

Dr.Mahalingam College of Engineering and Technology, Pollachi-642003

Office of Dean Research and Innovation

Report

“MATLAB – Signal and Image Processing Toolbox”

Date: 16.06.2023

About the Session

The Office Dean Research and Innovation organized a Knowledge Sharing Session for the benefit of the Faculty members of MCET. The session details are given below for your kind reference.

S.No	Name of the Resource Person	Topic	Date &Time	Venue	No of Participants
1	Dr.R.Sudhakar, HoD-ECE	MATLAB – Signal and Image Processing Toolbox	10.06.2023	Programming and IOT Lab(C315)	21

Topics Covered:

Image processing using MATLAB

Image processing involves various techniques and concepts. Image representation refers to the methods used to store and represent images digitally. Image enhancement techniques aim to improve the visual quality of an image by adjusting contrast, brightness, or sharpness. Image degradation/restoration focuses on mitigating or reversing the effects of noise, blurring, or other forms of image deterioration. Image segmentation involves dividing an image into meaningful regions or objects. Image compression aims to reduce the size of an image file while maintaining visual quality, enabling efficient storage and transmission of images. Visual information is considered more powerful and impactful than textual information. A picture is worth a Thousand words.

Image types

- Grayscale Image: Shades of gray representing light intensity.
- Color Image: Multiple color channels (e.g., RGB) determining pixel color.
- Black and white: Two pixel values (e.g., black and white) for foreground and background.

Image Representation of Gray Scale Image

- Gray Scale Image is also called as 2-D matrix
- The Value at (1,1) is top most left corner of an image
- A Values of this 2D matrix can be any integer value from 0 to 255 for 8 bit representation
- The Value “0” corresponds to black

- The Value 255 corresponds to white
- Intermediate values are shades from black to white
- 128×128 image = $128 \times 128 \times 8$ bits = 128×128 byt

Image Representation of Color Image

- Color Image=(Red+Green+Blue) Image
- i.e. at each location (x, y), we need to add on more dimension z as (x, y, z)
where $z = \{\text{red, green, blue}\}$ by $z = \{1,2,3\}$
 - (x, y, 1) --- red component at (x, y)
 - (x, y, 2) --- green component at (x, y)
 - (x, y, 3) --- blue component at (x, y).
- Color intensity value at the location (1,1)= value at $\{(1,1,1)+ (1,1,2)+ (1,1,3)\}$

The Image Processing Toolbox

- It is a collection of functions that extend the capability of the MATLAB ® numeric computing environment
- Many of the toolbox functions are MATLAB M-files, series of MATLAB statements that implement specialized image processing algorithms.

Images in the Image Processing Toolbox

- The basic data structure in MATLAB is the array, an ordered set of real or complex elements.
- MATLAB stores most images as two-dimensional arrays (i.e., matrices), in which each element of the matrix corresponds to a single pixel in the displayed image.
- For example, you can select a single pixel from an image matrix using normal matrix subscripting: I(2,15)

Matrix and array operations

```
>> a=[1 2 3]; b=[4 5 6]
>> a+b = [5 7 9]
>>a-b=[-3,-3,-3]
>>a.*b=[4 10 18]
>>a.^ b=[1 32 729]
>>a./b=[0.2500 0.4000 0.5000]
>>a.\b=[4.0000 2.5000 2.0000]
```

Addressing Parts of a Matrix

```
>> A=diag([1 2 3])
```

```
>> A(2,3)=-1
```

```
>> A(2,3)
```

colon operator

```
>> A(:,1) (only 1st column, all the elements in the row)
```

```
>> A(2,:) (only 2nd row, all the elements in the column)
```

```
>> A(:,[1 2]) (two columns)
```

```
>> A(:,1:2:4) (first and third columns)
```

```
>> A(:) (appending all the columns into one column)
```

Code to Load an Image

```
>> I=imread('mandrill.bmp','bmp');% load image
```

Code to Display an Image

```
>> image(I) % display image
```

```
>> whos I
```

Image conversion

- **gray2ind** - intensity image to index image
- **im2bw** - image to binary
- **im2double** - image to double precision
- **im2uint8** - image to 8-bit unsigned integers
- **im2uint16** - image to 16-bit unsigned integers
- **ind2gray**- indexed image to intensity image
- **mat2gray** - matrix to intensity image
- **rgb2gray** - RGB image to grayscale
- **rgb2ind** - RGB image to indexed image

Histogram Equalization

- Histogram: distribution of intensities
figure, imhist(I)
- Equalize Image (contrast)
I2 = histeq(I);
figure, imshow(I2)
figure, imhist(I2)

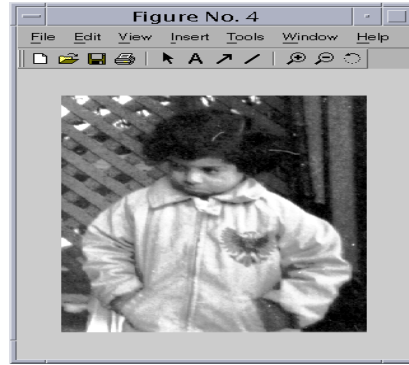
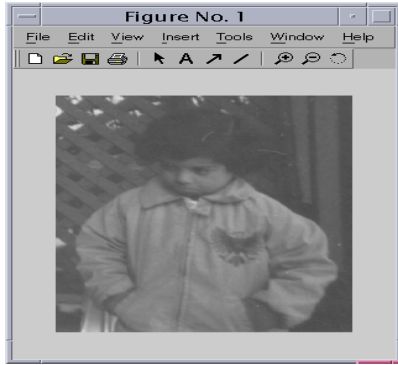


Image enhancement code

- `I = imread('pout.tif');`
- `J = imadjust(I);`
- `imshow(J)`
- `figure, imhist(J)`

Image Arithmetic code

- `imabsdiff`
- `imadd`
- `imcomplement`
- `imdivide`
- `imlincomb`
- `immultiply`
- `imsubtract`

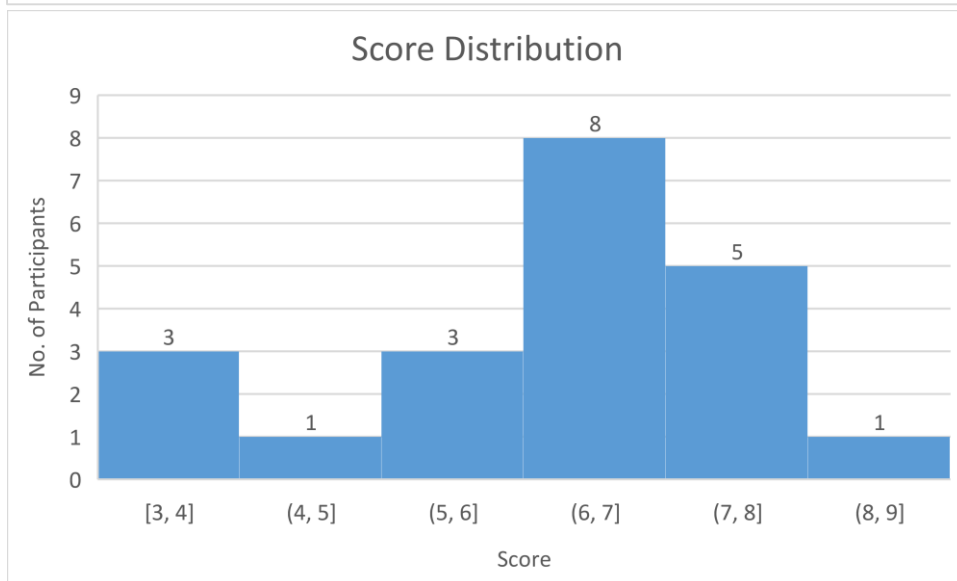
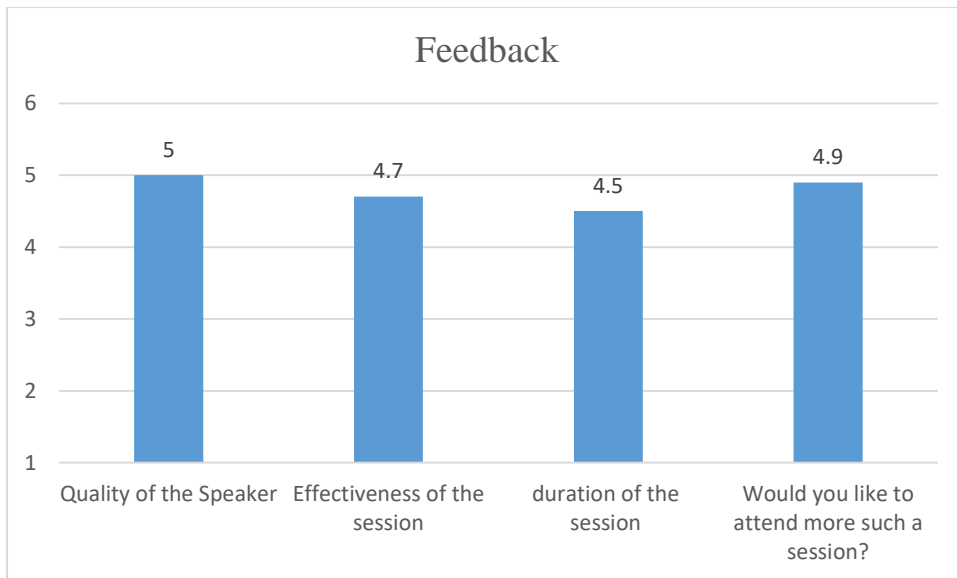
In addition, provide a hands-on session on geometric operations, picture editing (Image resizing, cropping, rotating) and Image Transformation (Convolution and Transform of images, DCT, 2D-DWT, filtering, Morphological opening and Eroding image).

Valedictory Address

Dr. J. Ramprasath winded up the session with a Vote of Thanks. He extended his gratitude of thanks to Resource Person and all participants for the successful completion of Workshop. He also honors the resource person and presents him with a certificate of appreciation.

Feedback and Assessment

Feedback was collected from all participants and they shared positive views about the session. Based on the topic discussed multiple choice questions assessment was given to participants to assess the effectiveness of the session.



1. Which of the following process helps in Image enhancement?
 - A. Digital Image Processing
 - B. Analog Image Processing
 - C. **Both a and b**✓
 - D. None of the above
2. Which of the following is the first and foremost step in Image Processing?
 - A. **Image acquisition**✓
 - B. Segmentation
 - C. Image enhancement
 - D. Image restoration
3. _____ determines the quality of a digital image.
 - A. The discrete gray levels
 - B. The number of samples
 - C. **discrete gray levels & number of samples**✓
 - D. None of the mentioned.

4. Which of the following is the abbreviation of JPEG?
 - A. Joint Photographic Experts Group**✓
 - B. Joint Photographs Expansion Group
 - C. Joint Photographic Expanded Group
 - D. Joint Photographic Expansion Group
5. Region of Interest (ROI) operations is generally known as _____
 - A. Masking**
 - B. Dilation
 - C. Shading correction
 - D. None of the Mentioned
6. Which of the following filter's responses is based on the pixels ranking?
 - A. Sharpening filters
 - B. Nonlinear smoothing filters**✓
 - C. Geometric mean filter
 - D. Linear smoothing filters
7. Which side of the greyscale is the component of the histogram concentrated in a dark image?
 - A. Medium
 - B. Low**✓
 - C. Evenly distributed
 - D. High
8. For $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$; what is the size of the matrix.
 - A. 3 X 3**✓
 - B. 5 X 5
 - C. 2 X 2
 - D. 4 X 4
9. The command used to 'display' an image is
 - A. imshow**✓
 - B. imread
 - C. iminfo
 - D. imadd
10. 'histeq' command is used for
 - A. Histogram doubling
 - B. Histogram equalization**✓
 - C. Histogram rounding
 - D. Histogram processing
11. The output of $A(:,1)$
 - A. only 1st column, all the elements in the row**✓
 - B. only 1st row, all the elements in the column
 - C. only 1st diagonal values
 - D. only 1st co diagonal values
12. $A(:)$ implies
 - A. appending all the columns into one column**✓
 - B. appending all the rows into one column
 - C. appending all diagonal values
 - D. appending all the columns into one row

13. The command to remove 1st row in a matrix is
- A. **a(:,1)=[]**✓
 - B. a(1,:)=[]
 - C. a(:,2)=[]
 - D. a(:)=[]
14. By default, MATLAB stores most data in arrays
- A. unsigned integer 8bits
 - B. unsigned integer 16 bits
 - C. **class double**✓
 - D. signed integer 8bits
15. The output of the image after executing the command J = immultiply(I, 1.2);
- A. the brightness of the image decreases
 - B. **the brightness of the image increases**✓
 - C. the darkness of the image increases
 - D. no change in the brightness

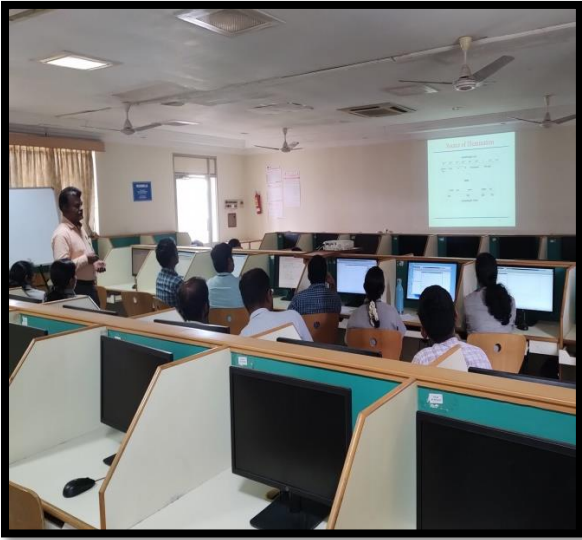
Interaction:

How to display subimage?

```
[X1,map1]=imread('forest.tif');  
[X2,map2]=imread('trees.tif');  
subplot(1,2,1), subimage(X1,map1)  
subplot(1,2,2), subimage(X2,map2)
```

Outcomes

- ❖ As outcomes of the session, participants can understand Basics of Image processing and have an ability to build an application using MATLAB.



S. Pruthi

Dean R&I

Pruthi

Principal

-Sd-

Secretary

Dr. Mahalingam College of Engineering and Technology, Pollachi - 642003


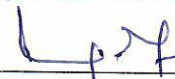

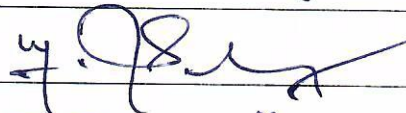



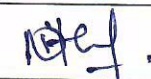
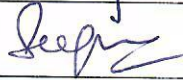




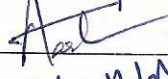
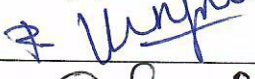
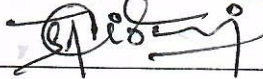
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Knowledge Sharing Session - Faculty Attendance

Venue: Program & IoT Project Lab (C315)

Time: 2:30 pm – 4:30 pm

Date:10.06.2023

S.No.	Name of the Faculty Members with Designation	Department	Signature
1. ✓	V. GURUNATHAN, AP	ECE	
2.	K. DURGA LAKSHMI, AP(Asst)	ECE	
3. ✓	S. Karthikeyan, AP	EIE	G. ✓
4. ✓	V. Karthikeyan, AP(SS)	EIE	
5. ✓	R. SHERINE SONY, AP(SS)	ECE	R. Sherine Sony
6. ✓	M. Saravandhan, AP	EEE	
7. ✓	Mathubharathi R AP(SS)	EEE	
8.	D. Anandprakashan, AP	EEE	
9. ✓	T. Flowham AP	EIE	T. Flowham
10. ✓	Shafeeb. A, AP	ECE	
11. ✓	N. Nithiyameenatchi, AP	ECE	
12. ✓	N. Seegirham, AP	ECE	
13. ✓	S. Dharami, AP/1	ECE	S. Dharami
14. ✓	K. C. Raja Rajeshwari, AP	ECE	
15. ✓	J. NAGARAJAN AP	EEE	
16. ✓	S. SIVANAYAGAN, AP	EEE	
17. ✓	A. Suganya	EEE	
18. ✓	N. Arathi	EEE	
19. ✓	P. Vanjipriya AP/1	ECE	
20. ✓	S. Abisamasundari	ECE	

21. ✓	T. Anand Kumar	EEE	TRD
22.			
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Topic: MATLAB - Signal and Image Processing Toolbox			
Resource Person: Dr.R.Sudhakar, HoD-ECE			Date : 10.06.2023
S.No.	Name of the Faculty	Designation	Score
1	P.Vanjpriya	AP/ECE	9 / 10
2	N.Nithiyameenatchi	AP/ECE	8 / 10
3	Abiramasundari S	AP/ECE	8 / 10
4	N Sugirtham	AP/ECE	8 / 10
5	R SherineJenny	AP(SS)/ECE	8 / 10
6	Selvanayakam A	AP/EEE	8 / 10
7	D.Gnanaprakasam	AP/EEE	7 / 10
8	Rajarajeshwari K C	AP/ECE	7 / 10
9	Dharani S	AP/ECE	7 / 10
10	Gurunathan V	AP/ECE	7 / 10
11	Shafeek A	AP/ECE	7 / 10
12	K Durgalakshmi	AP(SS)/EEE	7 / 10
13	Anand Kumar T	AP(SS)/EEE	7 / 10
14	Aarthi N	AP/EEE	7 / 10
15	Saravanakumar M	AP/EEE	6 / 10
16	Suganya A	AP/EEE	6 / 10
17	Muthubharathi R	AP/EEE	6 / 10
18	Karpagam V	AP(SS)/EIE	5 / 10
19	Gowtham.T	AP/EIE	4 / 10
20	G.Karthikeyan	AP/EIE	4 / 10
21	J Nagarajan	AP/EEE	3 / 10