

TEXTURE ANALYSIS FOR CLASSIFICATION OF CORAL STONE AND SOFT CORAL BY THE METHOD OF GRAY LEVEL CO-OCCURRENCE MATRIX BASED MATLAB IN OCEANOGRAPHIC PUSLIT-LIPI

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ABSTRACT- Coral reefs (coral reef) is one of the ecosystem of the sea have important values in human life especially in coastal areas. The beauty of form and benefits of coral is one of the economic value that must be kept preserved. Coral reefs have a fairly complete diversity as shape, color and texture. One way to protect and conserve coral reefs the reef is to perform monitoring (monitoring) on logging in such computerized type, the percentage of cover, health conditions as well as the distribution of geographically. In pattern recognition against the image or image of coral, segmentation the first process is done before the next process i.e. analysis images. The main function of image segmentation is dividing the image into parts regions (sub-regions) that have in common the features: texture, color, shape and the other. The purpose of this research is to determine the characteristics and texture objects the reef has a resemblance so that will make it easier in the grouping and calculations. This research uses the image of a photograph taken with coral use the method Under Water Photo Transect (UPT) were analyzed on the basis of the texture using the method of Gray Level Co-occurrence Matrix (GLCM) based matlab with the parameter value to the distance = 1 pixel. pixels distance = 2 and Euclidean distance. Extraction of texture feature analysis method aimed at getting earmarks or features on the photo image grayscale value in the form of contrast, correlation, energy, its homogeneity, scale grayish and standard deviation. GLCM was used for classification based on new data to a number of training data. The data used was image coral consisting of 26 pictures. Of the 26 photographs there are 6 data as training data and 20 data as test data. Data training it is also divided into Poritesvalenciennesi, lobate while for the soft coral Sinularia type of which has a different structure so that differentiated into Sinularia SP. 11, Sinularia SP. Sinularia SP. 12 and 13. Experiment performed against each GLCM features. The results of the research will be classifying a group of reefs and calculate the rate of its accuracy.

Keywords: classification, texture analysis, GLCM, coral stone, soft coral

1. Introduction

Research Center For Oceanography-LIPI have a vision that aligns with the new paradigm as organizations LIPI that is ' look out ', a variety of the changes planned by the Center Oceanographic research LIPI fore focused on more efforts to recognize the expectations of the public, and the achievement of the ability of an intelligent, creative and innovative in order to meet the expectations of the public such. One of the scenarios, the indications were originally has been revealed in the last few years, it is public expectations are getting bigger would services and provision of information Oceanography that is accurate, timely and appropriate as a result of the demands of the public accountability is increasingly increased. Hope that gets bigger the challenge period the front must be addressed wisely, realistic and right by the Centre for research Oceanography LIPI, and should be reflected on the vision of the organization selected. Formula an Oceanographic Research Center vision is a guide for addressing future challenges the is: "the realization of ability An intelligent Oceanographic in acquisition marine data and information provision for the public, "Puslit Oceanography – LIPI in one of her duties is to do monitoring against the reef health the reef. To maintain the sustainability and continue ecosystem live coral the reef, then various ways and methods has been done to monitor the rate of the growth of coral reefs such. As the development of technology where the taking of photos under water can be done using digital camera then the method now used is

the method Underwater Photo Transect (UPT). In UPT method, the object of coral which is taken using underwater cameras then using the device software (software) to knowing the area of coral reefs. In the process it turns out every the method has its advantages and disadvantages of each. Errors happening in broad calculations especially in certain specific types of and dominate in a frame can be minimised especially in this the object is to differentiate from other arounds objects. In the analysis coral reefs There are several objects or types of coral corals that have similarities if views at a glance. How do I distinguish various types of coral into groups soft coral and the reef hard? Whether on the basis of color, pattern or texture. the purpose of the writing aims to find the best or easiest in specify the objects that are included in the coral rock (hard coral) and soft coral (soft coral). Coral reefs have a rich diversity is a fairly complex as shape, color and type of the one photo that was placed a frame size 44 x 58 cm, there can be one to ten different objects, tend to be the same or the same. For it in this article want to distinguish coral stone and coral software so ease in extensive coverage of the calculation. The design of the program is done through the steps as follows:

- a. the study of literature either through the library or the internet to understand the workings of the Gray algorithm Level Co-Occurrence Matrix (GLCM)
- b. the design of the program for supports the proposed algorithm i.e. Gray Level Co-Occurrence Matrix (GLCM) using the language 2015A Matlab programming
- c. Prepare data as input (Photo of underwater research results)
- d. implementation of data with use the application program has been designed
- e. do some testing and evaluation results relating to application of Gray Level Co- Occurrence Matrix (GLCM) made

2. The Cornerstone Of The Theory

a. Analysis of Textures

Texture can be visually known as the Act of touch directly towards the object. Texture is the intrinsic characteristics of the an image associated with the the level of roughness (roughness), granularity (granulation), as far as where a larger entity divided, the regularity (regularity) and the structural arrangement of pixels. Aspects of the texture of an image can be utilized as the basis of segmentation, classification, or interpretation of the images. The advancement of science knowledge and technology allow people with computer aid can finally conduct an analysis of the object on the basis of texture. The texture can be defined as a function of spatial variation of intensity of pixels (the value of the grayish) in the image. Based on the structure, the texture can be are classified in two classes:

1) Makrostruktur

Texture makrostruktur have looping patterns of local the periodic table on an area of the image, usually found in the patterns man-made and tend to It is easy to be represented mathematically.

2) Microstructures

On the microstructures, local patterns and looping not the case so clearly, so that It is not easy to give a comprehensive definition of texture. Working with texture analysis observe the pattern of neighborliness between pixels in the spatial domain

b. Analysis of textures with a Grey Level

Co-occurrence Matrix (GLCM) Co-occurrence matrix (CM) It is one of a number of analysis method of texture. The size of the co-occurrence matrices are very Depending on the value of minimum and the value of the maximum of pixels-pixels in the areas of texture analyzed, whereas the value of each the elements of this matrix is the number of frequency of the emergence of values two pixels are neighbors (Mohanraj.R, and Jayageetha.J, 2014)In the matlab programming language available functions for calculating the co-occurrence matrix single angle IE syntax graycomatrix (). On the application image processing such as appointment to identify image (image searching) based the texture, the obstacles often encountered When an image of experience geometric transformation of image the original, especially rotation. In a visual image that has been rotating keep having the same texture with the original image but not as easy as it is for the computer to stating that both images have the same texture. For it required analysis in physical and to find a mathematical methods and algorithms are appropriate computer can be Analysis and compare the second image texture as done by the eye man.

c. Character GLCM texture

Robert Haralick has defined some characteristics of a texture image that is calculated from the co-occurrence matrix (CM) with stated the probability matrix. Among those features is the mean (μ_x , μ_y), variance, Homogeneity, Dissimilarity, entropy, and contrast energy. In this paper only discussed about the Contrast, Energy, Correlation and Homogeneity.

- 1). Energy is a measure of Uniformity checked local and its homogeneity is the opposite of entropy of this feature used to view level uniformity of texture. The higher the energy value, the higher the level its homogeneity texture. The value of energy there is on the range [0.1], where 1 describes a homogeneous area.
- 2). Contrast are a variation of intensity values local co-occurrence matrices. If the neighboring pixel intensity value similar or adjacent, then contrasting texture is very low. The value of the high contrast shows texture with a high intensity, variation for low contrast value smooth or texture that shows soft.
- 3). Homogeneity measure its homogeneity looping structures texture, where the weighting value is the inverse of the contrast. The level of very high texture homogeneity when the value of co-occurrence matrix concentrated along the diagonal matrix. This shows there is a lot of pixels with looping couples the value of the same intensity as forming the structure of the texture. Homogeneity have a range of values [0.1]. For same homogeneity values 1 indicates that the texture have a looping structure ideal, is when the value is low indicate that the elements of texture has the best-performing variations for height and is distributed evenly in the areas of texture
- 4). Correlation is a measure of connectedness degree of linear grayish one relative pixels against pixels more on certain positions.

d. Classification of k-Nearest Neighbour (K-NN)

K-Nearest Neighbour method (KNN) is a method that function to do the classification or grouping against an object based on the data most distance learning close to the object. Data learning is projected onto the space prolific lot, where each the dimension of the present characteristics from these data. This space is divided into sections based on data classification learning. Near or away neighbors can be calculated based on Euclidean distance with General formulas such as Figure 1.

$$\begin{aligned}
 d(a - b) &= \sqrt{(a_1 - b_1)^2 + (a_2 - b_2)^2 + \dots + (a_n - b_n)^2} \\
 &= \sqrt{\sum_{k=1}^n (a_k - b_k)^2}
 \end{aligned}$$

Description:

- d : distance between weights the image of test and training
- a1 ... n : Weighting image test data
- b1 ... n : Weight training data image
- n : dimension data
- k : variable

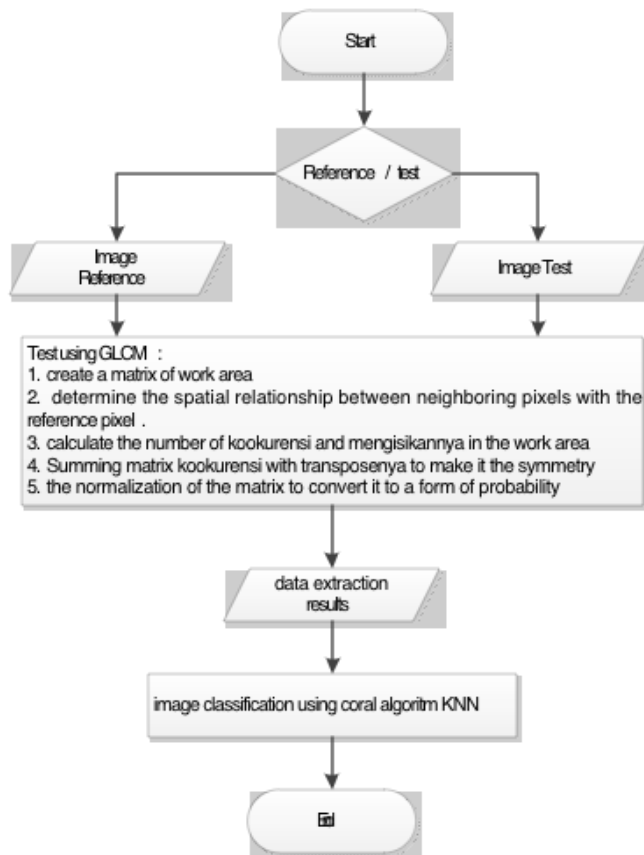


Figure 1: Flow diagram classification KNN

e. The Dataset

On the dataset using the image or species of coral reefs taken from the data field. Pengoleksian dataset was performed in some location data retrieval i.e. in buton Regency Sikka, and Raja Ampat Islands. Number of picture species datasets a total of 20 coral reef images include some species of Hard Coral and soft coral. Species data Hard coral has been identified with the Latin names of each While the spesies soft coral only identified as Sinularia sp., and Sarcophyton sp. However so both of these spesies have the form and structure of coral vary primarily Sinularia sp., which in this case there are 10 samples in the experiment. in between from 3 spesies with pixel size diferent.

1) Trainer data and image Selection test data

The selection of this image to divide Trainer image and image test with comparison of the ratio of 3:10. Ratio.3:10 that 30% of the number of data chosen for the training process, While 70% of the number of data chosen for the testing process.

2) The process of Masking

In this process, background on the image will be hidden by way of cover it with a plain black background, the purpose of this background, closing for focusing objects observed.

3) RGB to Gray

From the image (RGB) must be changed to gray (Gray) by using a function There is in matlab, with using the tools rgb2gray (RGB).

4) Extraction characteristics with GLCM

Co-occurrence matrices ar as grayish was formed with the using parameters required to form Co-occurrence matrices. There are the two parameters used in this study, namely the distance (d) with d = 1 and d = 2, direction or angle (θ), with 4 direction or angle 0 °, 45 °, 90 °, 135 °.

5) Label

To function for classify each image of the species coral reefs have had value extraction in accordance with the type. Extraction and save the results labeling Save the results of values feature extraction and labelling characteristics data training as well as test data: Feature extraction of characteristics used there are 4 of these values In contrast, its homogeneity, i.e. energy, and correlation. This extraction values can be used as input for which particular species of coral Coral or characteristics obtained from the results of the extraction of characteristic then saved for later use on the K-NN classification

3. Analysis Of The Problem And The Design Of The Program

a. Analysis of the Problem

Several methods have been used in conducting monitoring against the coral reefs has advantages and disadvantages. For to minimize this error then the last method used is a method of UPT (Under water Photo Transect). This method done using the camera under water to get visual data form photo or image of a coral reef. The determination of the location of data retrieval Using GPS.Expected that data can be reference for researchers or subsequent monitoring. However such errors can identification occur due to less scrupulous the observer caused factor the weather, or the condition of the waters of the result waves and currents. The condition of the coral reefs are Coral condition with cover coral rock (Hard Coral) over 75 %. Error in doing identification of species of coral can have an effect on the percentage of coverage.

b. Troubleshooting

One of the possible way can be a solution to Coral Reef data handling is the analysis of terkstur using the algorithm of Gray Level Co-occurrence Matrix (GLCM) to extract characteristics of the objects in the form of In contrast, energy correlation and homogeneity. Next classification is performed using the algorithm analysis of K-mean. A fusion algorithm is expected can reduce errors especially for identification distinguish types of coral stone (Hard coral) and the kind of soft coral (Soft coral). MATLAB is one of high level language programs allows to perform the calculation of the matrix in the handling data as image data management of coral reefs These.

In general design system on the GLCM algorithms are:

1. Take a an image of corals will in the process of
2. The process of segmentation
3. Formation of matrix GLCM
4. Extract the image characteristics category
5. Testing
6. finish

4. IMPLEMENTATION and TESTING PROGRAM

a. Testing

1) Training Samples

Training data for the hard coral used in this experiment Turbinaria is a mesenterina (figure 2) and AcroporaValenciennesi (Foto 3) The average extraction yield GLCM characteristics can be seen in table the following:

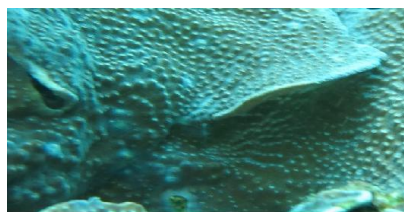


Figure 2



Figure 3

Table 1. GLCM features average sample training hard coral

	Turbinaria m.	Acropora v.
Contrast	0.09127	0.72686
Correlation	0.98251	0.89931
Energy	0.16021	0.06583
Homogeneity	0.95444	0.76823

From the table to see that the value of the highest contrast exists on the Acropora v. whereas the lowest there is on Turbinaria m. Three other features i.e. correlation, energy and homogeneity is just the opposite There are highest in Turbinariamesenterina. Klasifikasi K mean results for Turbinaria m., can seen in Figure 4. Pictures 5 is the result of the classification of the Acropora v

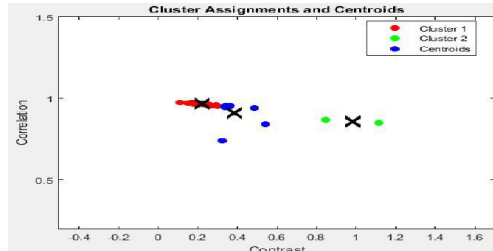


Figure 4 the Calcification of coral rock samples with K-mean for Turbinariamesenterina

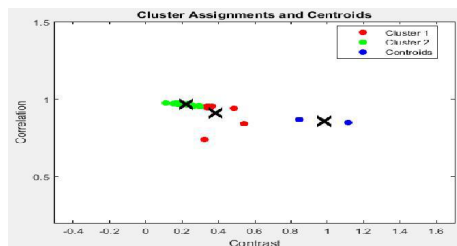


Figure 5 the Calcification of coral rock samples with K-mean for AcroporaValenciennesi

Training data to soft coral is Sinularia sp11 (Figure 6) and Sinularia sp12 (figure 7) results in an average extraction GLCM characteristics can be seen in table the following:



Figure 6



Figure 7

Table 2 GLCM test results for the samples Trainer soft coral

	Sinularia sp.11	Sinularia sp.12
Contrast	0.13063	0.11272
Correlation	0.96482	0.96562
Energy	0.17727	0.18095
Homogeneity	0.93631	0.94555

The results show that among the four existing features not shows the mean difference

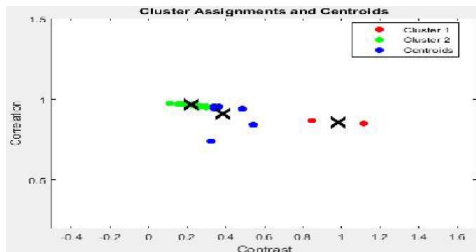


Figure 8 the Calcification of coral samples software with K-mean for Sinularia SP. 11

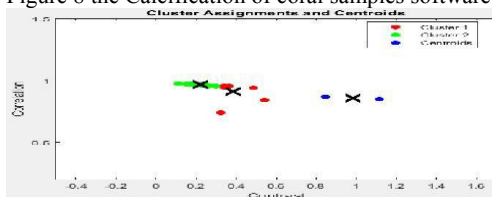


Figure 9 Calcification of coral samples software with K-mean for Sinularia SP. 12

5. CONCLUSION

The conclusion that can be drawn from the results of this testing is that for hard coral, classification committed against both samples test shows the same result however When compared to samples of training hard coral then this is very remote because just a sample of the course trainer showed that only on the centroid while at class no one is the same. So with the results testing against a soft coral. On soft

coral sample classification test results shows that there are similarities in the placement of temporary centroid classification for both samples this test different. However there is still similarities between trainer and samples sample test on Sinularia sp11 the terkaster like Sinularia sp2. In general it can be said that same sample between class training and test samples only found on soft coral while on the hard Coral it is not found.

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