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9/5/15

Name :- Aditya Rane
PRN :- 20070123002
Batch :- ENTC A1
Subject :- Digital Image Processing Lab

EXPERIMENT-1

Title :- Introduction to image processing.

Aim :- To have a brief overview about image formation, resolution, parameters and processing of an image.

★ When energy (light/sunlight etc.) falls upon an object, the amount of energy reflected by the object is detected/sensed by the sensors, and a continuous voltage signal is generated by the amount of sensed data.

★ In order to create a digital image, we need to convert this data into a digital form using sampling and quantization. This results in a 2-Dimensional array or matrix of numbers which is an image.

★ Parameters associated with image formation are :-
(i.) Energy
(ii.) Reflectance

$$f = e \cdot r$$

f : Image, e : Energy, r : Reflectance

★ Resolution is of many types:-

(i) Spatial Resolution:- Number of pixels utilized in construction of an image. Pixel size ↓ → Spatial Resolution

(ii) Intensity Resolution:- As the number of quantisation levels increases, the intensity resolution increases. Image has more levels of intensity.

(iii) Spectral Resolution:- An image with more spectral resolution will have more frequencies in the image. A colourful image has more spectral resolution than a grayscale image as it has more frequencies over visible range.

(iv) Time Resolution:- Amount of time needed to revisit and acquire data for the exact same location.

★ We need to process a formed image to get the required data that we want to extract from. Processing improves image data that suppresses unwilling distortions or enhances some image features important for further processing.

★ Outcome:-
Had a brief overview of image processing topics: (i) Formation of an image.
(ii) Parameter of formation
(iii) Resolution
(iv) Processing an image.

- I have a vague idea of image formation and still haven't understood how reflecting of energy leads to formation of image. good.
- Didn't understand how we are able to see the images. ? Let's discuss.
- I have comparitively understood resolution and its different types quite well. Also, understood the need for processing an image.

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EXPERIMENT - 2

NAME :- ADITYA RANE
PRN :- 2007012 3002
BATCH :- ENTC A1
SUBJECT :- DIGITAL IMAGE PROCESSING LAB

TITLE :- ZOOM IN, ZOOM OUT & EFFECT OF RESOLUTION

AIM :- To study the effects of zooming in and out and to study the effects of resolution on an image.

THEORY :-

* Scaling is used to change the appearance of an image. There are 2 types :- zoom in, zoom out
* ZOOM IN :- Zoom in lets you look closer into an image. A 'zoomed in' image can look more pixelated. We zoom into in image usually to aquire data about the finer details in an image. A picture (image with less spatial resolution will appear less clear as we zoom in. Scale of image is reduced. Intensity resolution, ~~plays~~ we can compare different intisities when we zoom in.
* ZOOM OUT :- We zoom out of an image to view the whole image, when we are not interested in the details of the image.
Scale of image increases when we zoom out.

EXPERIMENT-3

Name: Aditya Mahesh Rane
Class: ENTC IIIrd Yr
Subject: DIGITAL IMAGE PROCESSING LAB.
Div :- A1

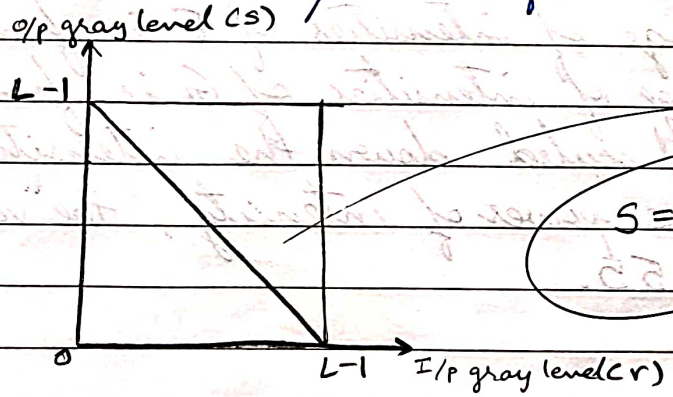
TITLE :- IMAGE ENHANCEMENT

AIM:- To find the negative of an image and enhance the image.

THEORY :-

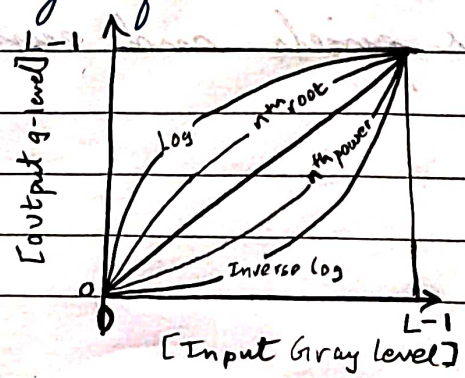
★ A negative image is a total inversion of a positive image, in which light appears dark and vice versa.

★ Image Negative is a gray scale transformation that does not depend on the position of the pixel in the image.



$$S = T(r) = (L-1) - r$$

★ Logarithmic Transformations are particularly useful when the input gray level values may have an extremely large range of values.



EXPERIMENT - 2

* Effect of resolution:-

① Spatial Resolution

Pixel size ↓ Spatial Resolution ↑ ∴ No. of pixels ↑

② Intensity Resolution

Quantization levels ↑ ∴ Intensity Resolution ↑ ∴ No. of bits ↑

③ Spectral Resolution

No. of frequencies in an image ↑ ∴ Spectral Resolution ↑ ∴ Colours ↑

④ Time Resolution

Time Resolution ↑ ∴ frames per second ↑

CONCLUSION:-

* I learned about effects of scaling and resolution.
* Learned extracting individual color channels of an image.
* Learned about resizing an image and grayscale

★ Power law transformation

$s = r^{\gamma}$

For $\gamma < 1$: Expand values of dark pixels, com
values of brighter pixels.

For $\gamma > 1$: Compress values of dark pixels, exp
values of brighter pixels.

Some important lines of code :-

① D = 255 - C ;
Here, C is a grayscale image & D is a n
image of C.

② G1 = im2 double (F);
Here, the range of intensities of F is from 0 to
and the range of intensities of G is from 0 to
We reduced / scaled down the intensities so
when we take power of intensity, the value wo
go above 255.

③ I = G.^3
To enhance the brighter pixels and expand thei
by a power of 3.

④ J = G.^0.2
To enhance the darker pixels and expand their

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EXPERIMENT-4

AIM :- Equalized image and histogram equalization

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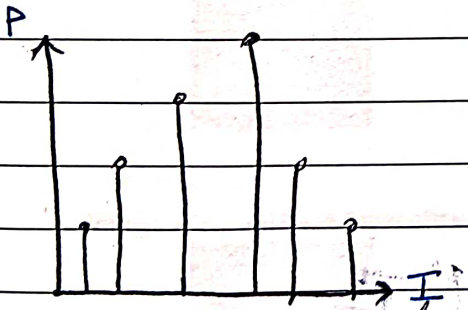
THEORY :-

Histogram Equalization is a computer image processing technique used to improve contrast in images.

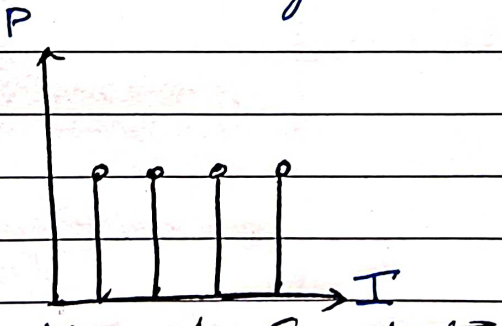
The Probability Density Function (PDF) of the initial image (unequalized) seems to be variable and non-uniform.

Upon equalization, the PDF of the image becomes more uniform.

Through this adjustment, the intensities seem to be better distributed on the histogram.



PDF of Unequalized Image.



PDF of ~~Equalized~~ Image.

This method is useful in images where backgrounds & foregrounds are both bright or both dark.
Ex :- To get better view of bone structure in an X-Ray.

CONCLUSION :- We learned to equalise an image & get an equalised histogram.

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EXPERIMENT-4

AIM :- Equalized image and histogram equalization

9/10

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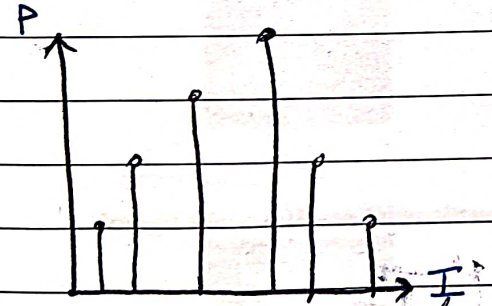
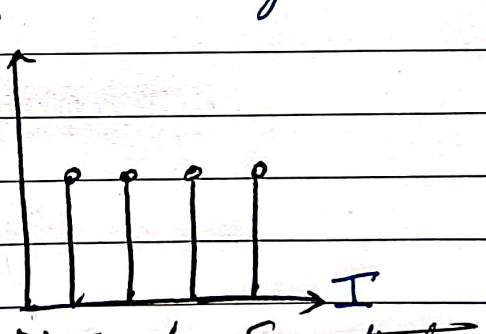


PDF of Unequalized Image.



PDF of ~~Equalized~~ Image.

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Ex :- To get better view of bone structure in an X-Ray.

CONCLUSION :- We learned to equalise an image & get an equalised histogram.

EXPERIMENT - 5 DATE

10/10

Name :- ADITYA RANE
PRN :- 20070123002
Batch :- ENTC A1
Subject :- DIGITAL IMAGE PROCESSING

TITLE :- Exploring the effect of different masks on an image.

AIM :- To understand masking & its effects.

THEORY :-

* 3×3 unit mask - A 3×3 unit mask is a simple matrix of 3 rows and 3 columns with all elements equal to 1. When applied to an image, this type of mask performs a type of image filtering operation called convolution.

* In convolution, each pixel in the image is replaced by a weighted average of its neighbouring pixels.

* Observation :- Applying this mask resulted in a blurring effect.

* Application :- Can be used in smoothing operations, to reduce noise/unwanted variations while preserving its overall structure.

* Increasing the size of mask resulted in increased blurring.

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CODE :-

```
M1 = ones(3);  // Creates a 3x3 unit matrice
C1 = conv2(double(B), M1/9, 'same');
                    ↑ We have to take weight
   ↑ Reducing intensity values from 0 to
     0-1 so that value doesn't increase
     convolution.
C1 = uint(C1); // To convert intensities to 0
imshow(C1);
title("Image with 3x3 mask");
```

⇒ [1 0 -1, 1 0 -1, 1 0 -1] ⇒ Mask 2

★ Applying this type of filter showed particular
there is a steep change in intensity value.
put this filter on image with same pixels value
the convolution result will be 0. [dark] But
value changes the result won't be 0. Hence
★ mask can behave like an edge detector.
The above mask acts like a vertical edge d

⇒ [1 1 1; 0 0 0; -1 -1 -1] ⇒ Mask 3

This mask seems to act like a Horizontal Edge

⇒ [1 2 1; 0 0 0; -1 -2 -1] ⇒ Mask 4

Upon zooming in the image, I can observe
both vertical & horizontal edges are dete

⇒ [1 0 -1; 2 0 -2; 1 0 -1] ⇒ Mask 5

This mask seems to have stronger vertical
detection than the Mask-2. as it places more

DATE

on the central pixel.

CONCLUSION:-

* I learned a real application of convolution.
* I learned the effects of different types of masks.
* I learned how to create edge detecting & smoothing masks.

EXPERIMENT - 7

NAME :- ADITYA MAHESH RANE
BATCH :- A1
BRANCH :- ENTC
SUBJECT :- DIGITAL IMAGE PROCESSING

9.5.18

TITLE :- MAGNITUDE & PHASE SWAPPING

AIM :- To study the magnitude & phase plots of an image

THEORY :-

* The phase of an image provides information about its geometry, specifically its geometry spatial structure.
* The phase information can be used to determine the shape and orientation of the object.
* Magnitude plot provides information about its frequency content.
* The phase and magnitude information obtained from the F.T of an image are both crucial for reconstructing the image.
* When the IFFT is performed on the magnitude and phase information seperately the resulting image will have the correct frequency content but may not be accurate in terms of its spatial structure This is because the phase information is lost when the magnitude is use alone & vice versa
* When swapping, frequency content of the image whose phase we have considered is maintained

EXPERIMENT-8.

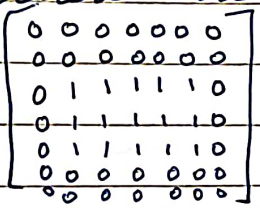
NAME:- ADITYA RANE
BATCH:- A1
BRANCH:- ENTC 20-24
SUBJECT:- DIGITAL IMAGE PROCESSING.

TITLE:- LOW and HIGH-PASS FILTER

AIM:- To observe the effects of low-pass and high-pass filter on an image.

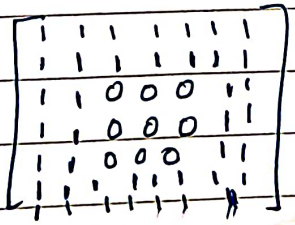
THEORY:- The below filters are applied in frequency domain.

LOW PASS FILTER:-



- Allows low-freq components to pass
- Removes high-freq components.
- Smoothens an image.
- Resulting image appears to be more chaotic.

HIGH PASS FILTER:-



- Allows high-freq components to pass.
- Removes low-freq components
- Enhances edges & fine details.
- Removes noise and smoothness.
- Sharper image.

OBSERVATION & CONCLUSION:- In conclusion, these filters can be used as smoothening filter and sharpening filters.

EXPERIMENT - 9

Name :- ADITYA RANE
BATCH :- A1
BRANCH :- ENTC 20-24
SUBJECT :- DIGITAL IMAGE PROCESSING

TITLE :- IMAGE THRESHOLDING

AIM :- To see the effects of thresholding on masked images.

THEORY :-

* In this experiment we apply different masks on an image using 2-D convolution. We the binarize these masked images using different thresholds.

* Applying different thresholds to the same masked image varied the visibility of its edges respectively.

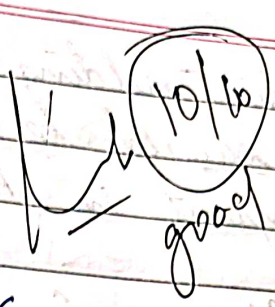
* Image thresholding is a simple yet effective technique of partitioning an image into foreground & background based on pixel intensity values.

* The process involves setting a threshold value, which seperates the pixels into 2 categories: Those with intensity values more than threshold and those with intensity values less then the threshold.

* The pixels above threshold are usually considered as the foreground or 'object of interest', while the pixels below threshold are considered as background

EXPERIMENT-11

NAME :- ADITYA RANE
BATCH :- A.
BRANCH :- ENTC
SUBJECT :- DIGITAL IMAGE PROCESSING

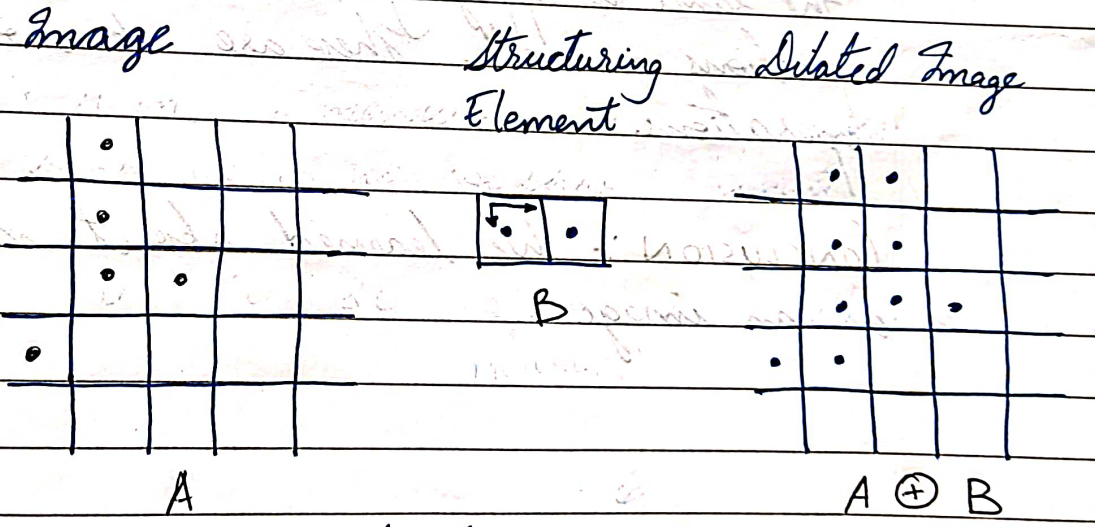


TITLE :- MORPHOLOGICAL IMAGE PROCESSING

AIM :- To perform non-linear operations on images :-
(i) Dilation
(ii) Elation
(iii) Closing
(iv) Opening

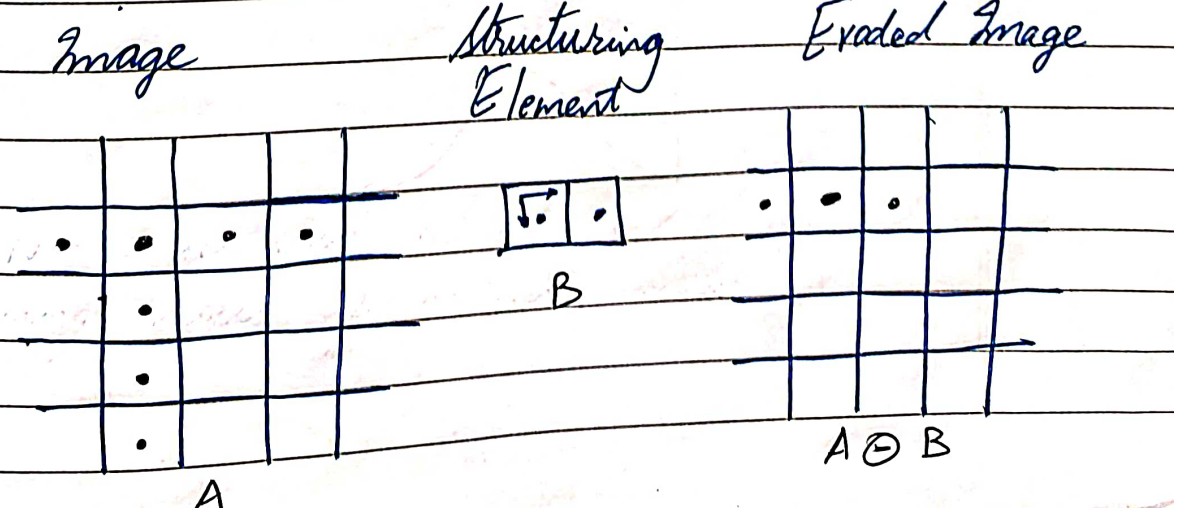
THEORY :-

Dilation -



Expands the boundaries of objects in an image. Works by adding pixels to the boundaries of the objects based on the size & shape of structuring element.

Erosion -



Upon adding the coordinates of A & B, both the su
should be a part of original set, else that
point in A is eroded.

Closing - Combines dilation followed by erosion. Fill
small gaps. Used to fill small gaps in an object.

Opening - Combines erosion followed by dilation. Remo
noise from an image while preserving the importa
features of the objects.

* Applying the closing operation twice sequentially to
the same as applying it once. Same goes for opening
operations as well. These are known as idempotent
operations.

CONCLUSION :- We learned about non-linear operati
on an image.

EXPERIMENT - 12

10/10

Name: Aditya Rane
Branch:- ENTC A1
Subject:- DIP

TITLE:- WAVELET TRANSFORM

AIM:-
To observe the various subbands formed after wavelet transform.

THEORY

* The wavelet transformation technique is used to overcome the drawbacks of fourier method. This method good frequency resolution as well as temporal resolution

* The 2 discrete components of wavelet analysis is:- approximation and details (sub-signals)

* The image is decomposed into 4 sub-bands: LL, LH, HL and HH, which represent the approximation coefficients, horizontal detail coefficients, vertical detail coefficients & diagonal detail coefficents.

* LL sub-band represents the low frequency information of the images, while other sub-bands represent the high frequency information of the image.

OBSERVATION:-

* When we combine 2 or more subbands, all the characteristics of those subbands seem to shown. Ex:- When LH & HL are non-zero in idwt, both the vertical & horizontal details are visible.

CONCLUSION

* We performed & analysed wavelet transform on an image.