Batch: C-1   Roll No.: 16010122323

Experiment No. 6

Grade: AA / AB / BB / BC / CC / CD /DD

Signature of the Staff In-charge with date

Title: Implement contrast stretching of a digital image.

Objective: To learn & understand contrast stretching.

Expected Outcome of Experiment:

CO	Outcome
CO4	Design & implement algorithms for digital image enhancement, segmentation & restoration.

Books/ Journals/ Websites referred:

1. http://www.mathworks.com/support/

2. www.math.mtu.edu/~msgocken/intro/intro.html.

3. R. C.Gonsales R.E.Woods, "Digital Image Processing", Second edition, Pearson Education

4. S.Jayaraman, S Esakkirajan, T Veerakumar "Digital Image Processing "Mc Graw Hill.

5. S.Sridhar,"Digital Image processing", oxford university press, 1st edition."

Pre Lab/ Prior Concepts:

Contrast stretching (often called normalization) is a simple image enhancement technique that attempts to improve the contrast in an image by `stretching' the range of intensity values it contains to span a desired range of values, *e.g.* the the full range of pixel values that the image type concerned allows. It differs from the more sophisticated histogram equalization in that it can only apply a *linear* scaling function to the image pixel values. As a result the `enhancement' is less harsh.
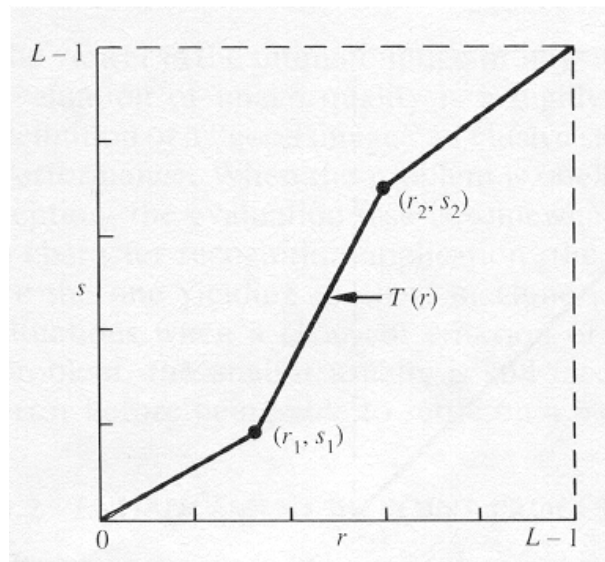
The locations of (r_1, s_1) and (r_2, s_2) control the shape of the transformation function.

- If $r_1 = s_1$ and $r_2 = s_2$ the transformation is a linear function and produces no changes.

- If $r_1 = r_2$, $s_1 = 0$ and $s_2 = L-1$, the transformation becomes a thresholding function that creates a binary image.

- Intermediate values of (r_1, s_1) and (r_2, s_2) produce various degrees of spread in the gray levels of the output image, thus affecting its contrast.

Generally, $r_1 \leq r_2$ and $s_1 \leq s_2$ is assumed.

Implementation steps with screenshots:

```
InPut = imread('images.jpg'); % Load the image

% First set of user inputs for r1, s1, r2, s2

r1 = input('Enter the value for r1: ');

s1 = input('Enter the value for s1: ');
```

```matlab
r2 = input('Enter the value for r2: ');

s2 = input('Enter the value for s2: ');

L = 256; % Number of gray levels

% Initialize output images

OutPut = zeros(size(InPut), 'uint8');

alpha = s1 / r1;

beta = (s2 – s1) / (r2 – r1);

gamma = ((L – 1) – s2) / ((L – 1) – r2);

[m, n] = size(InPut);

for i = 1:m

for j = 1:n

r = InPut(i, j);

if r < r1

OutPut(i, j) = alpha * r;

elseif r1 <= r && r <= r2

OutPut(i, j) = s1 + beta * r – r1;

else

OutPut(i, j) = s2 + gamma * r – r2;

end

end

end

% Display the original and the contrast stretched images

figure;

subplot(1,2,1);

imshow(InPut);

title('Original Image');

subplot(1,2,2);

imshow(OutPut);
```
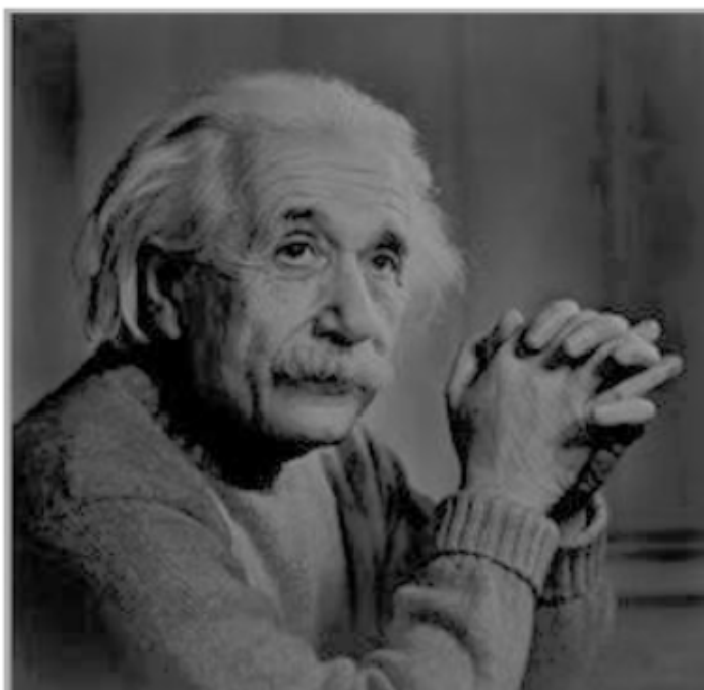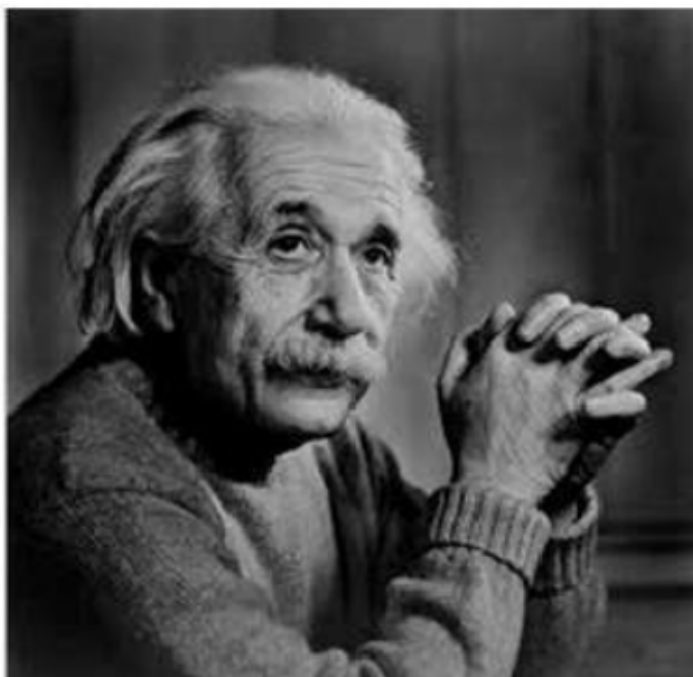
Conclusion:- Understood and implemented contrast stretching

Date: _____   **Signature of faculty in-charge**

 Post Lab Descriptive Questions

1. Thresholding function in contrast stretching creates

    a)binary image

    b)high quality image

    c)enhanced image

    d)low quality image

Ans: a) binary image

2. When is the contrast stretching transformation a linear function, for r and s as gray-value of image before and after processing respectively?

a)   r1 = s1 and r2 = s2

b)   r1 = r2, s1 = 0 and s2 = L – 1, L is the max gray value allowed

c)   r1 = 1 and r2 = 0

d)   None of the mentioned

Ans: a) r1 = s1 and r2 = s2

3.   Which gray-level transformation increase the dynamic range of gray-level in the image?

a)   Power-law transformations

b)   Negative transformations

c)   Contrast stretching

d)   None of the mentioned

Ans: c) Contrast stretching

4. When is the contrast stretching transformation a thresholding function, for r and s as gray-value of image before and after processing respectively?

a)   r1 = s1 and r2 = s2

b)   r1 = r2, s1 = 0 and s2 = L – 1, L is the max gray value allowed

c)   r1 = 1 and r2 = 0

d)   None of the mentioned

Ans: b)   r1 = r2, s1 = 0 and s2 = L – 1, L is the max gray value allowed

5. What condition prevents the intensity artifacts to be created while processing with contrast stretching, if r and s are gray-values of image before and after processing respectively?

    a) $r1 = s1$ and $r2 = s2$

    b) $r1 = r2$, $s1 = 0$ and $s2 = L - 1$, L is the max gray value allowed

    c) $r1 = 1$ and $r2 = 0$

    d) $r1 \leq r2$ and $s1 \leq s2$

Ans: d) $r1 \leq r2$ and $s1 \leq s2$