**SVKM’s NMIMS**

**Mukesh Patel School of Technology Management & Engineering**

**Computer Engineering Department**

Program: MBA Tech.Sem V

**Course: Image Processing**

**List of Experiments**

w.e.f. 1nd July 2020

**Faculty:** Dr. PrachiNatu

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| --- | --- | --- | --- |
| **Exp No.** | **Title** | **Prerequisite\*** | **CO#** |
| 1 | **Introduction to Image Processing using Matlab.** (Imread, Imwrite, Imshow, size, resize, Addition, Subtraction, Multiplication and division of Images) | Refer the Matlab manual, Soft copy of your Photograph | CO1 |
| 2. | **To study the pixel relationship in the Image** (4,8,m connectivity and Use distance measures like Minkowaski Distance, Eucledian Distance, City Block, Chess board, Sum of absolute difference. ) | Knowledge of 4,8,M connectivity and Distance measure formulae, Soft copy of your Photograph | CO1 |
| 3. | **Implementation of Point Processing Operations in Spatial Domain.**  a. Negation of an image  b. Thresholding of an image  c. Contrast Stretching of an image  d. Gray level Thresholding  e. Bit Plane slicing. | Matlab programming syntax,  Knowledge of point processing operation, Soft copy of your Photograph | CO1 |
| 4 | Write a program to enhance the quality of image (on your own photograph) by noise removal, (HPF, LPF and Median filtering). | Matlab programming syntax,  Knowledge of filtering techniques, Soft copy of your Photograph | CO1 |
| 5 | Apply various transforms (Hadamard, Walsh and DFT) on the image and compare its results. | Matlab programming syntax and knowledge of transforms, Soft copy of your Photograph | CO2 |
| 6 | Apply various transforms ( DCT, DST, Hartley, Slant) on the image and compare its results. | Matlab programming syntax and knowledge of transforms, Soft copy of your Photograph | CO2 |
| 7 | Perform second level decomposition of your photograph using Haat Wavelet | Matlab programming syntax and knowledge of Haar Wavelet, Soft copy of your Photograph | CO3 |
| 8 | Write a program to segment the given medical image using edge detection techniques: Robert, Prewitt and Sobeloperators. | Matlab programming syntax, understaning of medical image, soft copy of brain tumour CT Scan image and knowledge of edge detection operators | CO4 |
| 9 | Write and execute program for given noisy finger print image and apply following image morphological operations in given order.   1. Opening of image 2. Opening followed by closing | Matlab programming syntax, understanding of medical image and knowledge of morphological operations, Soft copy of finger print image | CO4 |
| 10 | Write a program to compress the image (your own photograph) using energy conservation concept of Discrete cosine transform and calculate RMSE, PSNR and compression ratio. | Soft copy of your Photograph and knowledge of Image compression concepts | CO5 |
| 11 | Case study: Presentation on selected IEEE /ACM paper based on chosen image processing application. | Selected IEEE/ACM paper, Summary of the paper and PPT presentation |  |

\* Students are expected to be ready with the prerequisite before attending the lab

LAB Manual

PART A

(PART A : TO BE REFFERED BY STUDENTS)

**Experiment No.02**

**A.1 Aim:**

**To write a menu driven program in Matlab to compare two images.**

**A.2 Prerequisite:**

1. Understanding of fundamental programming functions/commands and environment of Matlab (Refer the Matlab manual),

2. Understanding of Switch case statement in Matlab.

2. Availability of Soft copy of your Photograph for experiment.

3. Understanding of correlation among pixel intensities and concept of distance calculation.

**A.3 Outcome:**

**After successful completion of this experiment students will be able to**

1. Explore and understand the importance of Correlation among neighborhood pixel intensities.
2. Understand various distance measuring equations and compare them w.r.t. time complexity.
3. Write program to differentiate between two images based on following intensity distance calculation methods:
4. Minkowaski Distance
5. Eucledian distance
6. City block distance
7. Chess board distance
8. Sum of absolute difference

**A.4 Theory:**

**A.4.1 Relationship among pixels:**

Each pixel in the digital image has correlation with its neighboring pixel with respect to the intensity values they carry. This relationship focuses on the connectivity of the pixel with another pixel in the image. The connectivity among pixels can be determined in 3 ways : 4 connectivity, 8 connectivity and m connectivity. Lesser the difference among the pixel intensities w.r.t. to the neigbouring pixel can provide better quality of the image as a whole and this can be said to have the strong correlation among them.

There are various distance measuring methods (given in section A.4.2 below) which can be utilized to check the correlation among pixels. The distances calculated by these methods can be used to decide the level of correlation among pixels. Lesser the distance calculated that mean there is better correlation exists among the pixels and vice versa.

**A.4.2. Various distance measures:**

1. **Minkowaski Distance:**

The general formulaeof Minkowaski distance is given below:

…..Equation (1)

1. **Euclidian Distance:**

The Eucledian distance formula can be obtained if the value of p =2 taken in the Minkowaski equation given in the equation (1).

1. **City Block Distance:**

The city block distance of two pixels D4 [(i,j), (k,l) ] = |i-k| +|j-l|. This metric measures the path between the pixels based on 4 connected neighbourhood as given in Figure 1 below:

|  |  |  |
| --- | --- | --- |
|  | O |  |
| O | x,y | O |
|  | O |  |

**Figure 1: Four connected neighbors**

For a pixel ‘p’ with the coordinates (x,y), the set of pixels given by

**N4 (p) = { (x+1,y), (x-1,y), (x,y+1), (x, y-1)}** ….. Equation (2).

**|x1-x2| + |y1-y2|**

1. **Chess Borad Distance:**

The chess board distance of two pixels is given by

**D8[ (i,j), (k,l)] = max [ |i, k|, | j - l|]**  ….. Equation (3).

**max(| x1-x2| , | y1-y2 |)**

|  |  |  |
| --- | --- | --- |
| O | O | O |
| O | i ,j | O |
| O | O | O |

**A.5 Procedure/Algorithm:**

**A.5.1 TASK 1:**

1. Create new file in matlab

2. Write a program to Read two Image files and display both read image files.

3. Modify the intensity values of at least 10 pixels in input images randomly at random positions.

4. Calculate the distance of these modified pixels with its neighborhood pixels w.r.t. 4 and 8 connectivity in the block of 3x3, provide the percentage of difference and comment on closeness of pixel with its neighbors..

6. Observe the output and complete PART B of lab manual.

7. Save and close the file and name it as **EXP2\_Task1\_your Roll no.m**

**TASK 2:**

1. Create a new matlab file.
2. Read two input images.
3. Show the menu and ask for user choice of distance measure to be used.
4. Ask for comparison whether to be done between same images or two different images
5. Compare both images pixel by pixel using distance measuring method chosen.
6. Comment on the time taken by the program to complete the task and comment whether both input images are same or different.
7. Complete PART B of lab manual.
8. Save and close the file and name it as **EXP2\_Task2\_your Roll no.m**

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PART B

(PART B : TO BE COMPLETED BY STUDENTS)

***(Students must submit the soft copy as per following segments within two hours of the practical. The soft copy must be uploaded on the Blackboard or emailed to the concerned lab in charge faculties at the end of the practical in case there is no Black board access available)***

|  |  |
| --- | --- |
| Roll No. N049 | Name: Tarun Tanmay |
| Class: MBA Tech CE | Batch : B3 |
| Date of Experiment: | Date of Submission |
| Grade : |  |

**B.1 Software Code written by student:**

***(Paste your Matlab code completed during the 2 hours of practical in the lab here)***

clear all;

clc;

img1=imread('/Users/tjrox0825/Desktop/College.jpg');

img2=imread('/Users/tjrox0825/Desktop/College.jpg');

re\_img1=imresize(rgb2gray(img1),[100,100]);

re\_img2=imresize(rgb2gray(img2),[100,100]);

re\_img1\_mod=re\_img1;

for i=1:5

for j=1:5

re\_img1\_mod(i,j )= randi([50,100]);

end

end

figure();

subplot(131);

imshow(re\_img1)

subplot(132);

imshow(re\_img2);

subplot(133)

imshow(re\_img1\_mod);

re\_img1=double(re\_img1);

re\_img2=double(re\_img2);

re\_img1\_mod=double(re\_img1\_mod);

sum=0;

for i =1:100

for j =1:100

distance=(re\_img1(i,j)-re\_img1(i,j))^2;

sum=sum+distance;

end

end

eu\_dist=sqrt(sum);

disp("The euclidian distance for IMG1 with itself is " + eu\_dist);

sum1=0;

for i =1:100

for j =1:100

distance=(re\_img1(i,j)-re\_img1\_mod(i,j))^2;

sum=sum+distance;

end

end

eu\_dist1=sqrt(sum);

disp("The euclidian distance for IMG1 and modified IMG1 is " + eu\_dist1);

sum2=0;

for i =1:100

for j =1:100

distance=(re\_img1(i,j)-re\_img2(i,j))^2;

sum=sum+distance;

end

end

eu\_dist2=sqrt(sum);

disp("The euclidian distance for IMG1 and IMG2 is " + eu\_dist2);

man\_dist=0;

for i =1:100

for j =1:100

distance=abs(re\_img1(i,j)-re\_img1(i,j));

man\_dist=man\_dist+distance;

end

end

disp("The Manhattan distance for IMG1 with itself is " + man\_dist);

man\_dist1=0;

for i =1:100

for j =1:100

distance=abs(re\_img1(i,j)-re\_img1\_mod(i,j));

man\_dist1=man\_dist1+distance;

end

end

disp("The Manhattan distance for IMG1 and IMG1 modified is " + man\_dist1);

man\_dist2=0;

for i =1:100

for j =1:100

distance=abs(re\_img1(i,j)-re\_img2(i,j));

man\_dist2=man\_dist2+distance;

end

end

disp("The Manhattan distance for IMG1 and IMG2 is " + man\_dist2);

**B.2 Input and Output:**

***(Paste your program input and output in following format, If there is error then paste the specific error in the output part. In case of error with due permission of the faculty extension can be given to submit the error free code with output in due course of time. Students will be graded accordingly.)***

***A screenshot of a cell phone

Description automatically generated***

***A screenshot of a computer

Description automatically generated***

**B.2.1 TASK 1**

**Input Images:**Your photograph

**Output:**

1. Image with the visible random intensity changes.
2. Distance of each modified pixels in its 3x3 block w.r.t. 4 and 8 connectivity.
3. Percentage of difference w.r.t. the neighbor
4. Comment on closeness of modified pixel with its neighbor.

**B.2.2 TASK 2**

**Input Images:** Your photograph and output of TASK 1

**Output:**

1. Menu choices.
2. Menu selection
3. Output for each choices w.r.t. to comparison of same image and two different images
4. Time taken to compare images for all distance measures.

**B.3 Observations and learning:**

We have observed the Euclidean and Manhattan distances of the images with each other.

**B.4 Conclusion:**

*(****Students must write the conclusion as per the attainment of individual outcome listed above and learning/observation noted in section B.3)***

Hence the Euclidean and Manhattan distance between same, modified and

different images have been found.

**B.5 Question of Curiosity**

***(To be answered by student based on the practical performed and learning/observations)***

Why do you feel the relationship among all pixels in any digital image is essential to study and ponder over? How does it affect the overall quality of an image? Give a working example.

* The relationship between the pixels determines the quality and the objects in the image.
* If the pixels of similar intensity are close to each other, the image will be

clearer.

* Also, it is important for image compression. A change in the pixel values

tells us that the object is changed.

* When the image is compressed some pixels are

removed to reduce the size which indeed results in distortion of the image.

Some examples are

* + Image enhancement
  + Object recognition

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