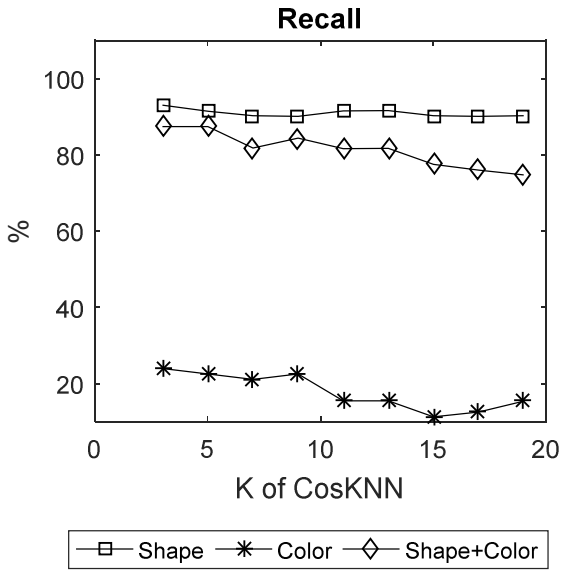
In this study, precision means the number of fish eye images objects that have been detected from all objects detected as fish eyes. Of course, one image only contains one fish eye, so the recall means that the number of the eye fish images that have been detected from all the images tested.

In the graph presented in Figure 3 (a), the result of segmentation with precision of shape features are always the best among all the other features, even the color features provide very bad precision below 70%. Thus, the classification for recognizing eye fish can be conducted using only the shape features, without combining color features.

In the graph presented in Figure 3 (a), the result of segmentation with precision of shape features are always the best among all the other features, even the color features provide very bad precision below 70%. Thus, the classification for recognizing eye fish can be conducted using only the shape features, without combining color features.



a. Precision performance



b. Recall performance

Fig. 3. Precision and recall performance

The recall performance also provides similar results, the shape feature successfully classifies objects with the best performance on all varies of K, where recall is always above 90%. While the combination of shape and color features achieve lower recall performance. Different results are achieved by the color feature where the recall achieved isn't up to 40%, of course this performance is very bad.

TABLE IV. THE RESULT OF COSKNN CLASSIFICATION FOR IMAGE SAMPLE 3

Features	Precision			Recall		
	CosKNN	**KNN**	**K-SVNN**	**CosKNN**	**KNN**	**K-SVNN**
Shape	**97.93%**	96.20%	95.77%	91.15%	**92.10%**	90.76%
Color	**43.86%**	43.86%	43.00%	19.30%	20.00%	**21.44%**
Shape+ Color	**95.14%**	94.12%	95.09%	**82.55%**	82.23%	81.49%

We resume performance evaluations into average precision and recall, as presented in Table IV. We also compare the performance with the other Nearest Neighbor method: KNN, and K-SVNN. For precision, CosKNN achieves the best performance for all varies of features compared to other method, the precision for shape, color, and combination of shape and color are 97.93%, 43.86%, and 95.14% respectively. The best recall performance are achieved by KNN with the shape feature, the recall performance is 92.10%. The performance of CossKNN achieves the best result with the combination of shape and color feature, the recall performance is 82.5%.

This research also provides evidence that the color feature can't improve the system performance. This can be seen on all method used in this research that the color feature performance isn't up to 44%. Of course, this is bad performance.

IV. CONCLUSION

From the research conducted, it can be concluded that CosKNN provide high performance both precision and recall. Especially on precision performance, CosKNN achieves the highest performance compared to other method, classic KNN and K-SVNN, while in recall performance, CosKNN achieve highest performance for combination of shape and color features. The color features are less suitable because it provides very poor precision and recall performance, even the performance of the shape features decreases when joining color features. The suggestion for the next research is to try using texture features to classify fish eye objects and try other methods such as edge detection or other region-based methods to segment milkfish eyes.

ACKNOWLEDGMENT

We would like to thank Directorate of Research and Community Service (DRPM) DIKTI that fund Authors' research in the scheme of Basic Research year 2019 at University of Bhayangkara Surabaya, with contract number 008/SP2H/LT/MULTI/L7/2019 on 26 March 2019, and 170/LPPM/IV/2019/UB on 4 April 2019.

REFERENCES

[1] L. K. S. Tolentino, Orillo, J.W.F., Aguacito, P.D., Colango1, E.J.M, Malit, J.R.H., Marcelino, J.T.G., Nadora, A.C., Odeza, A.J.D., "Fish Freshness Determination through Support Vector Machine," *Journal of Telecommunication, Electronic andComputer Engineering*, vol. 9, pp. 139-143, 2017.

[2] I. C. Navotas, Santos, C.N.V, Balderrama, E.J.M., Candido, F.E.B., Villacanas, A.J.E., Velasco, J.S., "Fish Identification And Freshness Classification Through Image Processing Using Artificial Neural Network," *ARPN Journal of Engineering and Applied Sciences*, vol. 13, pp. 4912-4922, 2018.

[3] E. Prasetyo, Adityo, R.D., Suciati, N., and Fatichah, C., "Mango Leaf Image Segmentation on HSV and YCbCr Color Spaces Using Otsu Thresholding," in *International Conference on Science and Technology*, Yogyakarta, 2017.

[4] E. Prasetyo, "Eye Black Circle of Milkfish Segmentation on HSV Color Space," *Journal of Electrical Engineering and Computer Sciences*, vol. 3, pp. 377-380, 2018.

[5] S. Zhang, Wang, H., Huang, W., You, Z., "Plant diseased leaf segmentation and recognition by fusion of superpixel, K-means and PHOG," *Optik*, vol. 157, pp. 866-872, 2018.

[6] M. N. Qureshi, Ahamad, M.V., "An Improved Method for Image Segmentation Using K-Means Clustering with Neutrosophic Logic," in *International Conference on Computational Intelligence and Data Science*, 2018, pp. 534-540.

[7] H. Yao, Duana, Q., Li, D., Wang, J., "An improved K-means clustering algorithm for fish image segmentation," *Mathematical and Computer Modelling*, vol. 58, pp. 790-798, 2013.

[8] X. Wu, Kumar, V. , *The Top Ten Algorithms in Data Mining*. Boca Raton London: CRC Press Taylor & Francis Group, 2009.

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Classification of Segmented Milkfish Eyes using Cosine K-Nearest Neighbor
Mr. Eko Prasetyo, Mr. R. Dimas Adityo and Mrs. Rani Purbaningtyas
2019 2nd International Conference on Applied Information Technology and Innovation (ICAITI)

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Parallel Session A: Electrical and Electronic Engineering

Location: Room I

No	Time	ID Paper	Title	Author
1	13.00 - 13.15	1570567070	Dirac Optical Materials for Low-Power All-Optical Plasmonic Devices	Kelvin J. A. Ooi (Xiamen University Malaysia); Yee Sin Ang (Singapore University of Technology and Design); Qingwei Zhai (Xiamen University Malaysia); Dawn T.H (Singapore University of Technology and Design); L. K. Ang (Singapore University of Technology and Design); Chong Kim Ong (National University of Singapore)
2	13.15 - 13.30	1570568219	Low-Power CMOS Variable Gain Amplifier for Modern RF Receiver	M.A.S. Bhuiyan, Z.Fan, Y.W.Wei, ffgG.F.Kaim(Xiamen University Malaysia), M.B.I.Reaz (Universiti Kebangsaan Malaysia), M.T.I Badal (RMIT University, Melbourne Australia)
3	13.30 - 13.45	1570569610	SWIPT-Assisted Device-to-Device Communications Underlaying a Cellular System	Hieu Van Nguyen, Hyeon Min Kim, Gil-Mo Kang, Yoan Shin and Oh-Soon Shin (Soongsil University, Korea)
4	13.45 - 14.00	1570584506	Simulation Of Link Failure Handling in Jellyfish Topology on Software Defined Networks Using Floyd-Warshall and Johnson Algorithm	Muhammad Arief Nugroho (Telkom University, Indonesia); Andrian Rakhmatsyah, Regita Anjani (School of Computing - Telkom University, Indonesia)
5	14.00 - 14.15	1570587007	Design of an Indoor Localization System based on WLAN for Assisting Victim's Evacuation Process	Viska Mutiawani, Cut Thifal Nazila, Kurnia Saputra and Amalia Mabrina MR (Syiah Kuala University, Banda Aceh, Indonesia)
6	14.15 - 14.30	1570587441	Three-Phase Direct Matrix Converter with Space Vector Modulation for Induction Motor Drive	Era Purwanto, Farid Dwi Murdianto, Dahried Wahyu Herlambang, Gamar Basuki, Mentari Putri Jati (Politeknik Elektronika Negeri Surabaya, Indonesia)
7	14.30 - 14.45	1570587837	Implementation of Single Stage Converter (Z-Source Inverter) For Induction Motor Supply	Indra Ferdiansyah, Era Purwanto, Lucky Pradigta S.R, Diah Septi Yanaratri, Rachma Prilian Eviningsih, Tita Aprilia(Politeknik Elektronika Negeri Surabaya, Indonesia)
8	14.45 - 15.00	1570589016	Multi Agent Protocol for Cooperative Rear-end Collision Avoidance System	Noor Cholis Basjaruddin (Politeknik Negeri Bandung, Indonesia); Zakka Izzatur Rahman Noor, Dwi Hendratmo Widyantoro (Institut Teknologi Bandung Indonesia)

No	Time	ID Paper	Title	Author
9	15.00 - 15.15	1570589081	Design Of Single Phase Full Bridge Inverter for Uninterruptible Power Supply (UPS)	Epyk Sunarno, Indhana Sudiharto, Indra Ferdiansyah, Syechu Dwitya Nugraha,Ony Asrarul Qudsi (Politeknik Elektronika Negeri Surabaya, Indonesia)
10	15.15 - 15.30	1570589085	Design of Battery Charging System as Supply of Rice Threshers In Tractor	Sutedjo,Indra Ferdiansyah, Ony Asrarul Qudsi, Fandi Setiawan (Politeknik Elektronika Negeri Surabaya, Indonesia)
11	15.30 - 15.45	1570589214	Movement Control of Two Wheels Balancing Robot using SMC based on Lyapunov Analysis	Nurul Hasanah, Syadza Atikah Rahmah, Wulandari Puspita Sari, Niam Tamami, Alrijadjis, Bambang Sumantri (Politeknik Elektronika Negeri Surabaya, Indonesia)
12	15.45 - 16.00	1570589829	An Unorthodox Way of Farming Without Intermediaries Through Blockchain	Shovon Paul, Jubair Islam Joy, Shaila Sarker, Bangladesh);Abdullah Al Haris Shakib, Sharif Ahmed, Amit Kumar Das (East West University, Dhaka Bangladesh)
13	16.00 - 16.15	1570589837	Security Concerns of Ridesharing Services in Bangladesh	Shamse Tasnim Cynthia, Moname Majumder, Anika Tabassum, Nazmun Nahar Khanom, Rashedul Amin Tuhin, Amit Kumar Das (East West University, Dhaka Bangladesh)
14	16.15 - 16.30	1570589889	LACP Experiment using Multiple Flow Table in Ryu SDN Controller	Farid Baskoro, Risanuri Hidayat, Sigit Basuki Wibowo (Universitas Gadjah Mada Yogyakarta, Indonesia)
15	16.30 - 16.45	1570589948	Separation of Acoustic Signals on a Compressor Using FastICA	Anindita Adikaputri Vinaya, Sefri Yulianto, Qurrotin A'yunina M. Okta Arifianti(Universitas Internasional Semen Indonesia Gresik, Indonesia), Dhany Arifianto, Aulia Siti Aisjah (Institut Teknologi Sepuluh Nopember Surabaya, Indonesia)
16	16.45- 17.00	1570563809	DDoS Detection on Network Protocol Using Neural Network with Feature Extract Optimization	Andi Maslan (Universitas Putera Batam Batam Indonesia); Kamaruddin Malik Mohammad, Feresa Binti Mohd Foozy (Universiti Tun Hussein Onn Malaysia, Johor Malaysia); Sestri Novia Rizki (Universitas Putera Batam Batam Indonesia)

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Parallel Session B: Artificial Intelligents

Location: Room II

No	Time	ID Paper	Title	Author
1	13.00 - 13.15	1570569671	Prediction of Semantically Correct Bangla Words Using Stupid Backoff and Word-Embedding Model	Tanni Mittra, Linta Islam, Deepak Chandra Roy (East West University, Bangladesh)
2	13.15 - 13.30	1570569714	Priority Path for Mutant Repairs on Mutation Testing	Sasa Ani Arnomo (Universitas Putera Batam, Indonesia); Noraini Binti Ibrahim (Universiti Tun Hussein Onn Malaysia, Malaysia)
3	13.30 - 13.45	1570570856	Participatory Heuristic Evaluations of Jeliot Mobile: End-users evaluating usability of their mlearning application	Muhammad Mustafa Hassan (University of Eastern Finland, Finland)
4	13.45 - 14.00	1570584246	Comparative Study on Handwriting Recognition by Machine Learning	Anandika Sharma, Anupam Sharma (Thapar institute of engineering and technology Patiala, Punjab)
5	14.00 - 14.15	1570587846	Optimization of Genetic Algorithms on Backpropagation Neural Network to Predict National Rice Production Levels	Aditya Wisnugraha Sugiyarto, Dhoriva Urwatul Wutsqa, Novia Hendiyani, Achmad Ramadhanna'il Rasjava (Yogyakarta State University, Yogyakarta Indonesia)
6	14.15 - 14.30	1570588496	Ultra Step Up Converter Using Fuzzy Sugeno on HVDC Application	Arman Jaya, Farid Dwi Murdianto, Era Purwanto, Ardiansyah Rachmatdianto (Electronics Engineering Polytechnic Institute of Surabaya, Indonesia)
7	14.30 - 14.45	1570589024	Implementation of Maximum Power Point Tracking on Solar Panels using Cuckoo Search Algorithm Method	Indra Ferdiansyah, Sutedjo, Ony Asrarul Qudsi, Alvin Noer Ramadhan (Politeknik Elektronika Negeri Surabaya)
8	14.45 - 15.00	1570589567	Classification of Segmented Milkfish Eyes using Cosine K-Nearest Neighbor	Eko Prasetyo, R Dimas Adityo, Rani Purbaningtyas (University of Bhayangkara Surabaya, Indonesia)
9	15.00 - 15.15	1570589855	Bangla Word Prediction and Sentence Completion Using GRU: an Extended Version of RNN on n-gram Language Model	Omor Faruk Rakib, Shahinur Akter, Md Azim Khan, Amit Kumar Das, Khan Mohammad Habibullah (East West University, Bangladesh)

No	Time	ID Paper	Title	Author
10	15.15 - 15.30	1570590170	An intelligent Approach for English Word Prediction Using Deep Neural Network	Omor Faruk Rakib, Shahinur Akter, Md Azim Khan, Amit Kumar Das (East West University, Bangladesh)
11	15.30 - 15.45	1570590540	Hyper-parameter Determination of CNN Classifier for Head Pose Estimation of Three Dimensional Degraded Face Images	Randy Pangestu Kuswana, Akhmad Faqih, Benyamin Kusumoputro (Universitas Indonesia, Depok Indonesia)
12	15.45 - 16.00	1570590791	Detecting Distributed Denial of Service Attack using Logistic Regression and SVM Methods	Mohammad Arafat Ullah, Arthy Anjum Jamal, Rashedul Amin Tuhin(East West University, Bangladesh); Shamim Akhter International University of Business Agriculture and Technology (IUBAT)
13	16.00 - 16.15	1570590876	Robustness Analysis of PI controller to Optimizing the output power for Energy Management in DC Microgrid System	Indhana Sudiharto, Epyk Sunarno, Farid Dwi Murdianto, Eni Wulandari (Politeknik Elektronika Negeri Surabaya, Surabaya, Indonesia)
14	16.15 - 16.30	1570591882	Designing Mamdani Fuzzy Inference Systems For Decision Support Systems	Humaira , Rasyidah, Indri Rahmayuni (Politeknik Negeri Padang, Indonesia)
15	16.30 - 16.45	1570593777	Measurement of Stain Area in Metal Surface with Particle Analysis	Riandini, Shahnan Kamil Dewantoro, Reza Istoni (Politeknik Negeri Jakarta, Indonesia)
16	16.45- 17.00	1570583652	IOS Mobile APP for Tuberculosis detection Based on Chest X-Ray Image	Hendrick, Wang Zhi-Hao, Chen Hsien-I, Chang Pei-Lun, Jong Gwo-Jia (National Kaohsiung University of Science and Technology Kaohsiung, Taiwan)

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Parallel Session C: Information Systems

Location: Room III

No	Time	ID Paper	Title	Author
1	13.00 - 13.15	1570569515	A Variable Sampling Interval Run Sum Chart for the Mean with Auxiliary Information	Faijun Nahar Nim (Universiti Sains Malaysia, Penang Malaysia); Sajal Saha (University of Business Agriculture and Technology, Dhaka Bangladesh); Michael Boon Chong Khoo (Universiti Sains Malaysia, Penang Malaysia)
2	13.15 - 13.30	1570574282	Analysis of the Effect of Quality Mulawarman University Language Center websites on User Satisfaction Using the Webqual 4.0 Method	Muhammad Firdaus, Novianti Puspitasari, Edy Budiman, Joan Angelina Widians and Nur Bayti (Mulawarman University Samarinda, Indonesia)
3	13.30 - 13.45	1570579398	Master Data Management Maturity Assessment: Case Study of XYZ Company	Regin Iqbal Mareza, Pramana Yuda, Wahyu Aditya, Achmad Nizar Hidayanto ,Putu Wuri Handayani, Nabila Clydea Harahap (University of Indonesia, Indonesia)
4	13.45 - 14.00	1570586041	The Evaluation of Finance Modul Impact Of Enterprise Resource Planning (ERP) for Employee Performance	Dayane Kamila Hafifah, Deden Witarsyah, Muhardi Saputra, Anik Hanifatul Azizah, Marhaeni Eka Saputri (Telkom University, Indonesia)
5	14.00 - 14.15	1570587201	Content-based Image Retrieval System for Locating Building in Syiah Kuala University Using Android Platform	Nazaruddin, Kurnia Saputra, Amalia Mabrina Masbar Rus, Dedek Fitri (Universitas Syiah Kuala Banda Aceh Indonesia)
6	14.15 - 14.30	1570588475	Integrating Nagari Information In West Sumatera With Laravel Framework	Hidra Amnur, Yance Sonatha and Rasyidah (Politeknik Negeri Padang, Indonesia)
7	14.30 - 14.45	1570588646	The State of the Art in e-Tendering Technology and Implementation	Syifa Nurgaida Yutia, Budi Rahardjo (Institut Teknologi Bandung, Indonesia)
8	14.45 - 15.00	1570588795	e-Vent: Support System for Event Registration	Yohanes Priadi Wibisono,Clara Hetty Primasari, Alwi Kesuma(Universitas Atma Jaya Yogyakarta, Indonesia)
9	15.00 - 15.15	1570589091	Design of Electronic Medical Record Security Policy on Hospital Management Information System (SIMRS) on XYZ Hospital	Hana Avianto, Dian Ogi (Sekolah Tinggi Sandi Negara, Indonesia)

No	Time	ID Paper	Title	Author
10	15.15 - 15.30	1570589639	Sales Data Monitoring Systems Telkom Indonesia Witel Samarinda Field Business Government and Enterprise	Andi Tejawati, Muhammad Bambang Firdaus, Sugesty Pramana Aditya, Edy Budiman, Masna Wati, Medi Taruk (Mulawarman University, Samarinda Indonesia)
11	15.30 - 15.45	1570589833	Impact of Social Media on Socialization of University Students (A study on East West University's Undergraduate Students)	Maliha Hassan, Anik Saha, Nujat Saba, Rashedul Amin Tuhin, Amit Kumar Das (East West University, Dhaka Bangladesh
12	15.45 - 16.00	1570589859	Software piracy:Factors and Profiling	Afsana Hossain, Jahidul Hoque, Amit Kumar Das, Nishat Tasnim Mim, Jahidul Hoque, Rashedul Amin Tuhin(East West University, Dhaka Bangladesh
13	16.00 - 16.15	1570589934	Digital Governance for Pension withdrawal System in Bangladesh	Shamima Sultana, Mohammad Hemayet Ullah, Sumiya Akter Nisher, Md. Shahad Iqbal, Md. Rashedul Amin Tuhin, Amit Kumar Das (East West University, Dhaka Bangladesh)
14	16.15 - 16.30	1570590063	Hotel Room Price Determination Based on Dynamic Pricing Model Using Nonlinear Programming Method to Maximize Revenue	Muhammad Fadly,Ari Yanuar Ridwan, Mohammad Deni Akbar(Telkom University, Bandung Indonesia)
15	16.30 - 16.45	1570590149	A Behavioral Model of Music piracy in Bangladesh: Factors influencing music piracy	Syed Sahariar Hassan, Fatema Nihar, Maimuna Rahman, Md Washim Razu, Rashedul Amin Tuhin, Amit Kumar Das(East West University, Dhaka Bangladesh)

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Parallel Session D: Computer Engineering

Location: Room IV

No	Time	ID Paper	Title	Author
1	15.00 - 15.15	1570569509	Side Sensitive Group Runs t Control Chart	Sajal Saha (University of Business Agriculture and Technology, Dhaka Bangladesh); Faijun Nahar Mim and Michael Boon Chong Khoo (Universiti Sains Malaysia, Penang Malaysia)
2	15.15 - 15.30	1570576333	Performance Evaluation of MongoDB, Cassandra and HBase for Heterogenous IoT Data Storage	Eko Sakti Pramukantoro, Dany Primanita Kartikasari, Reza Andria Siregar (Brawijaya University, Malang Indonesia)
3	15.30 - 15.45	1570588039	Implementation of Hybrid Password Authentication Scheme Based on Shape-Text on Raspberry Pi as a Client-Server-Based Access Control System to Overcome Shoulder Surfing Attack	Alfian Andre Anto, Dian Ogi (Sekolah Tinggi Sandi Negara, Bogor Indonesia)
4	15.45 - 16.00	1570588405	An Analysis on Python Programming Language Demand and its Recent Trend in Bangladesh	Aaquib J, Monika Z, Tasnova N (North South University, Bangladesh)
5	16.00 - 16.15	1570588859	Crowdsourced Transport Management System for Smartphone Users	Md. Sohel Rana,Md. Jakir Hosen,Abdullah Al Noman,Linta Islam, Tanni Mittra (East West University, Dhaka Bangladesh)
6	16.15 - 16.30	1570590148	Image Fusion-based Multi-frequency Microwave Tomography	Sebastian Siburian, Sastra Kusuma Wijaya, Prawito Prajitno(Universitas Indonesia, Indonesia)
7	16.30 - 16.45	1570590193	A Simulation of Enhanced Oil Recovery of Surfactant Flooding Using Sodium Lignosulfonate by CMG-STARS	Sukmana, Anggara, Azis, Cahyono (Universitas Gadjah Mada Yogyakarta Indonesia); Putra(Universitas Islam Riau Pekanbaru Indonesia)
8	16.45 - 17.00	1570591826	Performace Analysis of Simple Capacitive Cylinder Sensor for Measuring Soil Moisture Content	Radi, Bambang Purwantana Universitas Gadjah Mada, Yogyakarta Indonesia); Muhammad Rivai (Institut Teknologi Sepuluh Nopember, Surabaya Indonesia); Anditya Sridamar Pratyasta, Bayu Kuncoro, Nadia Umi Hanifah (Universitas Gadjah Mada, Yogyakarta Indonesia)

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No	Time	ID Paper	Title	Author
9	17.00 – 17.15	1570591824	Potency of Image Color & Textural Feature for Granular Size Estimation of Ground Coffee	Radi, Bambang Purwantana(Universitas Gadjah Mada, Indonesia); Muhammad Rivai (Institut Teknologi Sepuluh Nopember, Surabaya Indonesia); Muhammad Danu A (Universitas Gadjah Mada, Indonesia)

Classification of Segmented Milkfish Eyes using Cosine K-Nearest Neighbor

3 Author(s) Eko Prasetyo ; R. Dimas Adityo ; Rani Purbaningtyas All Authors

Abstract:
The classification of milkfish freshness based on the eyes is supported by the results of correct fish eye segmentation. Generally, the problems faced by segmentation results are many objects with similar characters and similar gray intensity. Segmentation with K-Means produces K layers of binary image according to the selected K cluster. As a result, many objects appear as the result of segmentation. Among all objects appear, the fish eye has a special character, where it is round black. The problem faced by classic K-Nearest Neighbor (KNN) in classification is sensitive to noise when using low K while using high K the classification performance falls to the most class that shouldn't as the result. We propose Cosine KNN (CosKNN) to solve the classic KNN problem where the classification results aren't taken from the most class of nearest neighbor. CosKNN gives soft value that represents the belonging level of each class to the testing data. To evaluate the performance of CosKNN, we use precision and recall. The experiment result shows that the CosKNN achieves performance both precision and recall of 97.93% and 91.15%, respectively, all with shape features. Especially on precision performance, CosKNN achieves the highest performance compared to other methods, CosKNN, classic KNN and K-SVNN achieve 97.93%, 96.20%, and 95.77%. While in recall performance, KNN achieves the highest performance compared to other methods, CosKNN, classic KNN and K-SVNN achieve 91.15%, 92.10%, and 90.76%, respectively, all with shape features.

Published in: 2019 2nd International Conference on Applied Information Technology and Innovation (ICAITI)

Date of Conference: 21-22 Sept. 2019
Date Added to IEEE *Xplore*: 06 February 2020
ISBN Information:
INSPEC Accession Number: 19323503
DOI: 10.1109/ICAITI48442.2019.8982124
Publisher: IEEE
Conference Location: Denpasar, Bali, Indonesia, Indonesia

I. Introduction

The classification of milkfish freshness based on the eyes is supported by the results of correct fish eye segmentation. Current research on [1] fish freshness is conducted by using digital image processing to determine the freshness quality and shelf life span of the three most consumed fish in the Philippines. The detected fish are milkfish (Chanos chanos), round scad (Decapterus maruadsi) and short mackerel scad (Rastrelliger brachysoma). By using support vector machine (SVM), this research classifies the redness of the fish's eyes and gills as a measure of the fish freshness quality level. The number images of fish are 16[illegible] milkfish, 480 images for round scad, and 480 images f[illegible]red image are classified to 4 freshness levels and achieve 98% accuracy. In this study, the segmentation method used is a combination of histogram equalization and binary thresholding. Segmentation results still raise some noise objects in the binary image results. The next research in [2] classifies the freshness of the fish from level 1 (stale) to level 5 (fresh) based on RGB

Keywords
Metrics