Mini Project Report
2020-2021

Mini Project Report on

Image Texture Feature Extraction Using GLCM Approach

Submitted in partial fulfillment of the requirements of the degree of Bachelor in Engineering

by

Name	Class/Roll no	Contact no	Email id
Sobiya Shaikh	SE-4-39	8208019186	sobiya.shaikh_19@sakec.ac.in
Khushi Jain	SE-4-48	8291746303	Khushi.jain_19@sakec.ac.in
Rajat Savdekar	SE-4-36	9423066122	Rajat.Savdekar_19@sakec.ac.in
Darshan Patil	SE-4-28	9011039707	darshan.patil_19@sakec.ac.in

Under the Guidance of
Dr. Manimala Mahato

DEPARTMENT OF COMPUTER ENGINEERING

SHAH AND ANCHOR KUTCHHI ENGINEERING COLLEGE

CHEMBUR, MUMBAI-400088

2020-2021

Table of Contents

Abstract-

In this project we are explaining image feature extraction using GLCM approach. Texture is a feature which is used to segment image into different region .The main aim of a project includes calculating different features of an image. Applications of texture features are divided into two parts Image processing and texture feature analysis.

The texture methods is divided into structural and statistical , model, and filter but we are using statistical method . Here in this we are going to be explaining about GLCM to extract second order statistical feature. There are many features but we have included the four most commonly used features which includes energy , correlation, homogeneity and contract. Texture analysis are divided into two parts but we are using statistical so that it is very much convenient. Hence this technique is based on analysis of statistical feature like GLCM will be implementing in our project .So basically at the end will be taking image is an input and output will also be an image with the a feature.

Chapter 1. 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-occurence matrix based features.In this project Co-occurence 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 commonly used features that are Contrast, Energy, Entropy and Homogeneity.

1. CONTRAST:The term contrast means measuring the spatial frequency of an image and also the difference between the moment of glcm.The formula that is used is given below:

$$\text{Contrast} = \Sigma \ P_{i,j}(i-j)^2$$

2. ENTROPY:It is defined as the state of intensity level in which the individual pixel can adapt.The formula for calculating the entropy is :

$$\text{ENTROPY} = \Sigma \ P_{i,j}[(-\ln P(i,j)]$$

3. HOMOGENEITY:It measures the homogeneity of the an image which is considered to be very lager values for a smaller grey tone.Homogeneity is also commonly called as Inverse Difference Moment.

$$\text{Homogeneity} = \Sigma \ P_{i,j}/1+(i-j)^2$$

4. ENERGY:Energy can also be called as Angular Second Moment.It measures the textural uniformity of an image.It Can be calculated from the below formula:

$$\text{Energy} = \Sigma \ P^2_{i,j}$$

The above mentioned features have been extracted from an image by using a software called as MATLAB.

Chapter 2. Literature Review

Sr. No	Author/Title/Year	Work done/Algorithm/Concept/Idea presented in paper	Remarks
1	Akshada A.Gade, Arati J. Vyanvahare,"Feature Extraction using GLCM for Dietary Assessment Application,2018	Salient region detection method is used. Individual food item features are extracted.	The idea of this paper fails of detect the food items of darker and lighter in colour.
2	Riddhi H. Shaparia ,Dr. Narenra M.Ptel, ProfZankhana H.Shah,"Flower Classification using Texture and Color Features",2017	Texture and colour features o f flowers is extracted. Input images are enhansed by adding portrait effects and removing noise.	Accuracy can be improved if others like edge and shape were used.
3	Shijin Kumare P.S, Dharvun V.S,"Extraction of Texture Features using GLCM and Shape Features using Connection Regions",	Given paper is about MRI scanner to detect the picture from different images of testing. Different features are used for classification. For normal MRI the classification of algorithm depends upon the segmentation for the process.Texture symmetry and intesitu based features are extracted from images.	The texture extraction feature method is the drawback that glcm approach is high and low classification and less efficiency are

			the demerits
4	S.Visweswara Rao,M.Harsha Vardhan."GLCM Architecture for image extraction",	FPGA-based architecture for real-time extraction of four GLCM features.For extracting the features they have used statistical method based on gray level pixel value.	Statistical method is used to obtained the image extraction in gray-scale level analysis which can be further extended to different algorithms represented theoretically in feature extraction of images.
5	P.Mohanaiah, P.Sathyanarayana,L.GuruKumar,"Image Texture Feature Extraction Using GLCM approach",International journal of Scientific and Reacher Publications,Vol 3,Issue 5,May 2013.	Features that are listed in the papers the results shows that these texture features have high discrimination accuracy,requires less computation time & hence efficiently used for real time pattern recognition application.	As the size of the image on which Texture features are extracted increases , the values of all the features also increased proportionally . So optimum size of image can only be use for better

			resolution and minimum loss of information. Optimum size is 128x128 pixels .
6	Santanu Kumare Sahoo,Asit Kumar Subudhui,"Using Color and Texture Feature Extration Technique to Retrieve Image",International Journal of Technology and Exploring Engineering,Vol-8,Issue-11S,September 2019.	This paper proposes a system that extracts and combines the features of the texture and colour. Texture and colour are extracted by using GLCM algorithm Colour feature extracted by histrogram values.	This paper could have used more classifier for identifying and classifying.
7	Hobert M.Haralick , K.Shanmugam and Its'HakDinstein,"Textural Feature for Image Classification",The Institute of Electronic Engineers,Vol.SMC-3,No-6,November 1973.	This paper gives detailed information about Texture Features. It also provides Information about the application of texture feature 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.

Chapter 3. Problem Definition and Objectives

Problem Statement:-

Image plays an important and crucial role in today's age.The image processing field has progressed alot in passed 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 alogrithmically 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 feature from images. In this project we are going to calculate four features by using GLCM method by modifying the colourful image to greyscale image . In it the number of times the certain pair of pixels with particular values appears in a matrix is calculated by GLCM functions for characterising the texture of 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 kind of fields.

Scope: -

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 accuracy of this system is about 80% and with some mix features like shape and edge recognition we can increase its accuracy more than 95%.Here is a detail explaination for use of glcm in different fields ,in medical field it is used to take images of internal organs to cure medical conditions like brain tumers and diseases like cancer. In flouriculture it is used to recognize types of flowers to make pharmacitical products. In autobile industry it is very efficient in recognising vehicle logos and their classification , but also plays a significient role in monitiring systems and security.In global positioning system it is used to take clear images in different types of terrains, it can be a key to defence systems of our country.

Feasibility Study:

The project here is to apply the gray level co-occurrence matrix (GLCM) to sample of satellite images and use the result for feature extraction . Feature Extraction is a method of capturing visual content of images for indexing & retrieval . The Four features namely Energy , Contrast ,

Homogeneity and Entropy are going to be calculated for a given image using GLCM . This topic has a lot of potential in future and also it is been used at advanced level by many resarchers . For eg ,we can use google assistant smart scan feature to extract all types of data and information from the sample image. This is a fairly simple project which does not need more facilities to be performed.We need only our computer and a set of sample images to perform the glcm analysis and our program which will handle all the analysis part.Then by analysing the data we would be able to extract details such as water body or high and low density region . In conclusion we have extracted important details from a image by using texture analysis approach by glcm .

Chapter 4. Proposed Methodology

Methodology/Planning of work:

We used the software called MATLAB for our mini project . This software has its own language which is easy to understand for beginners . We found many helpful videos and documents on MATLAB official website which helped us in our project . This software saves files in ".m " format . (INSERT YOUR MATLAB CODE HERE).First we take input as a jpg or jpeg image in our code . Then we convert the image to grayscale image by using rgb2gray function which is built in MATLAB . Then we show both input image and converted grayscale image as a output by subplot function after that we use the glcm function graycomatrix(), which takes the converted grayscale image and calculate the Graylevel co-occurence matrix and show it in ouput .Now we take this glcm and convert this to normalised glcm by doing calculation in matlab . Then we calculate the Contrast , Entropy , Energy , Homogeneity from our glcm matrix calculated in last step . We use two for loop for each calculation as the calculation is performed on each element of the normalised glcm .We have created a Graphical user interface which includes a button in which we choose the image to be insert and we are shown output.Then we get these in ouput

Input image

Grayscale Image

Glcm matrix

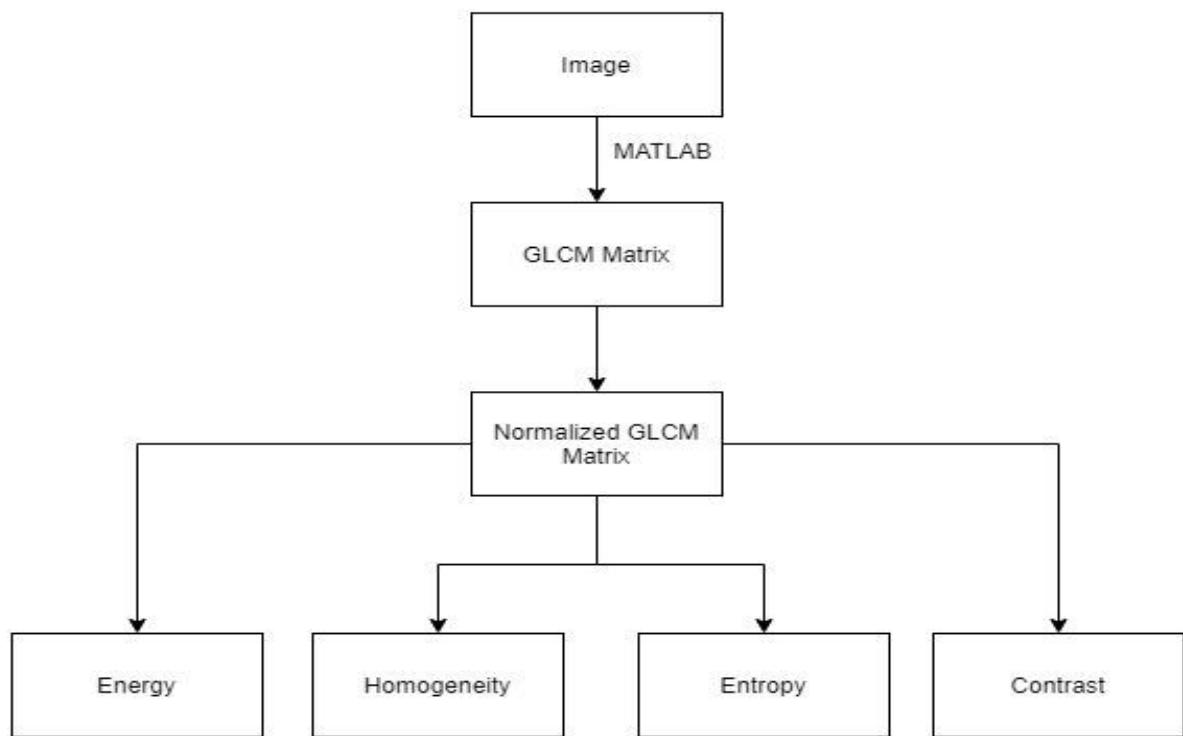Normalised Glcm matrix

Contrast

Entropy

Energy

Homogeneity

Facilities required for this Project were a laptop or pc to run the MATLAB software . No specific harware was required .

GLCM Features	Formula
Contrast	$\Sigma\ P_{i,j}(i\text{-}j)^2$
Energy	$\Sigma\ P^2{}_{i,j}$
Entropy	$\Sigma\ P_{i,j}[\text{-}\ln P(i,j)]$
Homogeneity	$\Sigma\ P_{i,j}/1\text{+}(i\text{-}j)^2$

Algorithm:

Block Diagram for Extracting The Features

Facilities required for proposed work:

Software-

Matlab for pc.

Hardware-

Our local system's RAM ranges from 4-8 GB and 128 to 1 TB main memory. They have processors manufactured by Intel and Ryzen.

Chapter 5:Summary

This document provides the overall view of the project.In this project as mentioned above four texture feature extraction from different images has been done. For this MATLAB software has

been used.In this first the image input is taken which is in jpg or jpeg format . Then the image is converted to grayscale image by using some functions which is built in MATLAB . Then both the input and the coverted images is shown which gets displayed on the screen . And then by graycoprops sub-function is used to calculate Contrast , Entropy , Energy , Homogeneity from our glcm matrix and then it is calculated .

References [IEEE format]

[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] Riddhi H. Shaparia ,Dr. Narenra M.Ptel, ProfZankhana H.Shah,"Flower Classification using Texture and Color Features,"International Conference on Research and Innovations in Science, Engineering &Technology,Volume 2, 2017, Pages 113–118.

[3] Shijin Kumare P.S, Dharvun V.S,"Extraction of Texture Features using GLCM and Shape Features using Connection Regions", International Journal of Engineering and Technology (IJET).

[4] 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.

[5] P.Mohaniah,P.Sathyanarayana,L.GuruKumar,"Image Texture Feature Extraction Using GLCM Approach",International journal of Scientific and Reacher Publications,Vol 3,Issue 5,May 2013.

[6] Santanu Kumare Sahoo,Asit Kumar Subudhui,"Using Color and Texture Feature Extration Technique to Retrieve Image",International Journal of Technology and Exploring Engineering,Vol-8,Issue-11S,September 2019.

[7]Hobert M.Haralick , K.Shanmugam and Its'HakDinstein,"Textural Feature for Image Classification",The Institute of Electronic Engineers,Vol.SMC-3,No-6,November 1973.