Prelab - 3

Q1. Explain the conversion from RGB to HSI ?

Ans. There are some steps for converting an RGB image to HSI !

1. Convert the input RGB image to double precision using the "im2double" function.
2. Convert the input RGB color image into HSI image using the "RGB2HSV" function.
3. Use the "disp" function to display the RGB & HSI images.

Q2. Write the limitation of any color representation ?

Ans- Color representation system such as RGB or CMYK are limited by device dependency, restricted gamut, challenges with extreme lighting, issues with color vision deficiencies, difficulty representing subtle differentiation and potential loss, or distortion during conversion.

Q3. Explain the image arthmetic operation ?

Ans. Image arithmatic operation involves manipulating pixel value of images through addition, substraction, multiplicatn or division. Allowing for task like blending, contrast adjustment, normalization and highlighting the difference b/w images.

Q4. What is subtractive color & explain the luminence, intensity & lightness.

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Ans. Subtractive color involves creating color by subtracting specific wavelength of light using pigments or filters.
Luminance refers to brightness, intensity to color purity and lightness to perceived brightness relative to gray. Adding more pigments reduses luminance while intensity depends on pigment purity & lightness is influenced by pigment balance and reflacted light.

Q5. What are the HSB & HSL?
Ans. HSB (Hue, saturation, Brightness) and HSV (Hue, Saturation, Lightness) are color models.
HSB uses brightness to represent the amount of light in a color. HSL uses lightness to indicate perceived brightness. Both model uses hue to repre the pure color and saturation to denote color intensity. Both are used in digital design for intuitive representation of color properties.

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Remarks:

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Practical - 3

Object - RGB / HSI conversion in an image, image arithmatic operation

Software used - Scilab 6.0.2

Coding - A. RGB/HSI Conversion in an image

```
A = imread("C:\users\Desktop\C.jpg");
figure (1);
imshow (A);
B = imread ("C:\users\Desktop\B.jpg);
figure (2);
imshow (B);
C = imadd (A, B);
figure (3);
imshow (C);
```

B. Image Arithmatic Operations

```
clear all;
a = imread ("C:\users\Desktop\C.jpg ");
imshow(a);
b = imread ("C:\users\Desktop\B.jpg");
imshow (b);
c = imadd (a, b);
imshow (c);
subplot (3,2,1);
imshow (a);
subplot (3,2,2);
imshow (b);
subplot (3,2,3);
imshow (c);
```

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C. In other method of arithmetic operation user can add some constant in an image.

```
i = imread ("C:\user\Desktop\snap.jpg");
imshow (i);
imshow (i(:,:,1));
imshow (i(:,:,2));
imshow (i(:,:,3));
hsv_i = rgb2hsv (i);
imshow (hsv_i);
```

Result

We perform RGB to HSI conversion of image and addition of two images and addition of multiple images correctly.

Conclusion

As addition, we can also perform subtraction, multiplication, division, etc. Arithmetic operations as well on images.

Precautions

- Ensure that RGB values are normalized to the range [0.1] in pre conversion.
- Check for spacial cases where hue value wrap around & adjust accordingly.
- Confirm saturation and value are within their specific ranges.

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Date :
S. No. : 4.

Pre-Lab-4

Q1. What is the spacification of Histogram ?

Ans. Histogram are graphical representations of the distribution of data. In context of digital images, a histogram provides a visual representation of the distribution of pixel intensities within an image. Its typically consist of a graph with pixel intensity values with x-axis and the frequency or number of pixel with that intensity along the y-axis. The histogram allows users to analyze various aspects of an image, such as its overall brightness, contrast and exposure.

2. Explain the algorithms related to histogram ?

Ans. Several algorithms are related to histogram in image processing including.

1. histogram Equalization - A technique used to enhance the contrast of an image by redistributing pixel intensities to cover a wider range.

2. histogram matching - A method used to transform the histogram of an input image to match a specific histogram, often from a reference image.

3. Adaptive histogram Equalization (AHE) - A variant of histogram equalization where the contrast enhancement is applied locally to diff regions of the image.

4. Contrast Limited Adaptive histogram Equalization (CLAHE) - An Extension of AHE that limits the amplification of noise

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in regions with low contrast.

Q3. Explain the histogram equalization.

Ans: Histogram equalization calculates the cumulative distribution fx^n (CDF) of an images histogram then maps pixel intensities based on this function. Darker regions becomes darker and brighter region becomes brighter, resulting in a visually appealing image with improved contrast & detail.

Q4. What happens when you apply equalization to an equalized histogram in continuous & discreate case?

Ans: When equalization is applied to an already equalized histogram.
In the continuous case, no further changes occurs as the histogram is already uniformly distributed.
In the discreate case, there is no additional changes since each intensity value has already been adjusted for an uniformly distribution.

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Q5. Explain the conventional histogram equalization method?

Ans: Conventional histogram equalization enhances image by contrast by redistributing pixel intensities based on the image's histogram and cumulative distributive function (CDF). This method ~~overall~~ improves the overall appearence of the image by making the histogram more uniformly distributed, resulting in a visually appealing image with enhanced contrast.

Experiment - 4

Objective - Image histogram and histogram equalization.

Software used - Scilab 6.0.2

Coding -

```
I = imread ("C :\Users\avita\Desktop\todo.jpg");
R = rgb2gray (I);
J = histeq (R);
figure;
subplot(2,1,1), imshow(R);
subplot (2,1,2), imhist (R);
title("Histogram of Original Image", "FontSize", 12);
xlabel ("Gray Level", "FontSize", 10);
%Label the x-axis
ylabel ("Pixel Count", "FontSize", 10);
figure;
subplot(2,1,1), imshow (J);
subplot(2,1,2), imhist(J);
title ("Histogram of Contrast Image", "FontSize", 12);
xlabel ("Gray Level", "FontSize", 10);
ylabel ("Pixel Count", "FontSize", 10);
```

Result

Through this experiment we have successfully describe the original image and histogram and pixel present the equalized histogram and the resulting image.

Conclusion

Discuss how histogram equalization enhance image contrast and visibility. details.

- see the changes observed in image after histogram equalization.
- Compare the original and equalization histogram to see changes.

Precautions

- Ensure the image is in appropriate formate and resolution for accurate analysis.
- Use proper scaling and normalization techniques during histogram equalization.
- Validate the result by comparing with other enhancement technique if possible.

Pre Lab - 5

Q1. Explain Gaussian Smoothing ?
Ans. The gaussian smoothing technique calculates weighted averages of pixel values based on their distance from there centeral pixel, effectively reducing noise while maintaining image clarity. Gaussian smoothing is widely used accross various image processing applications due to its simplicity and effectiveness.

Q2. What is the fourier transform property ?
Ans. The fourier transformation property refers to the various property associated with the fourier transformatⁿ, a mathematical operation that decomposes a fxⁿ into its constitute frequencies. Mathmatically it can be stated as:

$$F[af(x) + bg(x)] = aF(\omega) + bG(\omega)$$

where a and b are constants, f(x) and y(x) are function and f(w) and G(w) is the fourier transforms.

Q3. Explain the convolution process in spatial domain ?
Ans. In the spatial domain, convolution is an process in image processing where a filter (or kernel) is applied to an image by overlaying it pixel by pixel and computing a weighted sum of the neighbouring pixel values. The operations for the fundamental tasks like blurring, sharpening, edge detection and more.

Q4. Explain the spatial domain filter ?
Ans. In the spatial domain, a filter in range processing refers to a small matrix of a numarical values that is applied to its by moving an images and performing

mathmatical operation at each location. These operatio
could include averaging, sharping, blurring, edge
detaction & more. Filters modify the pixel valu
of an image to achieve desired effect like noise
reduction or feature enhancement.

Q5- Explain the frequency domain filter.
Ans- Frequency domain filter in image processing modify
the frequency content of an image through operat
on its fourier transform. They alter frequency
componants rather than pixel values directly, en
task like noise removal, edge enhancement and
image restoration.

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Remarks :

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Experiment - 5

Objective - Image filtering in spatial and frequency domain.

Software required - Scilab 6.0.2.

Coding.

1. In spatial domain

```
clc;
K = imread("C:\users\Desktop\bunny.jpg");
K = rgb2gray(K);
w = zeros(7,7);
for i= 1:7
    for j= 1:7
    w(i,j)= 1/70;
    y = imfilter(K,w);
    end
end
subplot(2,2,1);
imshow(K);
title("Original-image");
subplot(2,2,2);
imshow(w);
title("Smoothing-image");
```

2. Frequency Domain

```
clc;
r = imread("C:\users\Desktop\panda.jpg");
imshow(r);
a = double(r);
```

```
[m,n] = size(a);
w=[1 1 1 ; 1 1 1; 1 1 1];
b = zeros (m,n);
for i=2 ;m-1
    for j=2 : n-1
    b(i,j)= w(1)* a (i-1, j+1)+w(2)*a (i, j+1)+
            w(3)*a(i+1, j+1)...
          + w(4)*a(i-1,j)+ w(5)*a(i,j) + w(6)*a(i+1,j)...
          + w(7)*a (i-1, j-1)+w(8)*a (i, j-1)+ w(9)*
            a(i+1, j-1);
    end
end
c= int8(b);
imshow (c);
```

Result

Throught this experiment we have successfully performed the image filtering in both spatial & frequency domain.

Conclusion

Spatial and frequency image filtering offers flexibility, control and superior image in image processing tasks.

Precautions

- Ensure that image is in appropriate format and resolution for accurate analysis.
- Use proper scaling and normalization techniques during image enhancement.
- Validate the result by comparing with other enhancement technique if possible.

Prelab - 6

Q1. What is the structuring element in binary morphology?

Ans. In binary morphology, a structuring element is a small binary image used as a template for operatn like dilation and erosion. It defines the neighborhood around each pixel, guiding how the operation affects the images.

Q2. What is the basic morphological transformation of binary images?

Ans. The basic morphological transformations for binary images are dilation and erosion. Dilation enlarges shapes by including neighboring foreground pixels, while erosion diminishes shapes by removing edge pixels.

Q3. What is image restoration based on morphing operation?

Ans. Image restoration using morphological operations involves using dilation, erosion, opening and closing to remove noise, fill gaps, enhance edges or segment object in an image, improving its quality or preparing it for further analysis.

Q4. Explain the operation of dilation?

Ans. Dilation is a morphological operation that enlarges shapes or regions of intrest in an image by sliding a structure element over the image and setting the output pixel to 1 if any part of the structuring element overlaps with forground pixels in the output image.

Q5. Write basic morphological algorithms?

Ans. Here are the basic algorithms for common morpholo[gical] operations:

1. Dilation - Enlarging shapes by setting output pixel to 1 if any part of the structuring element ove[rlaps] with for ground pixels in the input image.

2. Erosion - Shrinks shapes by setting output pixel to 1 only if all parts of structuring element overlap with for ground pixels in the input images.

3. Opening - Erosion followed by Dilation, useful fo[r] removing noise.

4. Closing - Dilation followed by erosion, useful for fi[lling] small gapes or holes.

Experiment - 6

Objective - Morphological Operations in analyzing image structures.

Software used - Scilab 6.0.2

Coding

```
i = imread ("c:\users\Desktop\panda.jpg");
figure (~~2,2,1~~);
subplot (2,2,1);
imshow (i);
se = imcreatese ('rect', 1, 1);
b = imerode (i,se);
subplot (2,2,2);
imshow (b);
c = imdilate (i, se);
subplot (2,2,3);
imshow (c);
be = imcreatese (" ellipse ", 9, 9);
s2 = imopen (i, be);
subplot (2,2,4);
imshow (s2);
ce = imcreatese (" ellipse ", 11, 11);
s2 = imclose (i, ce);
subplot (2,2,4);
imshow (s2);
ce = imcreatese ("ellipse ", 11, 11);
s3 = imclose (i, ce);
figure ();
imshow (s3);
```

Result
We have successfully performed the experiment by quantify changes in image quality and structure by using morphological operations.

Conclusion
Summarize findings, emphasizing the effectiveness and limitation of different operation and also visualize the output.

Precautions.
- Ensure the proper parameters selection for each morphological operation to avoid under or over-processing.
- Validate the result through visual inspection and quantitative analysis if possible.
- Use appropriate image processing techniques if necessary to enhance the effectiveness of morphological operations.

Be Lab - 7

Q1. Explain the thresholding method?

Ans. Thresholding is an method in image processing where pixel in an image are catagorized as forground or background based on whether there intensity values are above and below a chosen threshold. This create a binary image where the object of intrest are separated from the background.

Q2. What is segmentation?

Ans. Segmentation in image processing refers to the process of partitioning an image into multiple segments or region based on certain characteristics such as intensity, color, texture or motion. The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze.

Q3. Compare between optimal and conventional thresholding?

Optimal Thresholding	Conventional Thresholding
1. Automation threshold determination based on image histogram.	1. Manual or predetermined threshold selection.
2. Adapt automaticelly to image characteristic, maximizes separability.	2. Simple and straightforward user control.
3. Suitable for bimodal histogram, automate	3. Suitable when image characteristic are known, required user i/p.

threshold selection	
4. Automated or less user intervention.	4. User control over thresh selection, manual adjustm

Q4. Explain mixture modeling?

Ans. Mixture modeling is a stastical technique for modeli data that assumes it arises form a combination of different underlying distribution and components, I estimates parameter for these distribution and thei proportion in the dataset, allowing for flexible representation of complex data structures.

Q5. What are the segmentation techniques?

Segmentation techniques in image processing partition a image into regions or segments based on criteria intensity, color or texture. There common method include

1. Thresholding
2. Edge detection
3. Region growing
4. Clustering
5. Watershed transform
6. Active contour model (snakes)
7. Graph based segmentation
8. Markov Random Fields (MRF)
9. Deeplearning based segmentation.

Remarks :

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Experiment - 7

Objective - Thresholding - based image segmentation.

Software used - Scilab 6.0.2

Coding

```
a= Imread ("c:\user\Desktop\bunny.jpg");
figure (1);
imshow (a);
title ("original-image");
b = imcrop (a, [100 240 200 180]);
figure (2);
imshow (b);
title ("crop-image");
c= imresize (a, 0.9);
figure (3);
imshow (c);
title ("Resize of the image");
d= imrotate (a, 75);
figure (4);
imshow (d);
title ("Rotate-image");
figure (5);
imshow (a(:,:,1));
title ("Segmentation of the image");
figure (6);
imshow (a(:,:,2));
title ("segmentation of the blue image");
figure (7);
```

imshow (a, (:, :, 3));
title ("Segmentation of the green Image");

Result

By performing this experiment successfully By -
- Show segmented Images using different thresholding methods.
- Access segmentation quality with matrices.

Conclusion.

We perform this experiment and learn :-
- Discuss thresholding effectiveness.
- Highlight method advantage and limitations
- Recommanded suitable techniques.

Precautions

- Select thresholds carefully to avoid errors.
- Consider preprocessing for better results.
- Validate outcomes visually and quantitatively.
- Be focused that have a good internet connectivity.