IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

TEXTURE FEATURE ANALYSIS OF AN IMAGE USING GRAY LEVEL CO-OCCURRENCE MATRIX.

[1]*Khushal Sarode*, [2]*Rajat Savdekar*, [3]*Tushar Chaudhari*
[1]*Student*, [2]*Student*, [3]*Student*
Computer Science and Engineering,
[1]*G.H.Raisoni Institute of Business Management, Jalgaon, India,*
[2] *Shah and Anchor Kutchhi Engineering College, Mumbai, India,*
[3]*Shah and Anchor Kutchhi Engineering College, Mumbai, India.*

Abstract : In this project we are analyzing features of image using the GLCM approach. There are various features calculated from Gray Level Co-Occurrence Matrix (GLCM) which helps us to understand the overall image. Our main goal in the project is to implement a calculating GLCM matrix using texture feature extraction of an image. GLCM is widely used for evaluating texture features that is used for classification of images. There are many features listed by author Haralick but in this we have considered the most commonly used features which includes energy , entropy, homogeneity, dissimilarity, angular second moment, glcm mean, glcm correlation, glcm variance, max probability and contrast Texture features are divided into two parts: Image processing and texture feature analysis. So basically at the end will be taking an image as an input and output will also be an image with a feature.

IndexTerms **- Glcm, Contrast group, Orderliness group, Statistics group, Graphs, Image processing, GUI, Texture Feature Extraction.**

INTRODUCTION

This project which is Image Texture Feature Extraction Using GLCM gives a basic idea about how image processing is done and how different features of an image can be extracted.As image processing means to perform different operation on an image to extract some useful information from it, in this process input is an image and the output will also be an image.GLCM means Gray Level Occurrence Matrix, and using glcm approach it makes it easy to perform the operation on the image.

There are different texture feature methods which are classified as a)Structural b) Statistical c)Model d) Filter.
From these methods Statistical method is further divided as 1)General statistical parameter 2)Laws texture energy features 3)Auto correction feature 4)Co-occurrence matrix based features.
In this project Co-occurrence matrix based feature has been used.There are many features that can be extracted from an image as listed by the Author Haralick but this project deals with the most used features that are energy , entropy, homogeneity, dissimilarity, angular second moment, glcm mean, glcm correlation, glcm variance, max probability and contrast.
We will focus on the different measures that can be obtained from the GLCM matrix. These measures are broadly classified into three different groups.

Contrast Group:

- Contrast (Con)
- Dissimilarity (Diss)
- Homogeneity (Hom)

Orderliness Group:

- Angular Second Moment (Asm)
- Maximum Probability (Max)
- Entropy (Entropy)

Statistics Group:

- GLCM Mean
- GLCM Variance
- GLCM Correlation

RELATED WORK

" Texture features for image classification" by Robert Haralick in this paper Haralick features are derived from the Gray Level Co-occurrence Matrix (GLCM). This matrix records how many times two gray-level pixels adjacent to each other appear in an image. Then based on this matrix, Haralick proposes 13 values that can be extracted from the GLCM to quantify texture. An additional 14 values can be computed using GLCM.This paper gives detailed information about Texture Features. It also provides Information about the application of texture features for image classification. Additional investigation is needed to determine the size of the sub image region and the distance which should be used in computing the gray-tone dependence matrices.

PROBLEM STATEMENT

Image plays an important and crucial role in today's age.The image processing field has progressed a lot in past few decades. Several year ago assessment of the quality of image was done subjectively using human observer based on their satisfaction.So to obtain a good quality of image algorithmically it becomes really easy.GLCM technique makes the process of calculating different texture features and it can also increase the quality of image by adding different required features in the image.

OBJECTIVE

The objective of Image Texture Feature Extraction Using GLCM Approach is that it is a statistical method of extracting textural features from images. In this project we are going to calculate features by using the GLCM method. In it the number of times the certain pair of pixels with particular values appears in a matrix is calculated by GLCM functions for characterizing the texture of the image. This helps to identify the type of image easily ,so it can be converted by the system for results. This process is very useful in different kinds of fields.

METHODOLOGY

- CONTRAST: The term contrast means measuring the spatial frequency of an image and also the difference between the moment of glcm.
- HOMOGENEITY: It measures the homogeneity of an image which is considered to be very large for a smaller gray tone. Homogeneity is also commonly called the Inverse Difference Moment.
- ENERGY: Energy can also be called the Angular Second Moment. It measures the textural uniformity of an image.
- CORRELATION: Correlation measures the linear dependency of gray levels of neighboring pixels. Digital Image Correlation is an optical method that employs tracking & image registration techniques for accurate 2D and 3D measurements of changes in images.
- DISSIMILARITY: Dissimilarity is a measure of distance between pairs of objects (pixels) in the region of interest.
- ENTROPY:The entropy or average information of an image is a measure of the degree of randomness in the image.
- MAXIMUM PROBABILITY: It shows the emergence of the gray level value g, adjacent to gray level value g, more dominant in the image.
- ANGULAR SECOND MOMENT:Angular Second Moment (ASM) represents the uniformity of distribution of gray level in the image.
- VARIANCE:Variance is a measure of the dispersion of the values around the mean.

Contrast Group:

Contrast	$\sum_{i,j=1}^{N} P_{i,j}(i-j)^2$
Dissimilarity	$\sum_{i,j=1}^{N} P_{i,j}\lvert i-j\rvert$
Homogeneity	$\sum_{i,j=1}^{N} \frac{P_{i,j}}{(1+(i-j)^2)}$

Orderliness Group:

Angular Second Moment	$\sum_{i,j=1}^{N} P_{i,j}^2$
Maximum Probability	$Max(P)$
Entropy	$\sum_{i,j=1}^{N} P_{i,j}(-\ln P_{i,j})$
Energy	$\sqrt{ASM}$

Statistics Group:

GLCM Mean	$\mu_i = \sum_{i,j=1}^{N} i(P_{i,j})$ $\mu_j = \sum_{i,j=1}^{N} j(P_{i,j})$ $\mu = \frac{(\mu_i + \mu_j)}{2}$
GLCM Variance	$\sigma_i^2 = \sum_{i,j=1}^{N} P_{i,j}(i - \mu_i)^2$ $\sigma_j^2 = \sum_{i,j=1}^{N} P_{i,j}(j - \mu_j)^2$ $\sigma^2 = \frac{(\sigma_i^2 + \sigma_j^2)}{2}$
GLCM Correlation	$\sum_{i,j=1}^{N} P_{i,j} \left[\frac{(i - \mu_i)(j - \mu_j)}{\sqrt{\sigma_i^2 \sigma_j^2}} \right]$

The GLCM matrix contains the number of occurrences of two gray levels and let's perform normalization to measure the probability of occurrence of these two pixels. Using this matrix we have derived all the above given values which are used to describe the texture of the image. Different values refer to different textures of the image and thus have been derived using the GLCM matrix. We need the normalized form of the GLCM to be used in these formulas of the different texture values.

GProb = glcm. /sum(glcm (:));

glcm =

	1	2	3	4	5	6	7	8
1	1	2	0	1	0	0	0	2
2	0	0	3	0	0	0	0	0
3	0	1	0	1	0	0	0	0
4	1	0	0	1	1	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	2	0
7	0	0	0	0	0	2	0	0
8	1	0	0	0	0	0	0	1

	1	2	3	4	5	6	7	8
1	**0.05**	**0.10**	0	**0.05**	0	0	0	**0.10**
2	0	0	**0.15**	0	0	0	0	0
3	0	**0.05**	0	**0.05**	0	0	0	0
4	**0.05**	0	0	**0.05**	**0.05**	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	**0.10**	0
7	0	0	0	0	0	**0.10**	0	0
8	**0.05**	0	0	0	0	0	0	**0.05**

IMPLEMENTATION

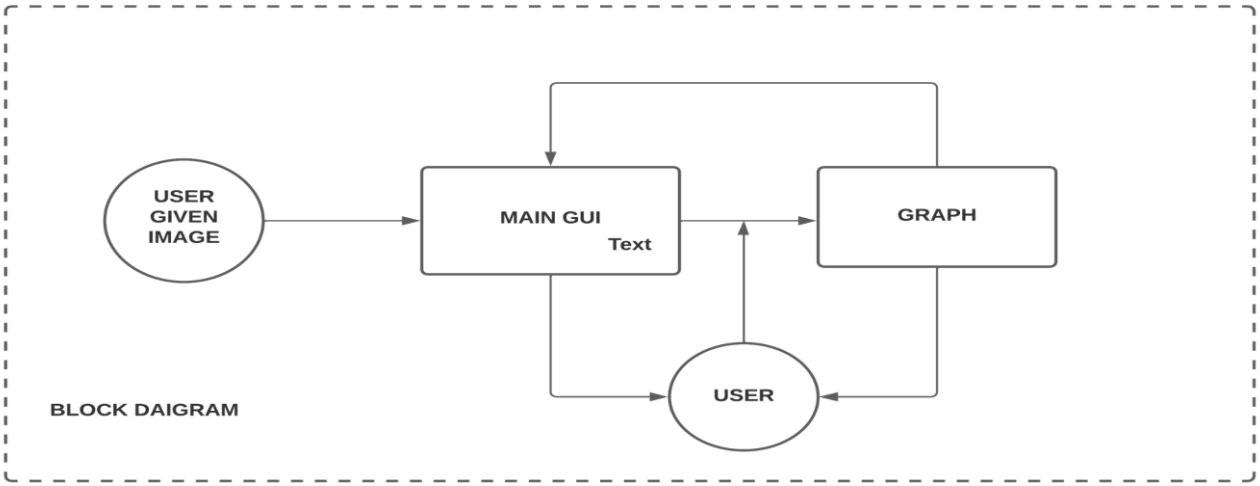
- **Main app**

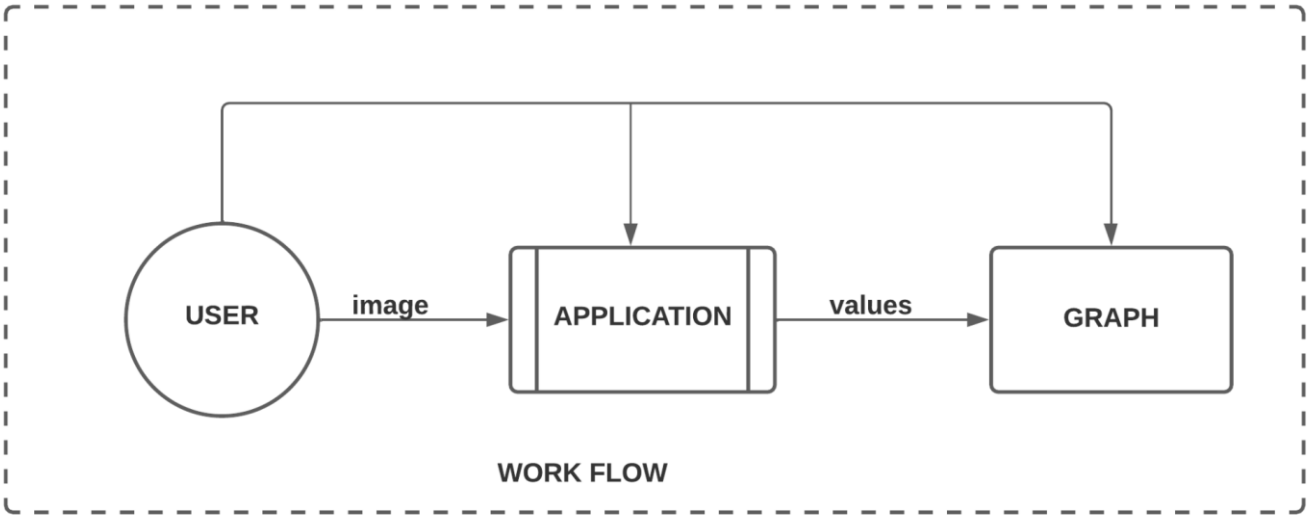
The gui has an insert image button to pass the image as data to calculate glcm matrix, user can insert image in tif, jpeg, jpg, png format. Calculated values of function will be displayed in the edit field of gui. The user can calculate on the preferred image of choice.

- **Show Graph**

The values Calculated in the main app will be passed to gui to gui and by clicking the graph button it will be showing the graph of the respective group as discussed above.

Step 1 - Taking image as a input by the function imread() and showing it on output by function imread()
step 2- Glcm is calculated using formulas.
Step 3 - Now the glcm is converted to normalized glcm which is required for our calculation. First, we add the transpose of glcm to its own matrix and then divide each element of the new matrix (formed by adding glcm and its transpose) by the sum of elements in it. This gives us normalized glcm sum of element of matrix is calculated by function sum (sum ())
Step 4 -Now after getting a normalized glam matrix we use it for texture feature Calculation of Texture features energy , entropy, homogeneity, dissimilarity, angular second moment, glcm mean, glcm correlation, glcm variance, max probability and contrast is done by implementing the formula list given above in our program. We also show these values on a graph to give a visual representation of the output.

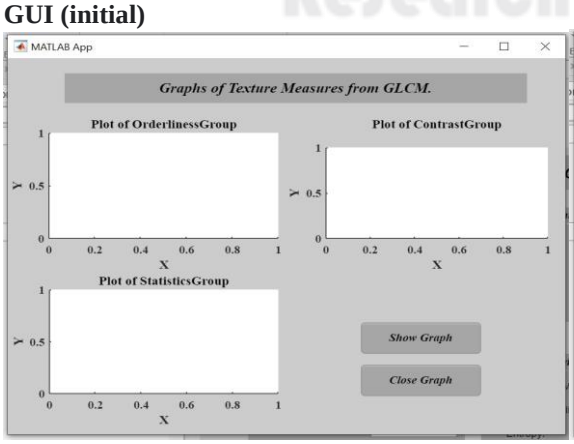


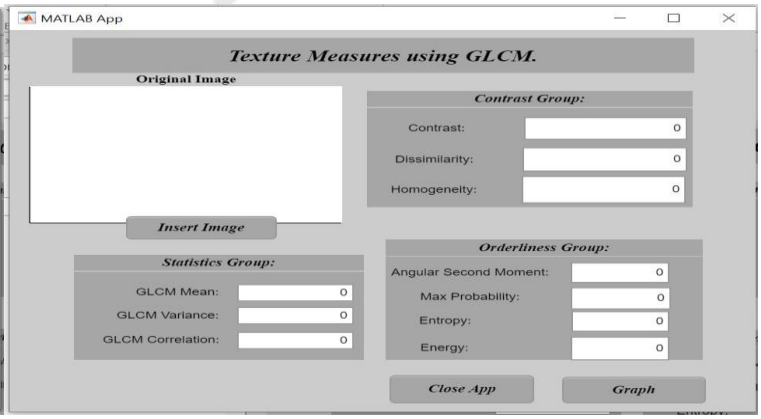


The user after opening the program is shown the GUI in which there is a button which lets you select any image of format jpg,tif, png. After the user selects the required image the program then calculates the texture values and shows the result in both the text as well as graph format for ease of understanding. Then the user can take another image and get the values for that image.

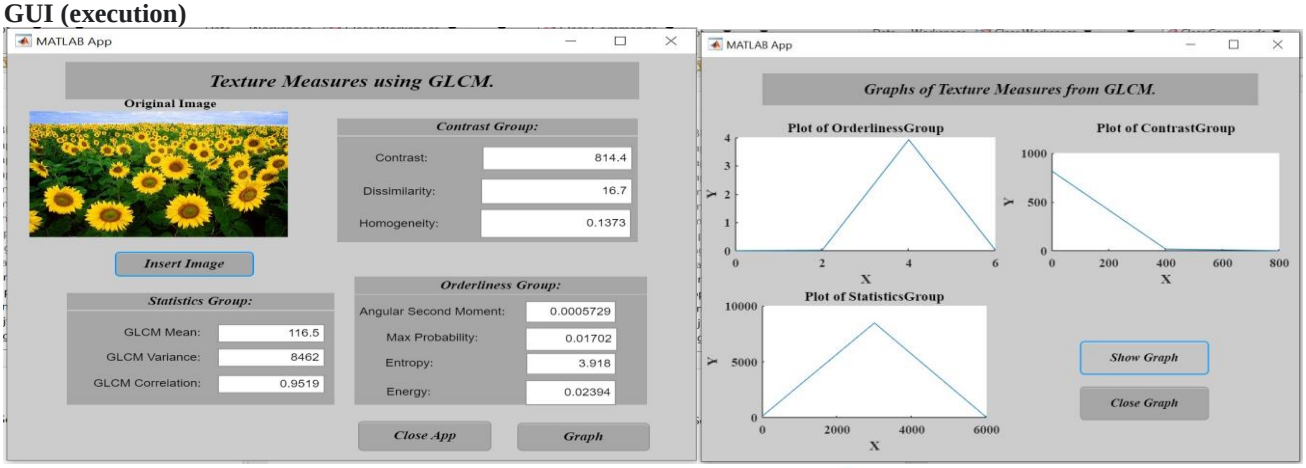
RESULTS AND DISCUSSION

GUI (initial)





GUI (execution)



The GUI is made really intuitive and also easy to understand so that any user can use our program. It has a button for inserting the image called "Insert Image", which can be used to select any image from the user's computer. After selecting the image the program then calculates all the texture values and displays them in their respective field as shown in the GUI. The values have been divided into three groups. The button "Graph" can be pressed for the graphical representation of the texture values of the graph

FUTURE SCOPE-WORK

This project can be further extended by performing Image Segmentation.
Image Segmentation means partitioning an image into multiple image segments or sets of pixels. We can consider a specific window of size w x w. Then for all sets of pixels in the window we can calculate the occurrence matrix and by using this matrix textural features can be derived from it. Window can also be moved by one pixel and the same procedure can be followed.
Image Texture Feature Extraction Using GLCM Approach is used in various kind of fields like Agriculture especially Floriculture, this process is also used in various fields like medical field, satellite images, in Automobile and IT industry it has been a boon from past few years.
The calculated values will be used for further calculation work required after the approach is done. Every time whoever does a project or research in the field has to go from the basics, so here we are providing gui to perform calculations on images that can be reused. The values are grouped under their characteristic properties.

CONCLUSION

The paper shows that the proposed method is an effective way to perform or extract image texture values using glcm approach.We presented a system in which the user can provide any image and the gui gives calculated values. The image provided by the user is converted to matrix format to perform the function calculation.This GUI application is to calculate the values for Texture Features of an image. This application will minimize the efforts that are required in calculating the occurrence matrix then taking the transpose of it then addition and some more steps that need to be performed can be reduced.

REFERENCES

[1] Akshada A. Gade, Arati J. Vyanvahare,"Feature Extraction using GLCM for Dietary Assessment Application,"International Journal Multimedia and Image Processing (IJMIP), Volume 8, Issue 2, June 2018.
[2] Robert M.Haralick , K.Shanmugam and Its'Hak Dinstein,"Textural Feature for Image Classification",The Institute of Electronic Engineers,Vol.SMC-3,No-6,November 1973.
[3] S.Visweswara Rao,M.Harsha Vardhan."GLCM Architecture for image extraction",International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE),Volume 3, Issue 1, January 2014.