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Code:

Grayscale

```
imagePath = './Barbara.bmp';
```

```
h = 10;
```

```
th = 10;
```

```
image = imread(imagePath);
```

```
image = double(image);
```

```
imageDim = size(image);
```

```
imageSmall = imresize(image, [128, 128]);
```

```
I = imageSmall(:);
```

```
n = length(I);
```

```
K = 10
```

```
J = I;
```

```
for k=1:K
```

```
    mxh = zeros(1, n)
```

```
    for i=1:n
```

```
        yk = J(i);
```

```
        numerator = 0;
```

```
        denominator = 0;
```

```
        for a=1:n
```

```
            weight = exp(-(yk - I(a))^2 / (h^2));
```

```
            numerator = numerator + (I(a) * weight);
```

```
            denominator = denominator + weight;
```

```
        end
```

```
        yMle = (numerator / denominator) - yk;
```

```
        J(i) = yMle + J(i);
```

```
        mxh(i) = yMle;
```

```
    end
```

```

disp([num2str(k), ' | ', num2str(norm(mxh / h)^2), ' | ', num2str(th^2)])
if norm(mxh / h)^2 <= th^2
    disp(i);
    figure;
    histogram(J);
    title(['h = ', num2str(h), ' K = ', num2str(K), ' k = ', num2str(k), ' ', imagePath])
    break;
end
if rem(k, 10) == 0
    figure;
    histogram(J);
    title(['h = ', num2str(h), ' K = ', num2str(K), ' k = ', num2str(k), ' ', imagePath])
end
end
end

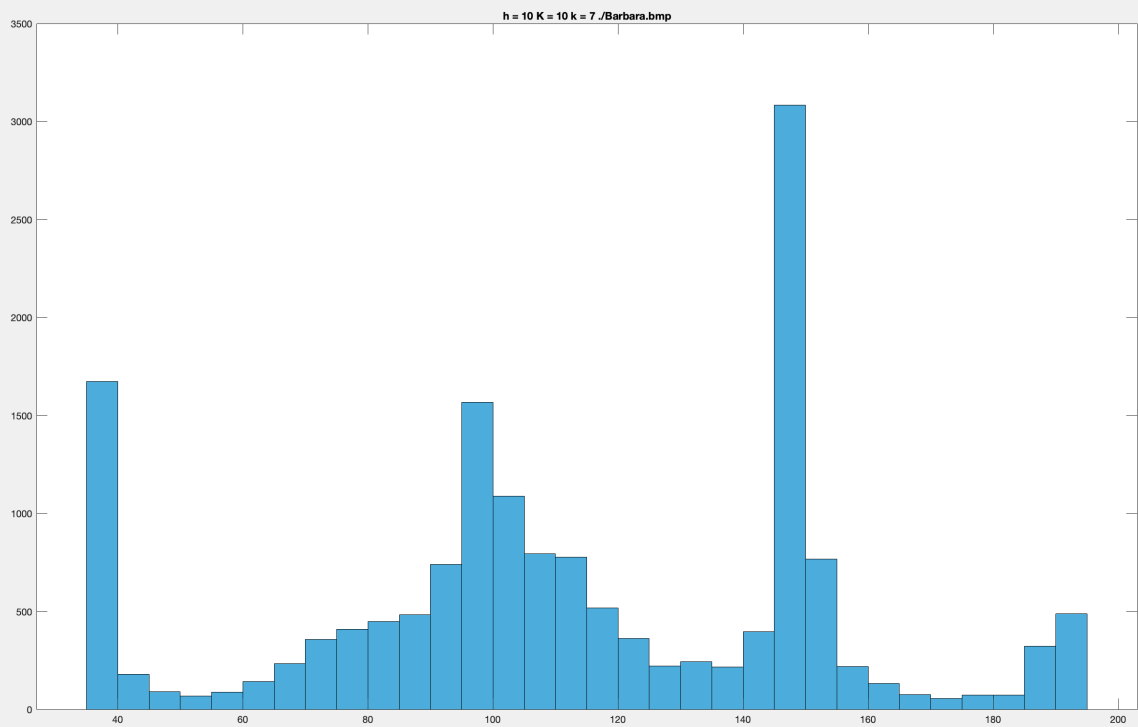
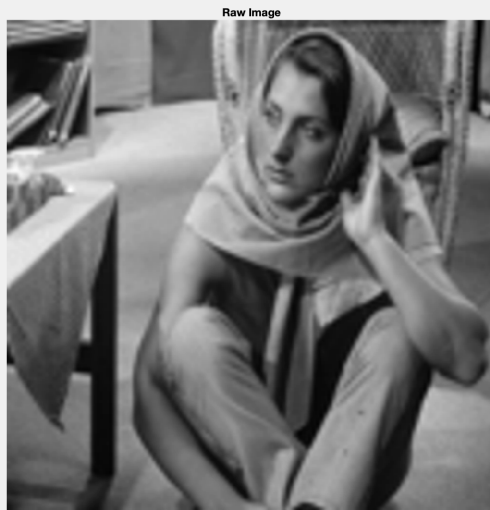
```

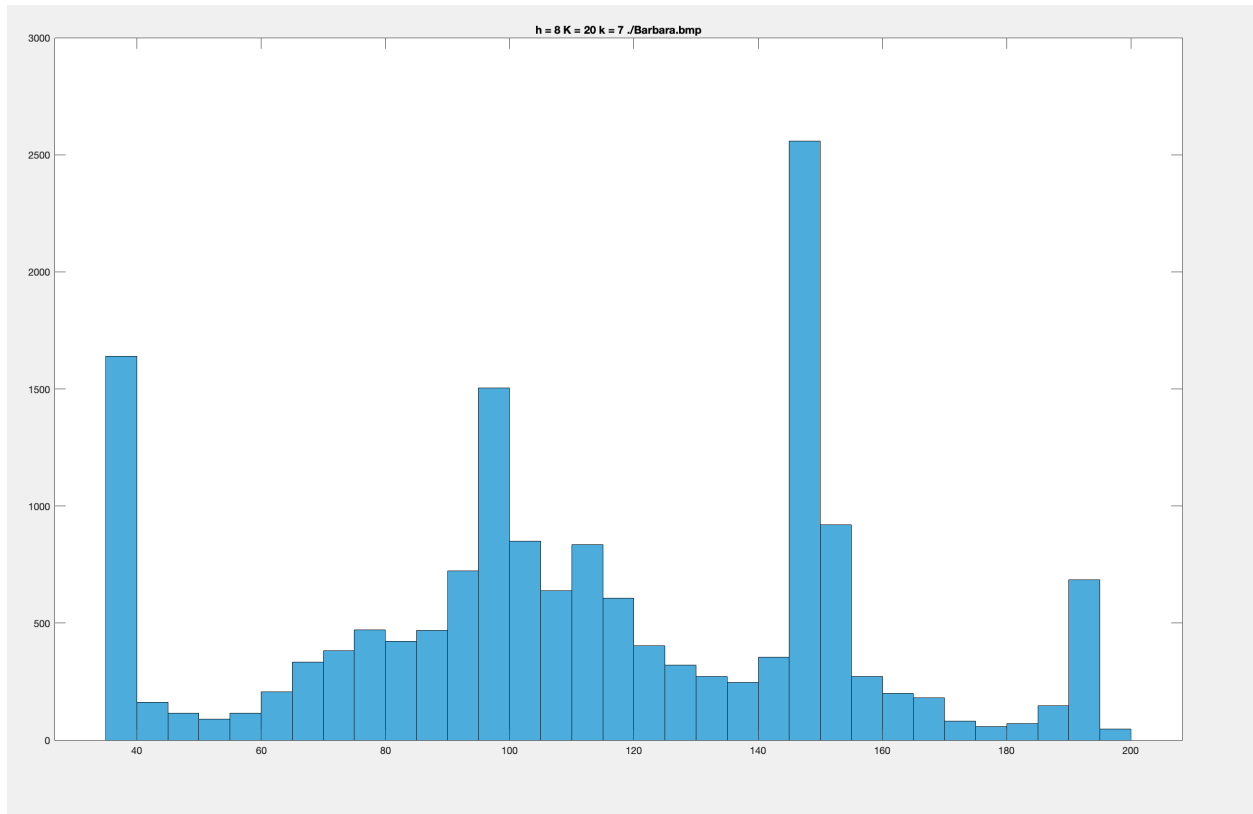
```

figure;
imageSmall = uint8(imageSmall);
imageSmall = imresize(imageSmall, [imageDim(1), imageDim(2)]);
subplot(1, 2, 1);
imshow(imageSmall, []);
title('Raw Image');
subplot(1, 2, 2);
J = reshape(J, [128, 128]);
J = imresize(J, [imageDim(1), imageDim(2)]);
imshow(J, []);
title('After Mean Shift');

```

Results:





As evident from the histograms at different iterations, the peaks become more pronounced as the pixels tend towards their local maxima. This phenomenon contributes to the smoothing of the image.

I observed that when I used a high value of K , such as 100, and set a low threshold, like 0.1, the pixel intensity values gradually shifted until I achieved a binary image. However, I opted to keep my K value at 20 to avoid drastic changes in the results.

I conducted this analysis on a single image due to the significant time complexity involved, which is $O(K * N^2)$. Despite resizing the image to reduce computational load, the process still demanded a considerable amount of time to complete.