

Assignment 04: Histogram Equalization

Juan Bermudez

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Implement the histogram equalization algorithm which is summarized by the following formula:

$$S[i] = \text{Round}[(2^k - 1) \cdot H_{CN}[i]] \text{ for } i \leq 0 \leq 2^k - 1$$

Source Code:

```
%Original Image
OgImg = imread('tsubasa.png');
figure, imshow(OgImg);
title('Original Image');

%Image Converted to Grayscale
GyImg = rgb2gray(OgImg);
figure, imshow(GyImg);
title('GrayScale Image');

%Original Histogram
L = 256;
h = size(GyImg,1);
w = size(GyImg,2);
num_pixels = h * w;

% create output image
OGHistimg = zeros(h, w);
OGHistimg = cast(OGHistimg, 'like', GyImg);

cdf = zeros(256, 1);
equalized = zeros(256, 1);
histogram = zeros(256, 1);
for r = 1:h
    for c = 1:w
        histogram(GyImg(r, c) + 1) = ...
            histogram(GyImg(r, c) + 1) + 1;
    end
end

count = 0;
for i = 1:size(histogram)
    count = count + histogram(i);
    cdf(i) = count / num_pixels;
    equalized(i) = round(cdf(i) * (L - 1));
end
```

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for r = 1:h
    for c = 1:w
        OGHistimg(r, c) = equalized(GyImg(r, c) + 1);
    end
end

figure, bar(OGHistimg);
title('Original Histogram');

%Histogram-Equalized Image
% create Histogram Equalized output image
Hist_EQimg = zeros(h, w);
Hist_EQimg = cast(Hist_EQimg, 'like', GyImg);

cdf2 = zeros(256, 1);
equalized2 = zeros(256, 1);

    histogram2 = zeros(256, 1);
for r = 1:h
    for c = 1:w
        histogram2(GyImg(r, c) + 1) = ...
            histogram2(GyImg(r, c) + 1) + 1;
    end
end

count = 0;
for i = 1:size(histogram2)
    count = count + histogram2(i);
    cdf2(i) = count / num_pixels;
    equalized2(i) = round(cdf2(i) * (L - 1));
end

for r = 1:h
    for c = 1:w
        Hist_EQimg(r, c) = equalized(GyImg(r, c) + 1);
    end
end

figure, imshow(Hist_EQimg);
title('Histogram Equalized Image');

%Histogram of Histogram-Equalized Image
L = 256;
h = size(Hist_EQimg,1);
w = size(Hist_EQimg,2);
num_pixels = h * w;

% create output image
Hist_HistEQimg = zeros(h, w);
Hist_HistEQimg = cast(Hist_HistEQimg, 'like', Hist_EQimg);

```

```

cdf3 = zeros(256, 1);
equalized3 = zeros(256, 1);
histogram3 = zeros(256, 1);
for r = 1:h
    for c = 1:w
        histogram3(Hist_EQimg(r, c) + 1) = ...
            histogram3(Hist_EQimg(r, c) + 1) + 1;
    end
end

count = 0;
for i = 1:size(histogram3)
    count = count + histogram3(i);
    cdf3(i) = count / num_pixels;
    equalized3(i) = round(cdf3(i) * (L - 1));
end

for r = 1:h
    for c = 1:w
        Hist_HistEQimg(r, c) = equalized(Hist_EQimg(r, c) + 1);
    end
end

figure, bar(Hist_HistEQimg);
title('Histogram of Histogram-Equalized Image');

```

1) Original image

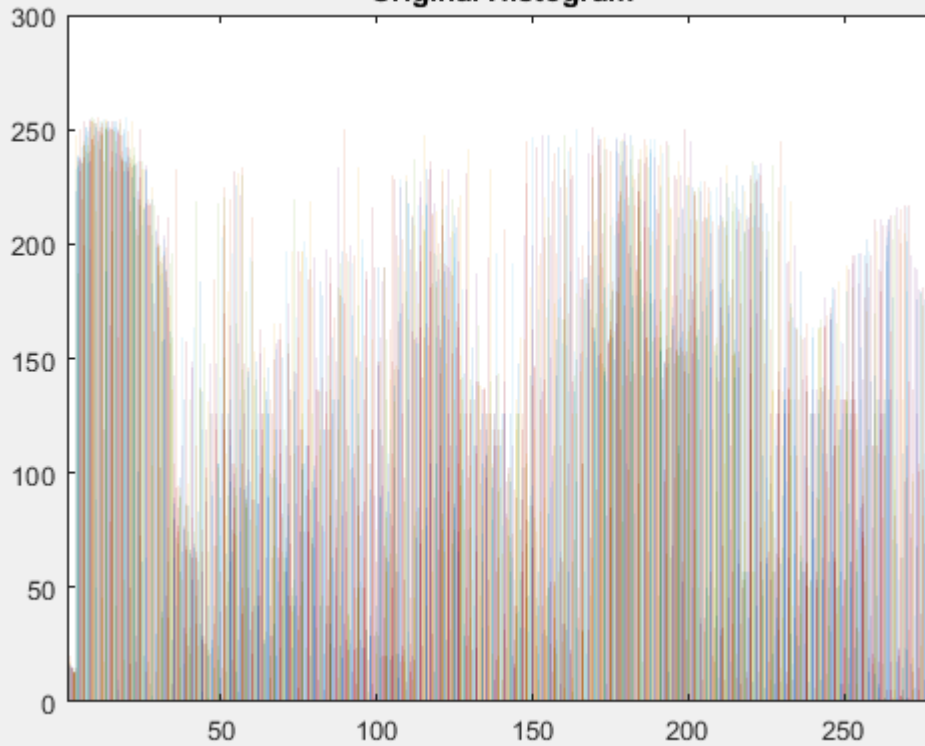


GrayScale Image



2) Original Histogram

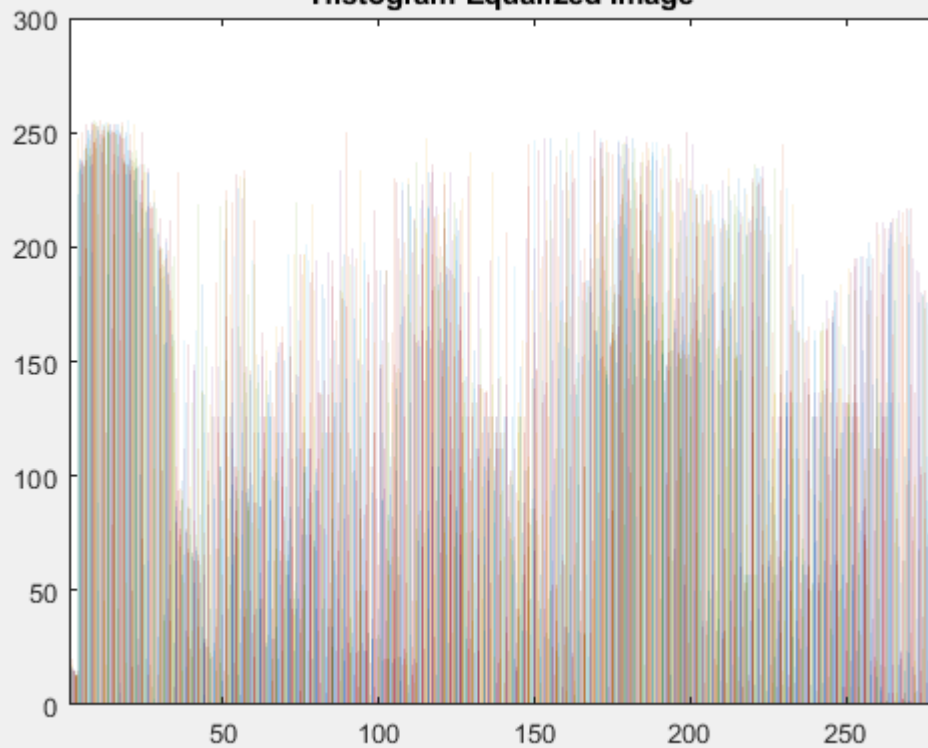
Original Histogram



3) Histogram-Equalized image



Histogram Equalized Image



4) Histogram of the Histogram-Equalized image

