

DIGITAL IMAGE PROCESSING;

Defined as two dimensional (2D) function.

Two dimensional function involves TWO VARIABLES as $f(x, y)$, where x and y are all spatial function and f is an amplitude.

- AMPLITUDE is also defined as an intensity of an image.

Question; What is an intensity?

- INTENSITY its also called GREY LEVEL.

Hence Amplitude or intensity or grey level.

- GREY LEVEL involves MONOCHROME (black and white images), the non-coloured screen.

TYPES OF IMAGE

^{Gray-scale image}
(a) Grey image (black and white)

(b) Coloured image (red, green and blue) ^{primary colours} RGB.
(different colours).

(c) Binary image

posses two values 0 and 1

(d) Indexed image.

0-black

255-white

Question: Why digital image processing and not analogy image processing.

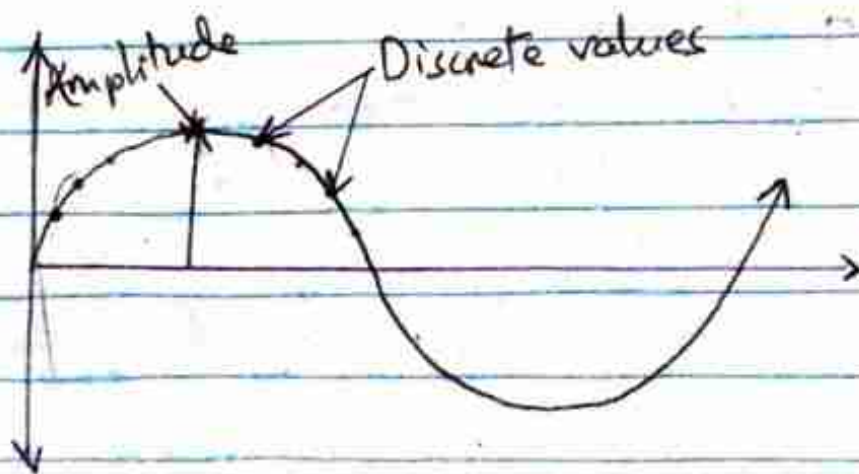
- The analogy image must be converted to digital form for easily processing process.

WHAT TO CONSIDER ON ANALOGY-DIGITAL CONVERSION

(a) Sampling

- Involves the discrete values (only some points)
- The sampling operated on analogy image by taking discrete values.
- Digital image is not continuous as the analogy, hence only some points needed for its conversion
- Discrete values obtained by taking the AMPLITUDE LEVEL (pick value)

Amplitude
coordinate
value



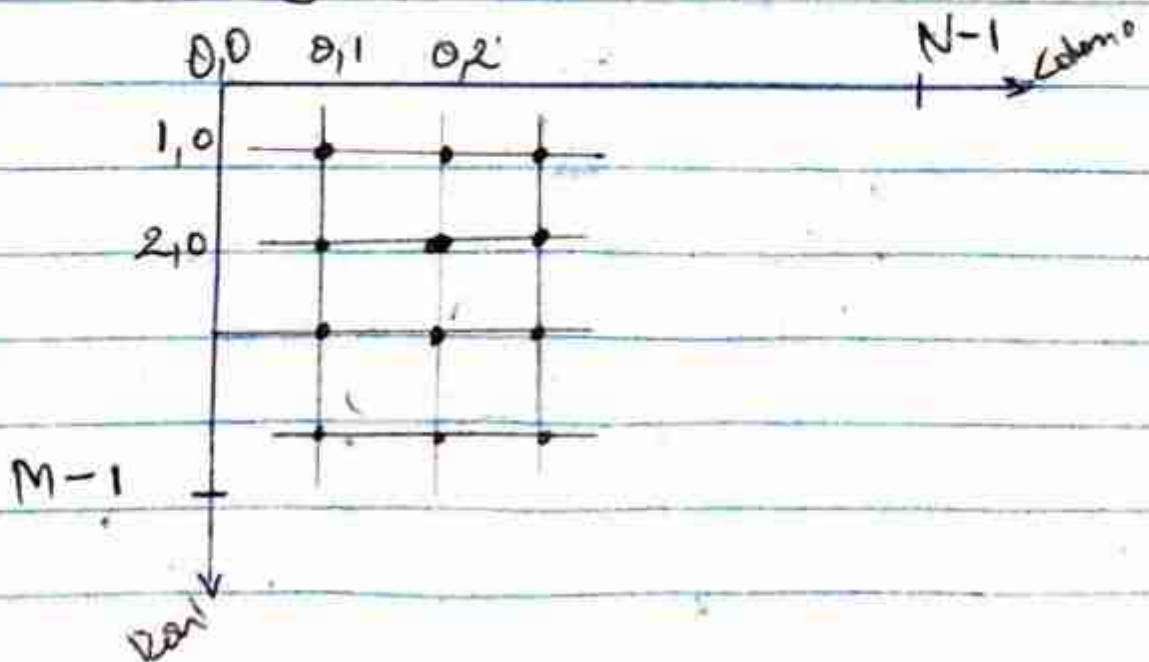
- After obtaining the discrete values hence the second stage which is;

(b) Quantization.

→ digitize the amplitude value
 - The process of converting an analog image to digital image process.

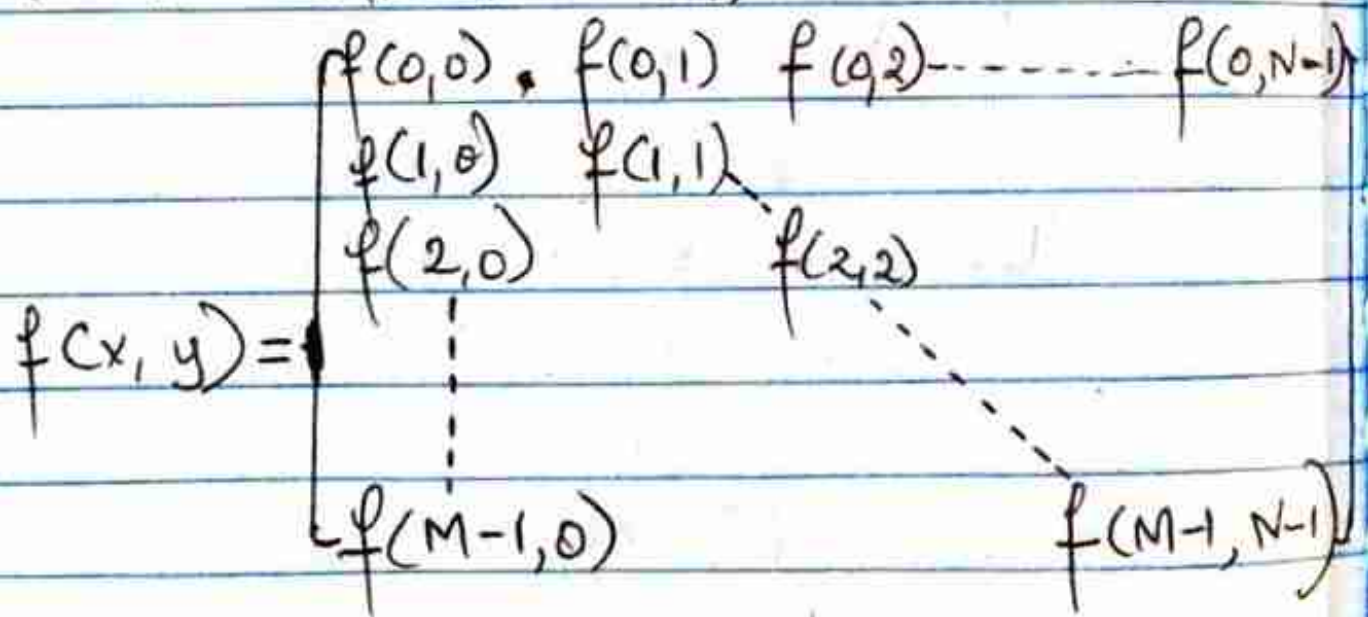
- $f(x, y)$ poses M by N ($M \times N$) dimension.
 where; M - row.
 N - column.

- The origin of DIGITAL IMAGE is $0, 0$ hence
 $x = 0$
 $y = 0$



- The coordinates obtained are called PIXEL or IMAGE ELEMENTS.
- Coordinates represent samples from the discrete values of an analog image.
 - More pixel samples & good image (quality) (Tree image)
 - More coordinates & good image.

MATHEMATICAL NOTATION;



MATLAB

→ There is no need to declare a Datatype.
→ Follow the Roles of declaring the Variables.

→ MATLAB consists of 3 parts

- * Current folder

- * Workspace

→ Used to show the declared variables names & their values.

- * Editor and Command Window.

Editor → Writing Scripts.

Command Window → Display

Results & Writing Scripts.

* Image Properties.

i. Dimension*

ii. Colour

iii. Width

iv. Height

v. size

> Dimension

* Function to read an image.

```
imread('D:\blackcat.png');
```

Variable Name = imread('D:\blackcat.png') → This is the File Name.

Syntax.

```
imread('File Name');
```

→ When terminating by using (;) means the results will not display at the command window.

While

```
imread('File Name')
```

→ Used to display the results of the image on the command window.

* To show an Image.

```
imshow(f)
```

where by f → Is the variable of an image declared.

Comments in MATLAB use (%).

for example:

% $y = \text{imshow}(f)$

Syntax.

1. $\text{VariableName} = \text{imread}(\text{'File Name'})$

eg:

$f = \text{imread}(\text{'mycat.png'})$

2. $\text{VariableName} = \text{imshow}(\text{VariableName})$

$y = \text{imshow}(f)$

* To know the size of an image

$\text{size}(f)$

→ variableName

Answer:

1333

1000

Also: To know the Number of Rows and Columns.

* Size ($f, 1$)

output

1333

where by;

$f \rightarrow$ Vertical dimension.

Hence:

Vertical Dimension means the Number of Rows.

* Size (~~1, f~~) ($f, 2$)

output
1000

where by:

$f \rightarrow$ stands for Horizontal Dimension.

Hence:

Horizontal Dimension means the Number of Columns.

Forexample:

$$X = \begin{bmatrix} 6 & 5 & 8 & 10 & 7 \\ 10 & 11 & 8 & 9 & 7 \\ 11 & 20 & 23 & 21 & 25 \\ 30 & 31 & 40 & 45 & 50 \end{bmatrix}$$

Qn:

Mention All the Members of the Row in the Column Number Two.

Ans:

$$X(:, 2)$$

Members = 5, 11, 20 and 31.

Qn: Mention All the members of the Column in the row number three.

Ans:

$$X(3, :)$$

Member = 11, 20, 23, 21 and 25.

* To Write Matrix on the MATLAB.

$$X = \begin{bmatrix} 6 & 5 & 8 & 10 & 7 & 11 & 20 \\ 10 & 11 & 8 & 9 & 7 & 23 & 21 & 25 \\ 30 & 31 & 40 & 45 & 50 \end{bmatrix}$$

* To display All the Members in the Matrix found at the centre.

$$X = \begin{bmatrix} 6 & 5 & 8 & 10 & 7 \\ 10 & 11 & 8 & 9 & 7 \\ 11 & 20 & 21 & 21 & 25 \\ 30 & 31 & 40 & 45 & 50 \end{bmatrix}$$

$$\therefore X(2:3, 2:4)$$

& rows & columns

* To Make the Centre Members to Zero.

$$X(2:3, 2:4) = 0$$

output.

$$X = \begin{bmatrix} 6 & 5 & 8 & 10 & 7 \\ 10 & 0 & 0 & 0 & 7 \\ 11 & 0 & 0 & 0 & 25 \\ 30 & 31 & 40 & 45 & 50 \end{bmatrix}$$

A. zeros is the function used to create the matrix with 0 value or elements.

$y = \text{zeros}(256)$

TO CONVERT IT INTO IMAGE FORM

$y = \text{zeros}(256)$

$a = \text{uint8}(y)$

$f = \text{imshow}(a)$

$\Rightarrow 0$ refers to BLACK IMAGE

B. ones is the function used to create the matrix with 1 value or elements.

$5 = 255 * 1$

$y = 255 * \text{ones}(256)$

$a = \text{uint8}(y)$

$f = \text{imshow}(a)$

$\Rightarrow 255$ refers to WHITE IMAGE


```

C;
130 = 130 * 1; y = 130 * ones(256)
a = uint8(y)
f = imshow(a)

```

⇒ The number between 0 and 255 such as 130 leads to different colour eg. 130 leads to GRAY color.

Question;

Why 256?

In MATLAB image is coded by using 8 bits.

AN IMAGE WITH BLACK AND WHITE COLOR

```

y = zeros(256)
y(101:156, 101:156) = 255 white
a = uint8(y)
f = imshow(a)

```