IDIP HW2 REPORT

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DEVELOPMENT TOOL:

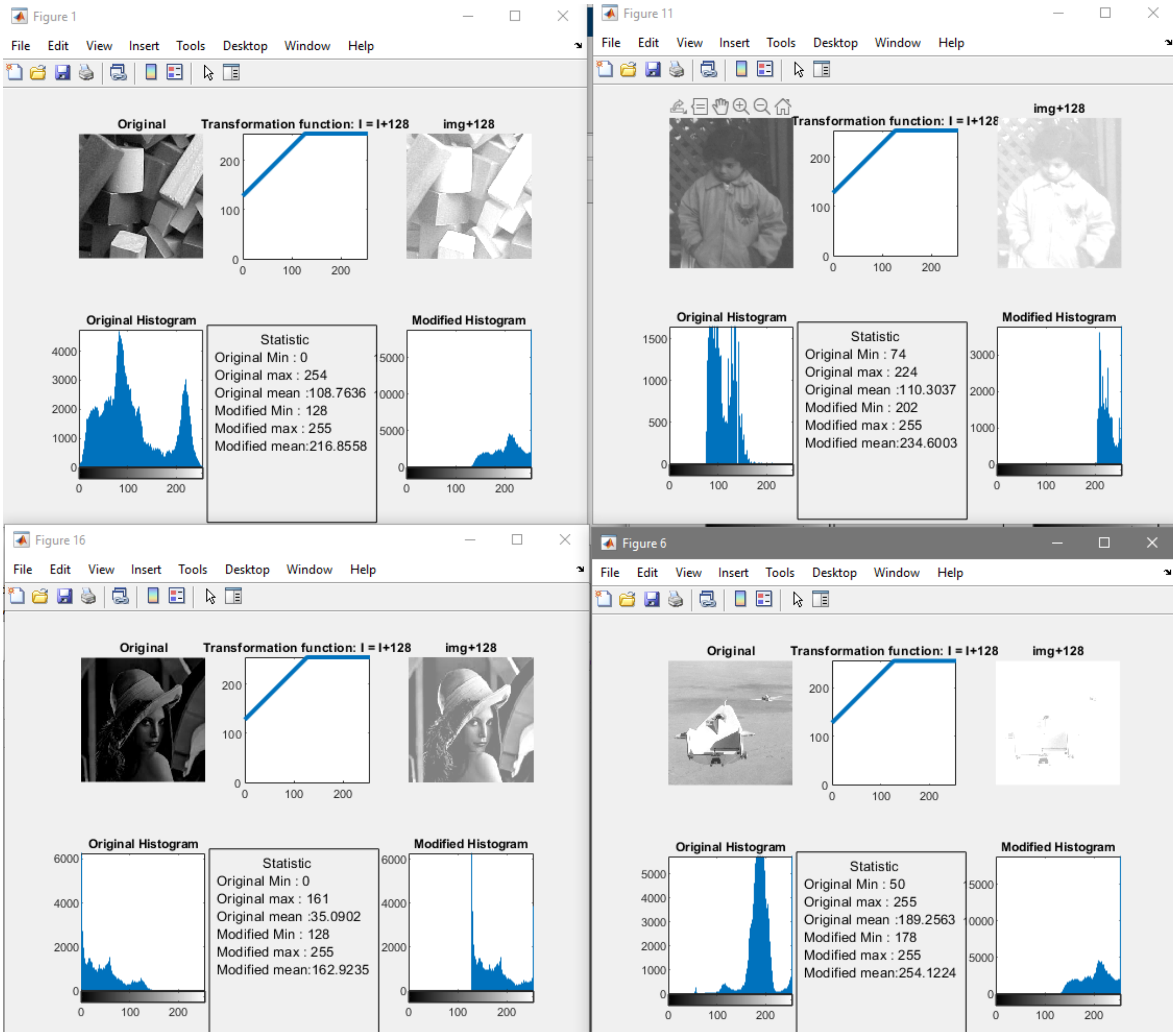
MATLAB R2021a(9.10.0.1602886)

TASK 1

In the first stage of this assignment, we applied some point proccess transforms to four separate input images. We compared the images created after the transformations we applied and the original images. In addition, we compared the histogram plots of the original images with the histogram plots of the converted graphics. As a result, we tried to interpret the effects of point proccessing transformations on images.

POINT PROCESSING TRANSFORMATIONS

1- Adding 128 to each pixel



When we apply this function, we can say that generally 128 additions lighten the image. When we go into detail, we can see from the histogram graphs that the pixels between 0-128 in the original image have been moved to the range of 128-255 in the new image. In addition, 128 and larger pixels in the original image are fixed to 255. In other words, the colors of 128 and above are completely white in the new image. The dynamic range of the pixels in the 0-128 range remained the same. As a result, the addition process with 128 whitened the color of the image, the intensty values of the pixels with 128 and above were fixed to 255 (the details in these parts were lost), the dynamic range of the pixels in the 0-128 range remained constant.

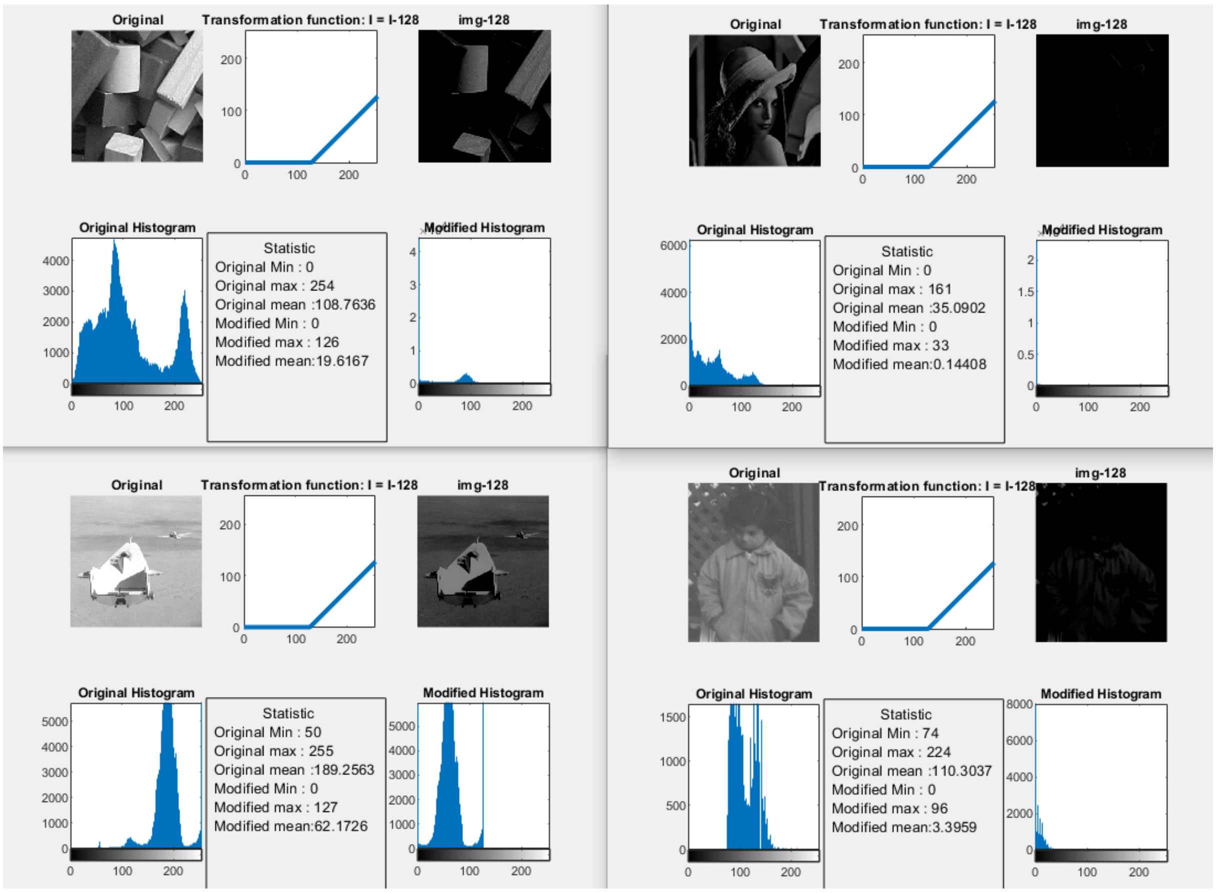
İmage1: In the original image, as we can see from the histogram graph, the intensity values of the pixels have a very wide, homogeneous range. We can only say that the gray tones are a bit intense. When adding with 128, the pixels in some parts of the picture are fixed at 255 and the white parts lost the details.

Image2: As can be seen from the histogram graph in the original image, a wide intensity range is not used and the gray tones are intense. Therefore, when 128 is added, the intensity values in the modified image remain in a high but narrow intensity range. The image is bright, but the details are diminished.

Image3: As we can see in the histogram graph of the original image, the intensity values of the pixels are low. So overall it's a dark visual. When adding with 128, the picture becomes light.

Image4: As we can see in the histogram chart of the original image, the intensity values are in a high range, so the tones of the image are very light. When we add 128 to this image, since it exceeds 255, there are many pixels equal to 255, so the picture has lost its details.

2- Subtracting 128 from each pixel



When we apply this transformation function, we can observe that the image gets darker. As we can see from the histogram graph, the intensity values of the pixels in the 0-128 range are set to 0 when the I-128 operation is performed. This causes the image to darken and details are lost. Intensty values of pixels that are 128 and larger in the original image have decreased to values in the range of 0-128. This caused the image to darken, but the dynamic rage remained constant in this range. As we can generally observe from the histogram graph, our generally used intensty value range has decreased and this has led to a decrease in details.

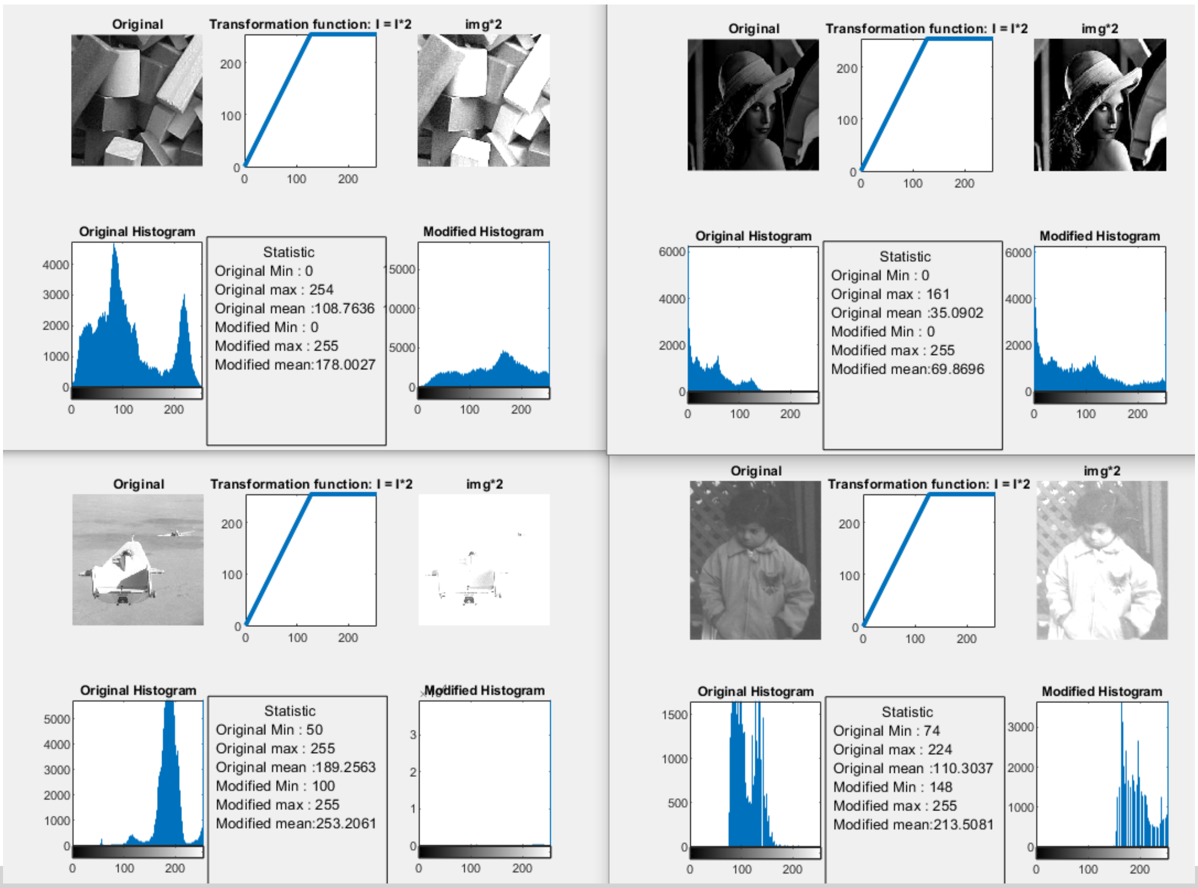
Image1: In the original image, as we can see from the histogram graph, the intensity values of the pixels have a very wide, homogeneous range. We can only say that the gray tones are a bit intense. For this reason, when we apply 128 subtraction, having 0 equalized pixels caused the loss of details and the image became quite dark.

Image2: In the original, we see that the intensity values of the pixels in the image are dense in the low value range. Therefore, when 128 subtraction is applied, as can be seen from the histogram, almost all of the pixels are equal to 0 and the picture has lost all its details.

Image3: We can say that the intensity values of the pixels in the original image are in very high ranges. When 128 subtraction is done, pixels equal to 255 in this image are equalized to 128, the color becomes darker but does not add any detail.In addition, while the gray tones in the original image have a range, when 128 is removed, some pixels are equal to 0, black and detail is lost.

Image4: When we look at the original picture, we see that the intensity values of the pixels have a narrow range in gray tones. When 128 subtraction was done, the pixel value was mostly equal to 0 and the areas that were black in the picture caused a loss of detail.

3- Multiplying each pixel value by 2



When we apply the multiply by 2 function to the image, we see that our function in the graph we see above stays above the identity function. This shows us that multiplying by 2 generally whitens the image. If we examine it in a more detailed way, we can say that the pixels in the range of 0-128 in the original image can get more various intensity values in the modified image, that is, the dynamic range has increased. This means that the part in the range 0-128 in the original image is more detailed in the modified image. Since the values of the pixels that are 128 and above in the original image will exceed 255 when multiplied by 2, all of these values are fixed to 255. In other words, pixels in the 128-255 range are now white with the modified image. This situation caused the image consisting of pixels in this range to lose its details.

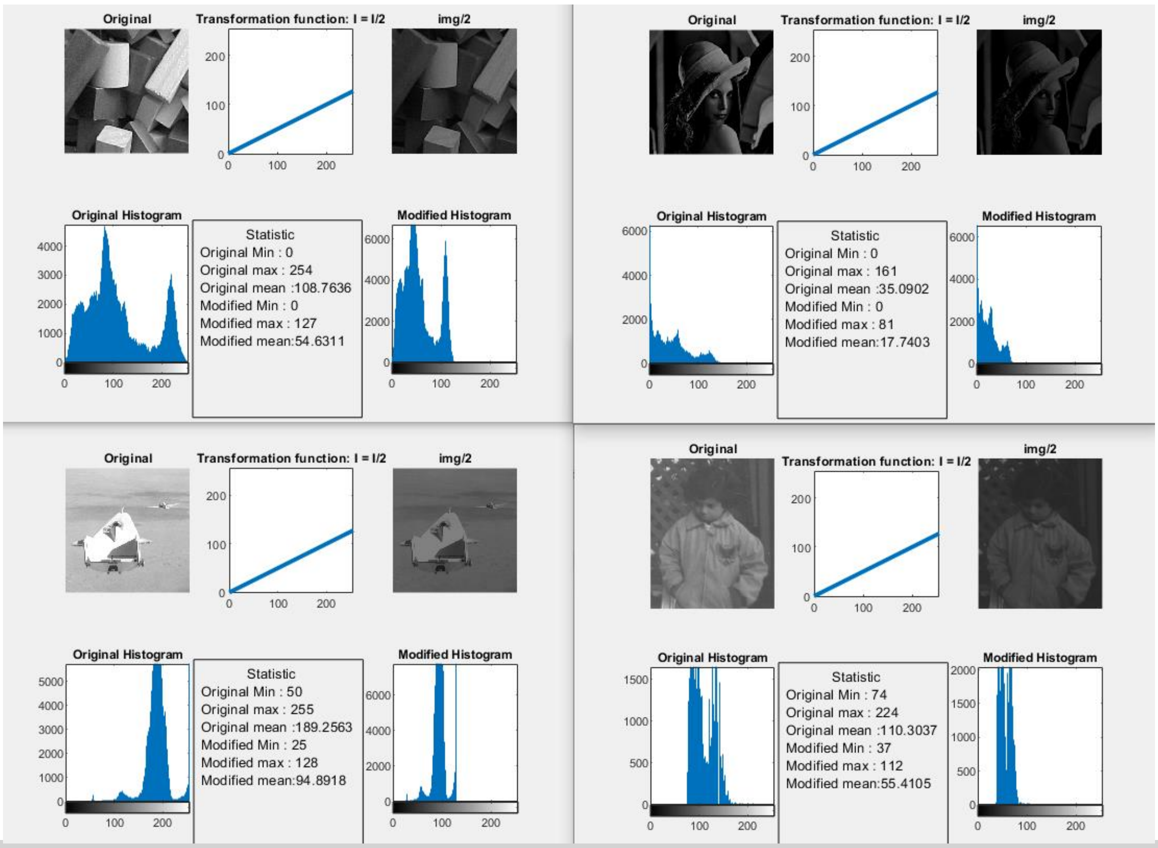
Image1: When we look at the histogram graph of the original image, we can see that the intensity values are distributed homogeneously. When multiplying by 2 is applied, there is still a homogeneous intensity range, but since some pixels are fixed to 255, they are white and lose the details.

Image2: We can see that the intensity values of the pixels in the original image are in low values and in a narrow range. When multiplying by 2, we can see that other values except 0 spread to a wider range, some pixels are equal to 255, but despite this, the details in the picture increase as the dynamic range increases.

Image3: In the histogram graph of the original image, we see that the high intensity values are in the density . When these values are multiplied by 2, the values of almost all pixels exceed 255 and become equal to 255, so the image becomes white and almost all details are lost.

Image4: In the original image, the intensity values of the pixels were stuck in gray tones, but when multiplied by 2, they were moved to the higher intensity values range. The picture is illuminated, some pixels are equal to 255, so there is a loss of detail in those parts.

4- Dividing each pixel value by 2



When we apply the division by 2 process to the image, the graphic that is formed under the identity line directly shows us that the image becomes darker. .We can clearly see the effect of the division process we applied here from the histogram graph. Intensity values, which were in the range of 0-254 in the original image, were reduced to the range of 0-128 in the modified image. In other words, it caused the dynamic range of the image to narrow. The decrease in intensity values had a darkening effect on the image, but the narrowing of the dynamic range also caused a decrease in details, that is, a darker but less detailed image.

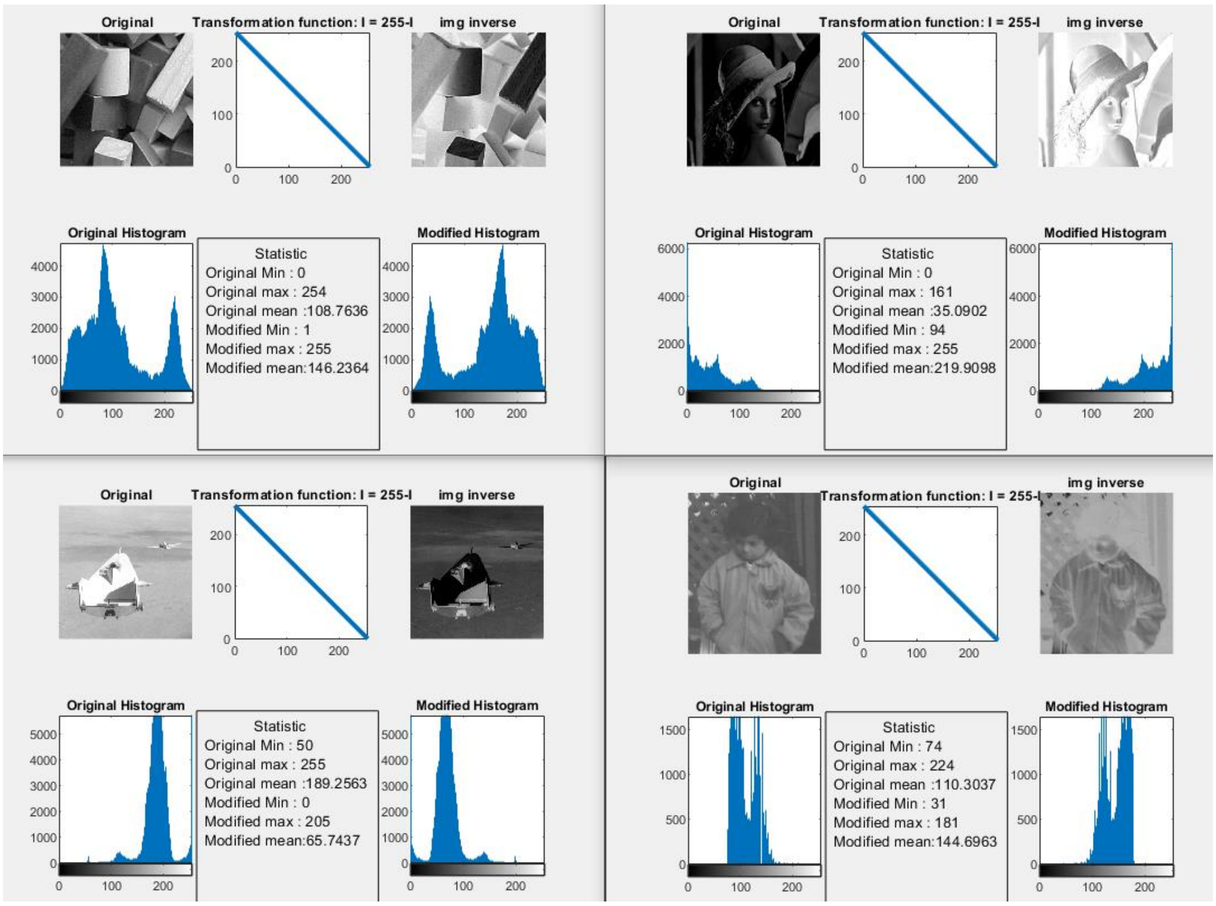
Image1: As can be seen from the histogram plot of the original image, the dynamic range of intensity values ranges widely and homogeneously. When dividing by 2, the image got darker and additionally the dynamic range narrowed. This caused the loss of detail.

Image2: While the intensity values of the pixels of the original image were in a low and narrow range, the dynamic range became narrower when the division by 2 was made and the details decreased.

Image3: The image brightness is because the values of the pixels in the original image are generally high. When dividing by 2, the completely white pixels are fixed to a value in gray tones, but the range of values that other pixels can take has decreased. In this case, the image got darker but there was some loss of detail.

Image4: We can see that the dynamic range of the pixels in the original image is low and the image is in gray tones. When dividing by 2, the image got a little darker, but in addition, the dynamic range was further reduced. In this case, the image has lost some more details.

5- Taking the negative of the image



When we apply the inverse process to the original image, we get the opposite of the identity function, as we can see from the graphic. This causes the white parts to turn black, and the black parts to turn white. We can also observe from the histogram graph that the intensity, which was in the range of 0-128 in the original image, has reached the range of 128-255 symmetrically in the histogram of the modified image.

Image1: When we compare the histogram of the original image with the histogram of the modified image, we can see that it is inverted symmetrically. When the inverse process is performed, the dark toned parts of the image become light in the modified image and the image is illuminated.

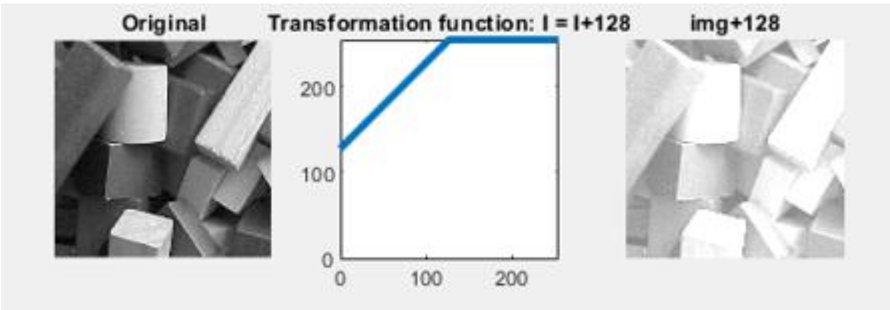
Image2: As seen in the histogram of the original image, we can see that there are many pixels with an intensity of 0 and the image is in dark tones. Since the pixels that were 0 were set to 255 when the inverse import operation was performed, the black parts became white and the white parts became black.

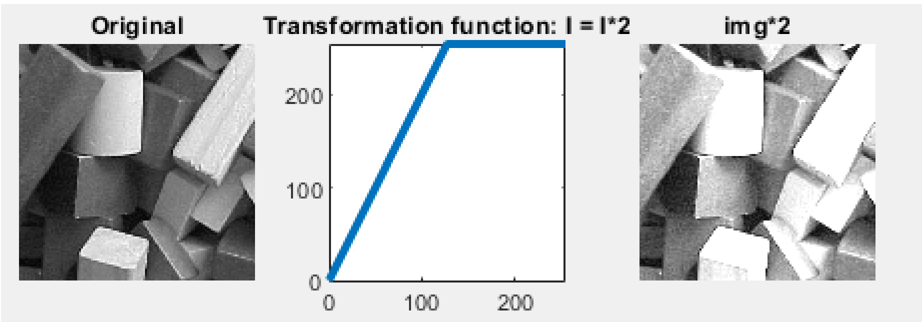
Image3: Since the intensity values of the pixels in the original image are high, we see that the image is in light tones. As it can be understood that the histograms are symmetrical to each other, the white parts are black and the black parts are white.

Image4: We see that the original image is in gray tones and its dynamic range is less. With the inverse process, the image has become a little whiter, but the dynamic range has not changed.

Comparison

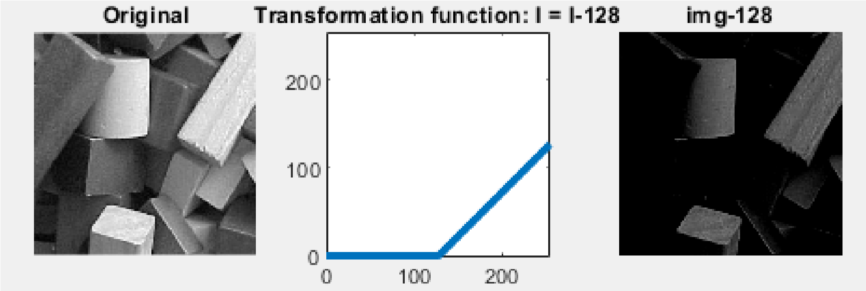
1- Adding 128 to each pixel / Multiplying each pixel value by 2

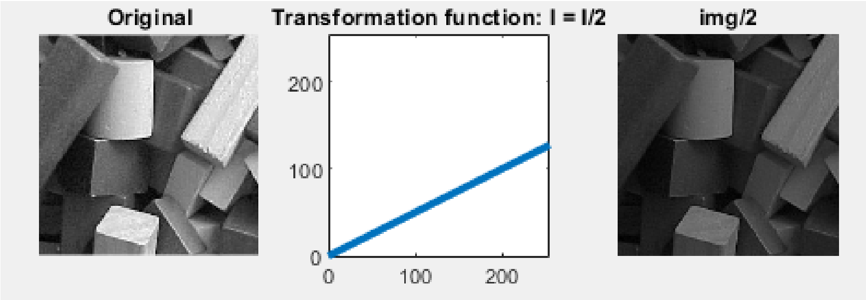




We can see that the two processes we applied illuminate the image, but in fact, the effects of the two are very different. After the addition with 128, the intensity values of the pixels of 128 and above become white as the intensity values are fixed to 255 and the details are lost. Apart from that, keeping the dynamic range of the pixels in the range of 0-128 the same and increasing the intensities at the same rate does not change the detail ratio. In the multiplying by 2, the dynamic range of the values in the 0-128 range of the image has increased, so the detail in those parts has become more.

2- Subtracting 128 from each pixel / Dividing each pixel value by 2





We can observe that the subtraction and division operations also make the image black as a result, but of course there are big differences between these operations. Since 128 subtraction takes all values in the range of 0-128 to 0 in the original image, there are areas in the resulting image where the black and details disappear. In the process of dividing by 2, there are no disappearing areas that become completely black, but we can say that the intensity values that the pixels can get, the dynamic range decreases to the range of 0-128, so the details of the image are reduced.

TASK 2

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#The biggest communication problem is we don't listen to understand. We listen to reply.
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In this part of our homework, we first took the 66th image and the 2nd strategy according to the last digits of our school numbers. While separating the image into bit planes, we used the codes we saw in the lesson. According to our strategy, we combined the first 8 elements as strings with the "append" function.

We found the ASCI equivalent of this string with the "bin2dec" function and assigned it to the variable named "harf". We put this variable in the "msg" array. We have done the operations we have done so far in the while loop until the result of the append function is equal to the binary equivalent of the "#" character. Finally, when the loop was completed, we reversed the existing array with the "flip" function and printed it on the screen.

What we have learned ,what challenges did we face?

We performed operations on multiple grayscale images. After these processes, we learned how to play with the intensity values of the pixels and how to interpret the changes on the image. How do we split an image into bitplanes. We learned how to hide data in LSB.Since we saw the examples in the lesson in Task 1, we had no difficulty in writing the code and interpreting the outputs. While writing a function for our own strategy in Task 2, we searched the "append" function to combine 8 elements in string form. We searched for a function that finds the decimal transformation of binary. As a result, we found the "bin2dec" function. Apart from that, we had to reverse the array we kept for the message. We searched and found the flip method.

OUR MESSAGE

The biggest communication problem is we don’t listen to understand. We listen to replay.