

# Geographic Image Classification Considering on Texture Features by GLCM

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## ABSTRACT

For image classification, texture features improves the classification of digital image. Geographical Image Classification (GIC) proposed depending on the features of texture information for entry image classifier. Our method to classified geographical image into three classes Water planes, green land, and Desert, the system have two levels, first, extract texture features depending on GLCM values basically, second level is classifier of geographical images entered and identification of its class that Image of geography. Classification system was performed on many digital color images of geography and that have proved good successful.

## Keywords

Image Classification, geographical image, and GLCM.

## 1. INTRODUCTION

For extraction a good information from images like color information, texture, Image analysis will used in both computer vision and image processing. [1, 2]. One of the most important tasks of an image analysis system is image classification , digital image was taken of color geographical areas on the surface of the earth can be classified by using image analysis techniques of coloring, digitizing and depending on the features of such images from texture. Image classification is the process of assigning thematic labels to each image pixel [3, 4], The use of texture feature for representing image data is very general in an image segmentation and classification [ 5]. Higher important to using texture is that it provides additional features at each neighbor pixels in an image to be used in pattern classification [6, 7]. Many geographic image classification techniques it have been proposed during the past years, A. Marcal and T. Mendonca(2007) used black and white air photographs for the production of historic land cover maps done with evaluate the ability of texture[3], P. Jeyanthi and V. Jawahar in(2010) they used K-means clustering for the classification of feature set obtained from the histogram method[8]. In this research implemented method to classified geographical images including (Water planes, green land, and Desert) that by using (Energy, Entropy, Contrast, and Homogeneity Features) considering texture information computed from GLCM for each Geography class, then classifier an images by Geography Image Classification System (GIC).

## 2. GLCM

The Gray Level Co-occurrence Matrix (GLCM) method is a way of extracting second order statistical texture features this technique is good in wide range of image analysis applications. [9]

The matrix element  $P(i, j | d, \theta)$  contains the second order statistical probability values for changes between gray levels  $i$  and  $j$  at a particular displacement distance  $d$  and at a particular angle  $\theta$  [10,11]. Figure (1) show an example of directional Analysis P0o, P45o, P90o, & P135o in sample image.

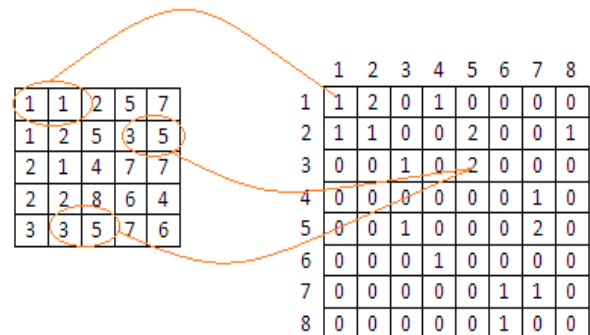


Figure (1): GLCM directional Analysis in sample image

After execution of GLCM , a several statistical features can be generate from it. Some of statistical features which used in this work summarize as follow [9,10]:

- 1) Contrast feature, is compute the intensity the pixel and its neighbor.

$$Contrast_F = \frac{1}{(N-1)^2} \sum_{i=0}^{n-1} \sum_{j=0}^{n-1} (i-j)^2 P(i,j). \dots\dots Eq.(1)$$

- 2) Entropy Feature, the quantity of energy.

$$Entropy_F = - \sum_{i=0}^{n-1} \sum_{j=0}^{n-1} P(i,j) \times \log(P(i,j)). \dots\dots Eq.(2)$$

- 3) Homogeneity feature, Compute the not-zero in the GLCM, it is the inverse of contrast weight.

$$IDM_F = \sum_{i=0}^{n-1} \sum_{j=0}^{n-1} \frac{1}{1+(i-j)^2} P(i,j). \dots\dots Eq.(3)$$

- 4) Energy feature, compute the local homogeneity, it refer to the Entropy.

$$Energy_F = \sum_{i=0}^{n-1} \sum_{j=0}^{n-1} P(i,j). \dots\dots Eq.(4)$$

### 3. GEOGRAPHY IMAGES CLASSIFICATION

When looking at nature, there was different types of images of the geographical nature and in various classes, in this research uses three types of Geography images, first type images for water parts, seas, rivers, second type images for green land such as forests and gardens rich, and third type images for desert.

Geographical Image Classification system(GIC) can be divided into two main approaches, Texture Features Extraction algorithm, and Geographical Classification algorithm. Texture used to represent four features for geography image including in one class.

Texture Feature Extraction Algorithm (TFE) include steps to find the feature values for each images in one class, then compute an average value for four features in each entries image to improve five feature into the system.

All this that values are saved in our database system to uses it in classification method in our system, three classes in the database system are found, each class for one type geographical image.

#### Algorithm 1:Color Feature Extraction (TFE)

**Input:** read digital color image N \* N.

**Output:** Saved Five features values for each class in database system.

**Step 1:** convert an image into gray level.

**Step 2:** compute GLCM value.

**Step 3:** Compute four Features values, for each input digital geographical image.

**Step 4:** compute an average value for four features in each entries image.

For each image :  $Av = [(Energy+ Entropy+ Contrast+ Homogeneity) / 4] \dots\dots Eq.(5)$

**Step 5:** feature values and its average for each image in one class are saved in database system.

Geographical Image Classification (GIC) is depended on result from the Texture Feature Extraction algorithm( TFE).

#### Algorithm 2: Geographical Image Classification

**Input:** entries a new digital geographical image.

**Output:** classified entry image to one classes in DB.

**Step1:** applied TFE on entries image, to extract four Texture Features

**Step 2:** Using minimum distance Classifier, classify a new geographical image data to classes which less distance between an image information and a class, By Euclidean distance to measures a distance [12]:

$$Dj (X) = \| X - Y_j \| \dots\dots\dots Eq.(6)$$

where : X is the Av. value for four texture feature for entries image, Y is the Av. value for four texture feature for one class in database.

Dj is distance between X and Y , j= 1,2,3,.....w and w number of classes




$$MinD = \min(dclass1, dclass2, dclass3). \dots\dots\dots Eq.(7)$$

**Step 4:** If the result is more than one Geography digital image features have same distance value then the entries test image will not to be classified.

### 4. EXPERIMENTAL RESULTS

Four texture Values results from (TFE) database system have saved three class types each class have many Geographical digital image with their four feature values, Table(1) show texture features values for each class by applied TFE algorithm.

**Table(1): Four Texture Features for one test image in each class**

	Image	Energy	Contrast	Entropy	Homogeneity	Av. Value
Class1		24079	879	-4110	32007	599935.8
Class2		36349	1297	-3547	28836	907397.8
Class3		10858	876	-3281	33503	271863.8

Where

Class1 : Water part, , seas, etc., Class2 : Forest, green land, and Class3 : Desert or sandy soil.

Energy, Contrast, Entropy, and Homogeneity: four texture features.

#### 4.1 Geographical Image Classification

From TFE algorithm steps, one features value that is Average value will be compared with the specification of the geographical image and what had been extracted considering on the texture features that was stored in images database.

The experiment is calculated for Digital Geographical image JPEG type with same size, get from Personal Camera and Some of test images is loaded from internet web site.

In this study, the application system work on three varieties of digital geographical images. Table(2), shown the test image and its features value.

From the feature of test image shown in Table(2)and features of three classes shown in Table(1), we finding a minimum distance:

$$D(\text{class1}) = | \text{Av. (test image)} - \text{Av. (Class1)} | = 27363$$

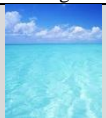
$$D(\text{class2}) = | \text{Av. (test image)} - \text{Av. (Class2)} | = 334825$$

$$D(\text{class3}) = | \text{Av. (test image)} - \text{Av. (Class3)} | = 300709$$

$$\text{Minimum Distance} = \text{Min}(D(\text{class1}), D(\text{class2}), D(\text{class3}))$$

$$\text{Minimum Distance} = \text{Min}(27363, 334825, 300709)$$

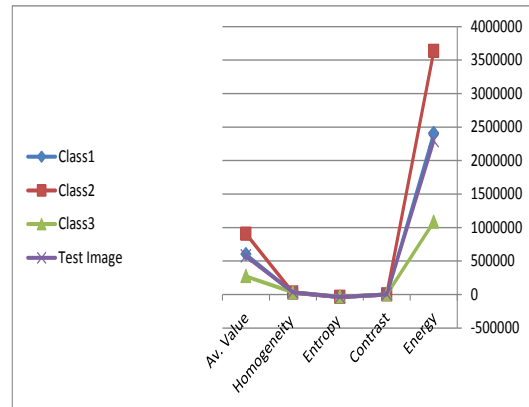
**Table(2) : Test geographical image and its features.**

Test Image	Energy	Contrast	Entropy	Homogeneity	Av. Value
	22926	584	-3755	34613	572572.8

The test image nearest from class1 at 27363 minimum distance, from class2 at 334825 distance and from class3 at 300709 distance, that means the test image classified belong class1. The relation between test image features and three classes features in Database shown in Figure(1) and Table(3).

**Table(3) : Test Image distance from three Classes.**

	Energy	Contrast	Entropy	Homogeneity	Av. Value
Class1	24079	879	-4110	32007	599935.8
Class2	36349	1297	-3547	28836	907397.8
Class3	10858	876	-3281	33503	271863.8
Test Image	22926	584	-3755	34613	572572.8



**Figure(1): Test geography Image classified to class1**

## 5. CONCLUSIONS AND SUGGESTION WORK

The higher important of GLCM matrix is give more detailed texture features of the digital geographical. In the our system for Digital Geographical Image, firstly TFE method is using to extract texture features based on GLCM, then the ways to do Image Classification stage by comparing five features (Average value) with three classes Average features saved in database. From classification stage result, the Average value more than one of the features will be seen in database, therefore the Class has Maximum Distance value is the Class that test image entry related it. In this research uses texture features to classified images, so it possible to merge the color information with texture features for new classification approach, and test other types of images.

## 6. REFERENCES

- [1]. Umbaugh S.E., "Computer Vision and Image Processing", Prentice-Hall, (1998).
- [2]. Young I.T., Gerbrands J.J., and . van Vliet L.J," Image Processing Fundamentals", Netherlands Organization for Scientific Research (NWO) Grant 900-538-040, (1998).
- [3]. Marcal A.R.S,and Mendonca T., "The use of texture for image classification of black & white air-photographs", New Developments and Challenges in Remote Sensing, Z. Bochenek (ed.), Millpress, Rotterdam, ISBN 978-90-5966-053-3, (2007).
- [4]. Farouk E. , "Remote Sensing: Generating Knowledge about Groundwater", Special study, (2006).
- [5]. Gonzalez R. C. and Woods E. , "Digital image processing", Addison-Wesley Publishing Company, (2008).
- [6]. Luo X. Y., "Color Image Analysis For Cereal Grain Classification", University of Manitoba, Canada, Ph.D. thesis, (1997).
- [7]. Low B. K., and Hjelmxas E., "Face Detection : A Survey", Academic Press, computer vision and Image Understanding, 83, pp. 236–274, (2001).
- [8]. JeyanthiP., and Jawahar V., " Image Classification by K-means Clustering", Advances in Computational Sciences and Technology ISSN 0973-6107 , pp. 1–8,( 2010).



- [9]. Alaa eleyan , Hasan dem`irel” Co-occurrence matrix and its statistical features as anew approach for face recognition”, Vol.19, No.1, 2011.
- [10].P. Mohanaiah, P. Sathyanarayana, L. GuruKumar” Image Texture Feature Extraction Using GLCM Approach” International Journal of Scientific and Research Publications, Volume 3, Issue 5, May 2013
- India
- [11].Zvoleff A.,” Calculating image textures with GLCM”, Data Science at Conservation International, (2014).
- [12].Hogg R. V., and Tanis E. A., ”Probability and Statistical Inference”, Pearson Education, Inc. Prentice Hall, (2006).