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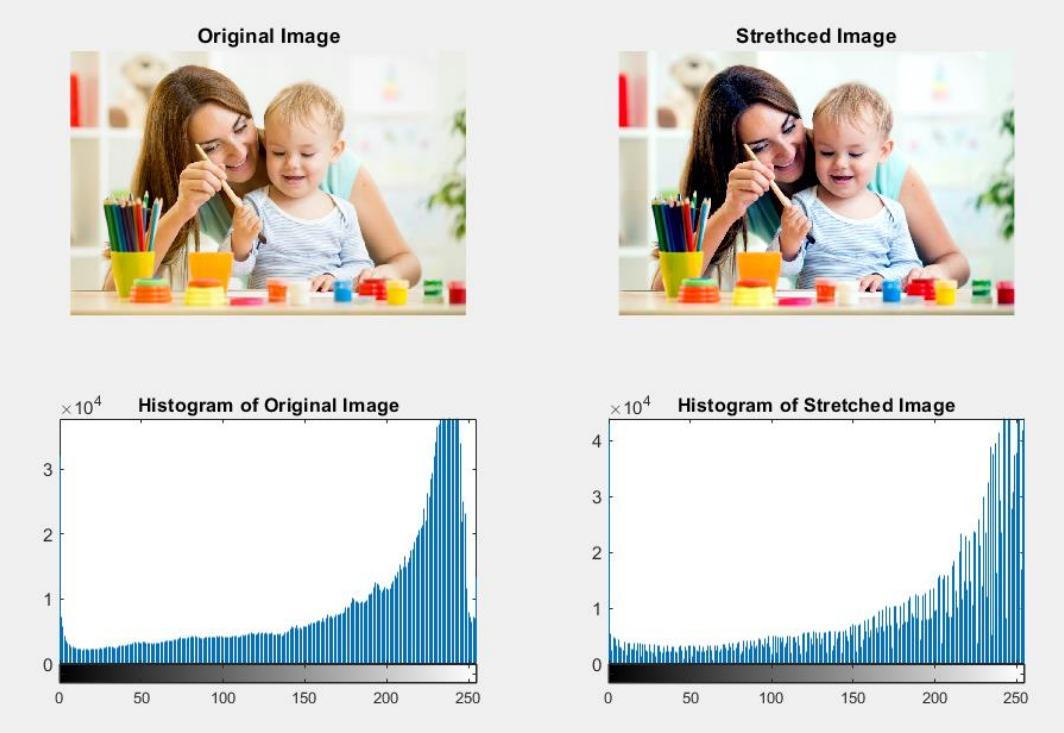
MACHINE VISION – DIGITAL ASSIGNMENT – 1

Image Enhancement Techniques:

Histogram Equalization:

```
image = imread('hist_eq.jfif');
stretched_Image = imadjust(image, stretchlim(image, [0.05, 0.95]),[]);
subplot(2,2,1), imshow(image), title('Original Image');
subplot(2,2,2), imshow(stretched_Image), title('Strethced Image');
subplot(2,2,3), imhist(image), title('Histogram of Original Image');
subplot(2,2,4), imhist(stretched_Image), title('Histogram of Stretched
Image');
nscore=niqe(image);
nscoree=niqe(stretched_Image);
fprintf("Image score for orginal image: %0.2f.\n", nscoree)
fprintf("Image score for histogram equalized image: %0.2f.\n", nscore)
```

Output:

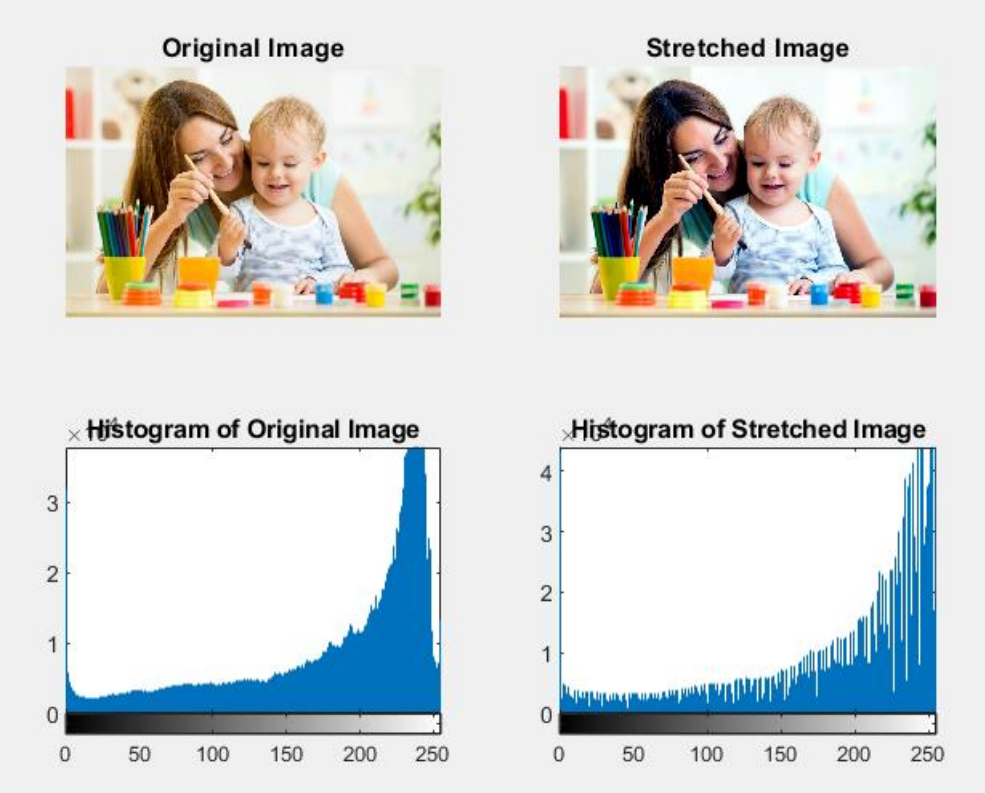


```
Command Window
  Image score for orginal image: 2.25.
  Image score for histogram equalized image: 2.42.
fx >>
```

Contrast Stretching:

```
image = imread('image1.jpg');
stretched_Image = imadjust(image, stretchlim(image, [0.05, 0.95]),[]);
subplot(2,2,1), imshow(image), title('Original Image');
subplot(2,2,2), imshow(stretched_Image), title('Strethced Image');
subplot(2,2,3), imhist(image), title('Histogram of Original Image');
subplot(2,2,4), imhist(stretched_Image), title('Histogram of Stretched
Image');
nscore=niqe(image);
nscoree=niqe(stretched_Image);
fprintf("Image score for orginal image: %0.2f.\n", nscoree)
fprintf("Image score for histogram equalized image: %0.2f.\n", nscore)
```

Output:



```
Command Window
   Image score for orginal image: 2.25.
   Image score for contrast strecthed image: 2.42.
fx >>
```

Gray Level Slicing:

```
clc;
clear all;
i=imread('img1.jpg');
j=double(i);
k=double(i);
[row,col]=size(j);
T1=input('Enter the Lowest threshold value:');
T2=input('Enter the Highest threshold value:');
for x=1:row
    for y=1:col
        if((j(x,y)>T1) && (j(x,y)<T2))
            j(x,y)=i(x,y);
            k(x,y)=255;
        else
            j(x,y)=0;
            k(x,y)=0;
        end
    end
end
subplot(311), imshow(i), title('Original image')
subplot(312), imshow(uint8(j)), title('Graylevel slicing with background')
subplot(313), imshow(uint8(k)), title('Graylevel slicing without
background')
nscore=niqe(i);
nscoree=niqe(uint8(k));
fprintf("Image score for orginal image: %0.2f.\n", nscore)
fprintf("Image score for gray scaled image with background: %0.2f.\n",
niqe(uint8(j)))
fprintf("Image score for gray scaled image without background: %0.2f.\n",
nscoree)
```

Output:

```
Command Window
  Enter the Lowest threshold value:100
  Enter the Highest threshold value:200
  Image score for orginal image: 2.42.
  Image score for gray scaled image with background: 5.88.
  Image score for gray scaled image without background: 12.26.
fx >>
```

Bit Plane Slicing:

```
clc
clear all
close all
warning off;
A=imread('coins.png');
A=double(A);
B=bitget(A,1);
subplot(2,4,1);imshow((B));title('Bit plane 1');
B=bitget(A,2);
```

```
subplot(2,4,2);imshow(B);title('Bit plane 2');
B=bitget(A,3);
subplot(2,4,3);imshow(B);title('Bit plane 3');
B=bitget(A,4);
subplot(2,4,4);imshow(B);title('Bit plane 4');
B=bitget(A,5);
subplot(2,4,5);imshow(B);title('Bit plane 5');
B=bitget(A,6);
subplot(2,4,6);imshow(B);title('Bit plane 6');
B=bitget(A,7);
subplot(2,4,7);imshow(B);title('Bit plane 7');
B=bitget(A,8);
subplot(2,4,8);imshow(B);title('Bit plane 8');
```

Output:

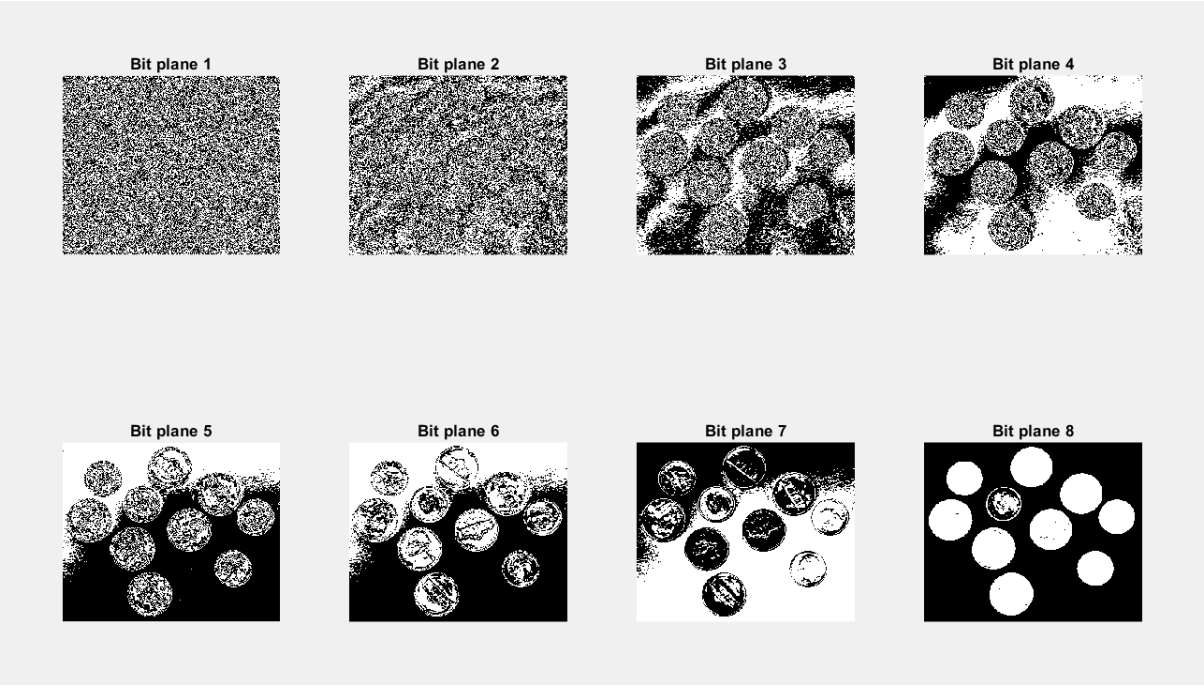


Image Sharpening:

Code:

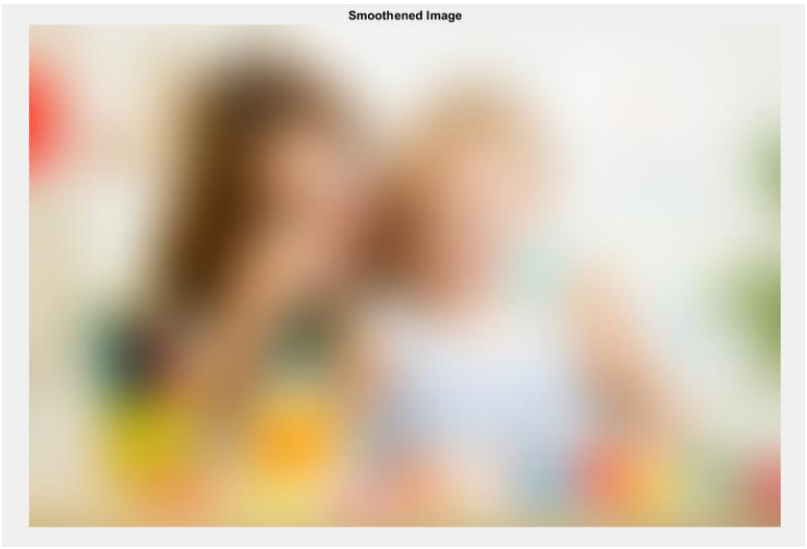
```
x=imread('img1.jpg');
figure;
```

```
imshow(x);
title('Original Image');
I = imgaussfilt(x,40);
figure();
imshow(I);
title('Smoothened Image');
I_sharpen=imsharpen(x,'amount',3);
figure;
imshow(I_sharpen);
title('Sharpened Image');
nscore=niqe(x);
fprintf("Image score for orginal image: %0.2f.\n", nscore);
nscores=niqe(I);
fprintf("Image score for smoothened image: %0.2f.\n", nscores);
nscoree=niqe(I_sharpen);
fprintf("Image score for sharpened image: %0.2f.\n", nscoree);
```

Output:

```
>> sharp

ans =

    '90.5731'


ans =

    '76.5923'

>> sharp
Image score for orginal image: 2.42.
Image score for smoothened image: 7.48.
Image score for sharpened image: 2.63.
fx >>
```


Original Image


Smoothened Image


Sharpened Image

Image Restoration:

Code:

```
clc
A = imread('img1.jpg');
Anoise = imnoise(A,'Gaussian',0,0.05);
Ablur = imgaussfilt(A,2);
score = niqe(A);
score_noise = niqe(Anoise);
score_blur = niqe(Ablur);
figure
montage({A,Anoise,Ablur},'Size',[1 3])
title({['Original Image: NIQE score = ', num2str(score),'    |    Noisy
Image: NIQE score = ', num2str(score_noise),'    ' '|    Blurred Image:
NIQE score = ', num2str(score_blur)]}, 'FontSize',12)
```

Output:

Image Inversion:

Code:

```
clear all
clc
i = imread('img1.jpg');
gs = rgb2gray(i);
nscore=niqe(gs);
fprintf("Image score for Grayscale image: %0.2f.\n", nscore)
bw = imbinarize(gs);
InvertedBW = imcomplement(bw);
subplot(1, 2, 1)
```

```
imshow(bw)
title('Black and white Image');
subplot(1, 2, 2)
imshow(InvertedBW)
title('Inverted B&W image');
```

Output:

```
Command Window
Image score for Grayscale image: 2.42.
>>
```

Metrics used to measure enhancement of Image :

• niqeModel - Naturalness Image Quality Evaluator (NIQE) model

Description: A niqeModel object encapsulates a model used to calculate the Naturalness Image Quality Evaluator (NIQE) perceptual quality score of an image. A smaller score indicates better perceptual quality. nscore = niqe (A,model) calculates the image quality score using a custom model.

niqeModel scrores for the above images showed using various techniques

S.No	Image	Score
1	Original Image	2.25
2	Histogram Equalised Image	2.42
3	Contrast Stretched Image	2.42

4	Gray level slicing with background	5.88
5	Gray level slicing without background	12.26
6	Smoothened Image	7.48
7	Sharpened Image	2.63
8	Noisy Image	18.82
9	Blurred Image	5.14
10	Inverted B&W Image	2.42

The image enhancement methods with least scores :

- Histogram Equalised Image = 2.42
- Contrast stretching = 2.42

The image enhancement methods with high scores :

- Gray level slicing without background = 12.26
- Noisy Image = 18.82

Changes Suggested:

Adding metrics:

```
nscore=niqe(image);
nscoree=niqe(stretched_Image);
fprintf("Image score for orginal image: %0.2f.\n", nscoree)
fprintf("Image score for histogram equalized image: %0.2f.\n", nscore)
```

Smoothening Image before sharpening:

```
x=imread('img1.jpg');
figure;
imshow(x);
title('Original Image');
I = imgaussfilt(x,40);
figure();
imshow(I);
title('Smoothened Image');
```