Computer Vision
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Homework 1

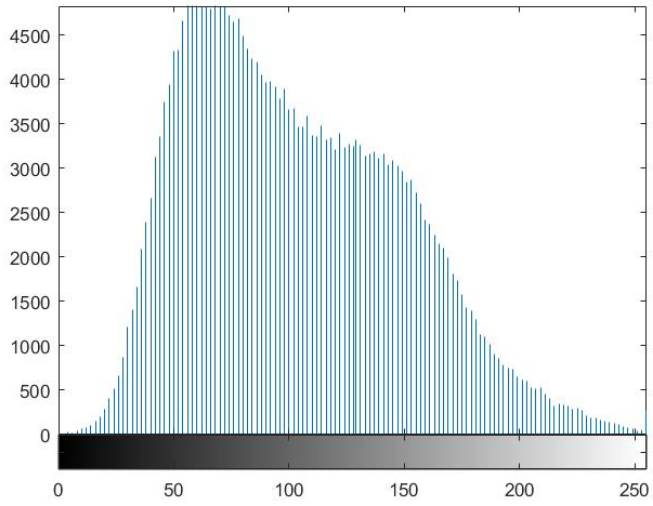
Problem 1

Solution:

a) The average pixel value is 76.9622. The min value is 25 and the maximum is 153.

b) This is the picture produced by my Matlab code:

And this is the histogram of it and we can see now that we have spread the spectrum and that it is going from the beginning to the end of the histogram:



And this is the code used to make it:

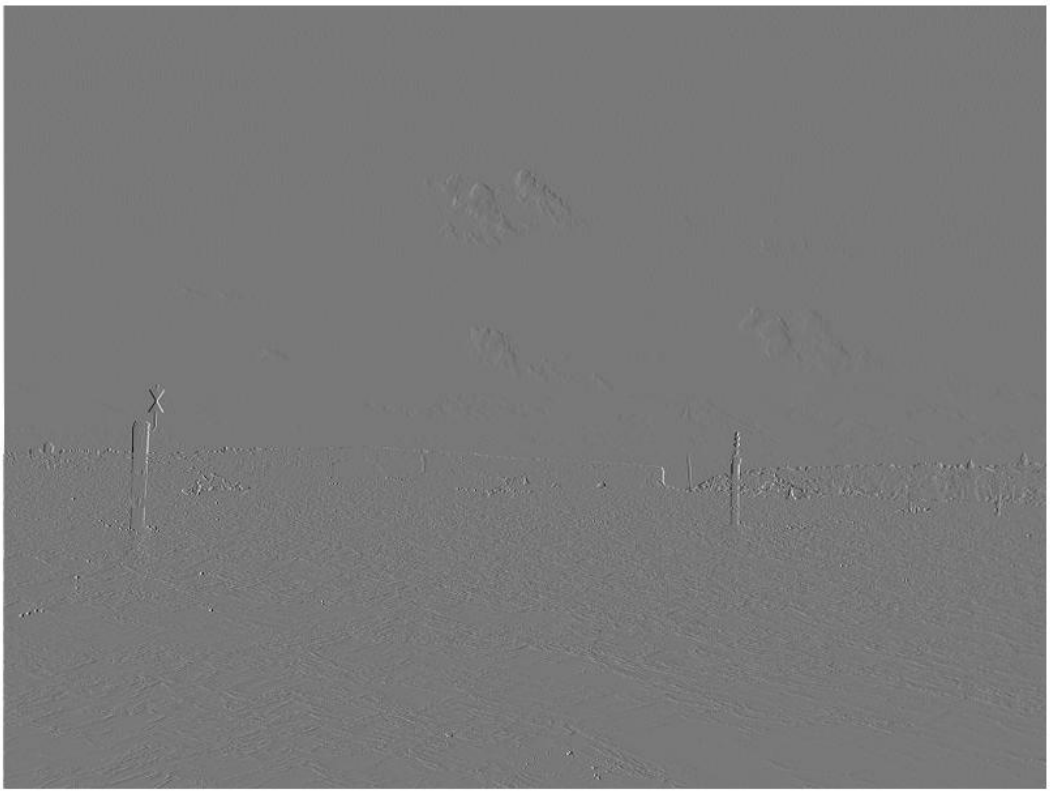
```
dark = double(rgb2gray(imread('u2dark.png')));
fixedimg = [];
minimum_offset = min(min(dark));
maximum_offset = max(max(dark));
offset = 255 / (maximum_offset-minimum_offset);
fixedimg = (dark - minimum_offset) * offset;

%displays the image
imshow(uint8(fixedimg));
figure,imhist(uint8(fixedimg));
```

c) The downside of the contrasted picture is that we are losing information about the photo, because all we have on the picture are clear blacks or clear whites, there are no shades in between. But because of that we are getting a sharper image.

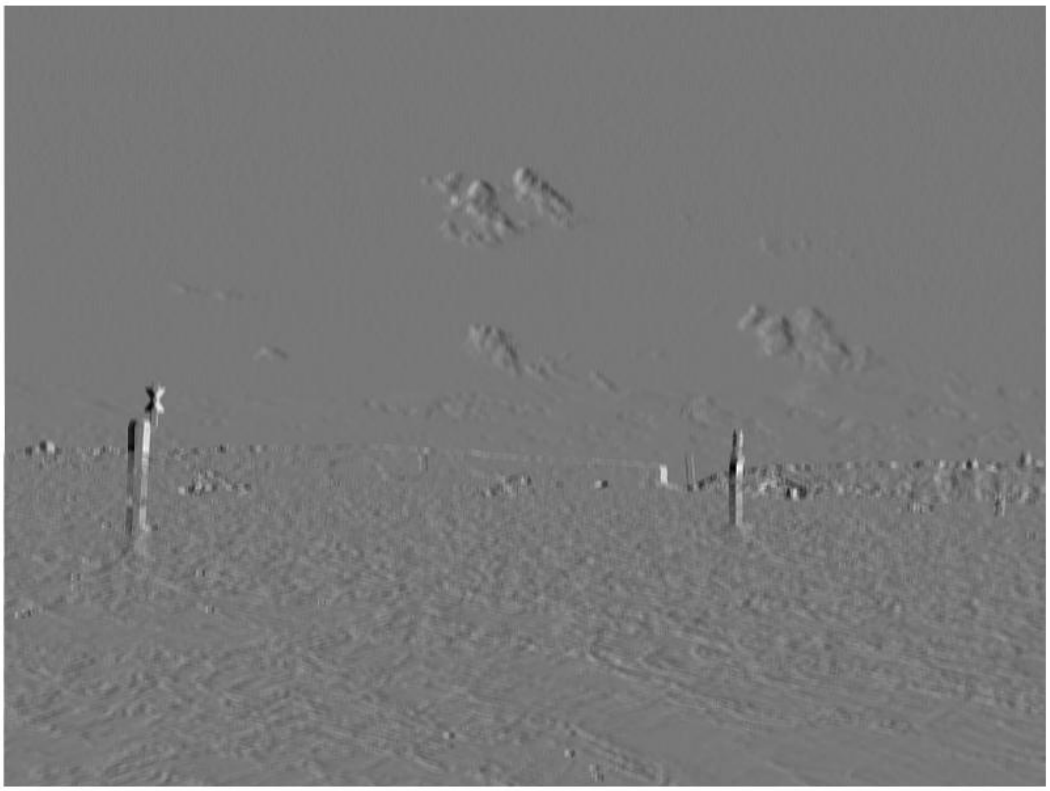
Problem 2

Solution:

a) To make the edges I am dividing the picture in two parts, one part is from the beginning until the before last column and the second part is starting from the second column and going until the last row. In that way I can subtract the columns easier.



b) There is a larger blur on the large edges because the edges are more clear as in the small edges are not that clear so we cannot really notice the blur.



Problem 3

Solution:

a) $X_1 = AAX_0$
We apply the same rotation matrix twice because with the first rotation we get a rotation of 45 degrees counter-clockwise and with the second one 45 degrees more and we end up with an image that has been rotated 90 degrees counter-clockwise.

b) $S \cdot R \cdot X_0 = X_2$

$$\begin{bmatrix} 1.0 & 0 \\ 0 & 0.5 \end{bmatrix} \cdot \begin{bmatrix} \cos 45 & -\sin 45 \\ \sin 45 & \cos 45 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix} = X_2$$

c) $X_2 = \begin{bmatrix} 0.7604 & -0.3247 \\ 0.6495 & 0.3802 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix}$

d) $p_0 = \begin{bmatrix} 7 \\ 0 \\ 1 \end{bmatrix}$

$p_1 = \begin{bmatrix} 6.3640 \\ 6.3640 \\ 1.0000 \end{bmatrix}$

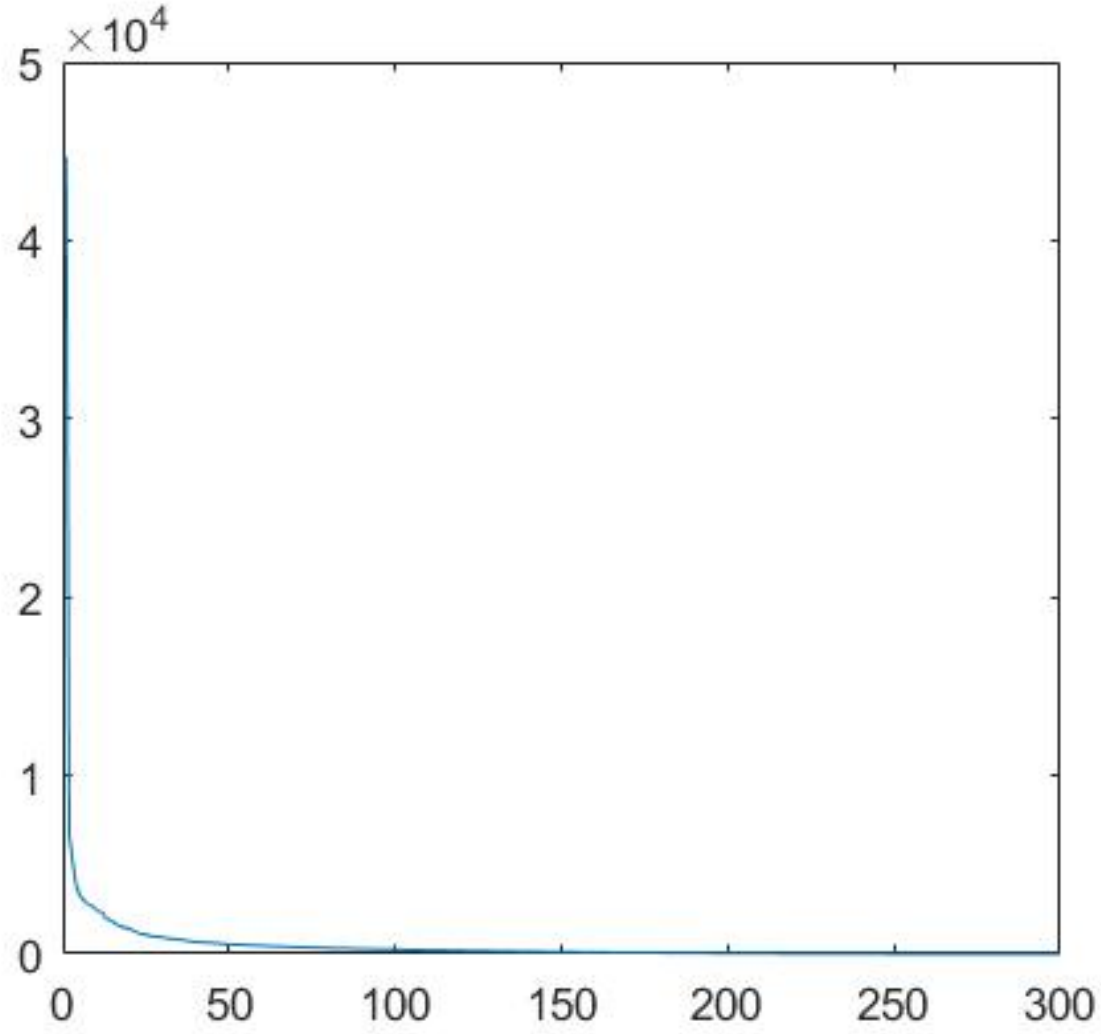
$p_2 = \begin{bmatrix} 6.9497 \\ 0 \\ 1.0000 \end{bmatrix}$

p_1 and p_2 are not the same vector, because in the one case we first scale the vector and then we rotate it and in the other we first rotate it and then scale it.

Problem 4

Solution:

a) Here is the plot:



c) With k=200 we will save space because we will have a compression ratio of more than 1.

b) Trying for different k values gives us different quality of images. The higher the k value the more quality the image has.