Assignment 1

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COMP 546

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Question 1

(a) The optimal sigma value is between 15-17. When the sigma value is set too low the tiles become indistinguishable from one another, but when you set the sigma value too high, it becomes nearly identical to having a shadow. This is demonstrated by the images below. When $\sigma = 1||200$, rather then aiding in distinguishing the tiles they actually inhibit the process. When, viewing $\sigma = 5$, it become apparent, when contrasting with the figure from when it was set to 1, that it is becoming easier to distinguish the difference in RGB values between the left side and right.The images are clearest when the sigma values is set to around 16; incrementing the sigma value past this value either making no significant difference in this making the image more distinguishable, or being flat out becoming detrimental.

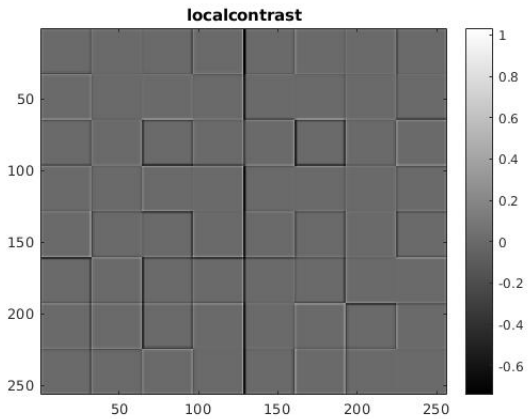


Figure 1: $\sigma = 1$

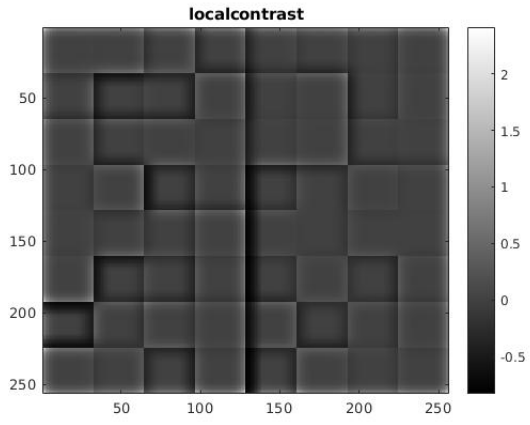


Figure 2: *
$\sigma = 5$

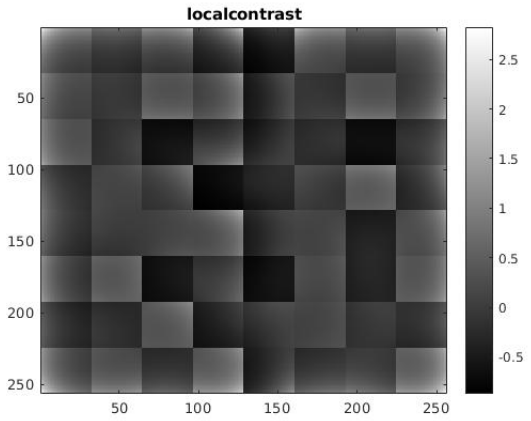


Figure 3: $\sigma = 16$

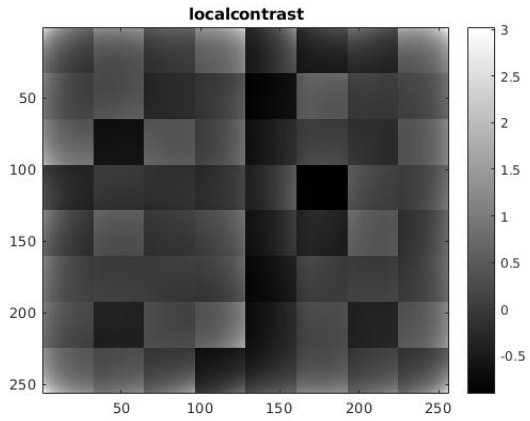


Figure 4: $\sigma = 20$

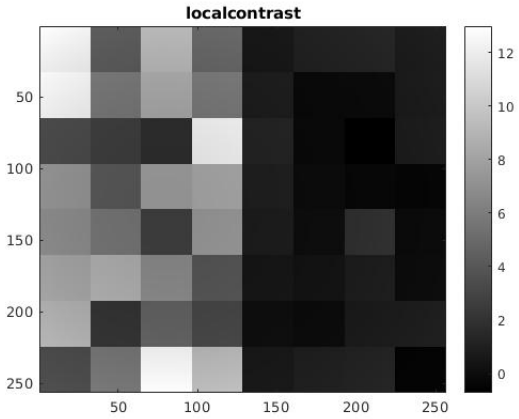
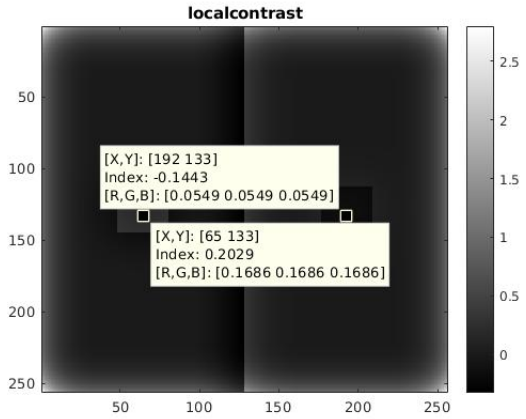


Figure 5: $\sigma = 200$

(b) Viewing the local contrast using the data cursor, shows that there is a clear 'apparent difference' in the RGB values. The RGB value of the one on the right is lower then that on the left, meaning that the left is supposed to look lighter then the one on the right.



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(c) Using the data cursor on the original image shows that the RGB values are identical, despite our eyes making it seems as though the grey streak on the left is darker then the one on the right. So in a similar fashion to the previous question, applying the local contrast should make the value on the RGB value on the left be lower then the one on the right. However when actually checked, the RGB value is actually lower on the right side, meaning that the one on the right should actually be the darker one.

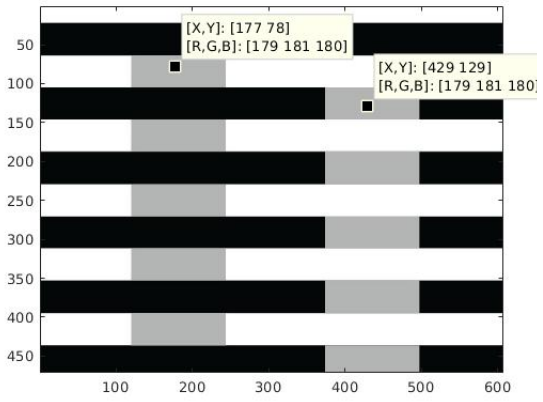


Figure 6: *
Original

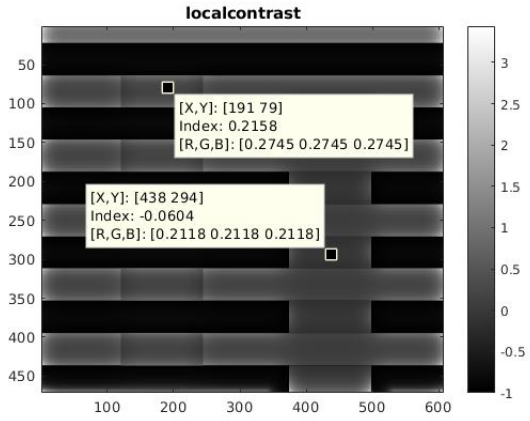
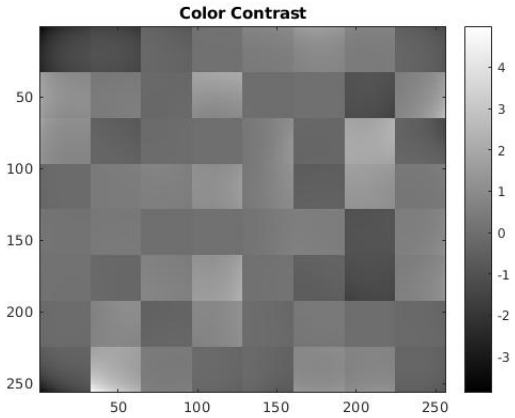


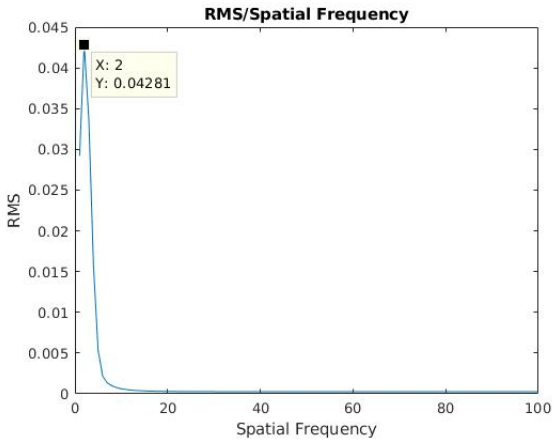
Figure 7: *
Local Contrast

(d) It is meant to normalize the intensity, and accentuate the existing green and red colors, to counteract the effects of the shadow. However, it doesn't completely neutralize the shadow completely, as seen with the image below.

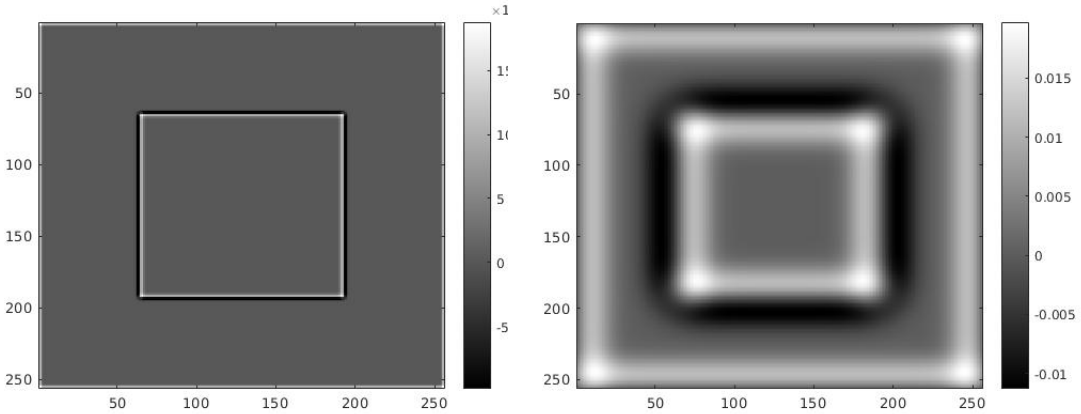


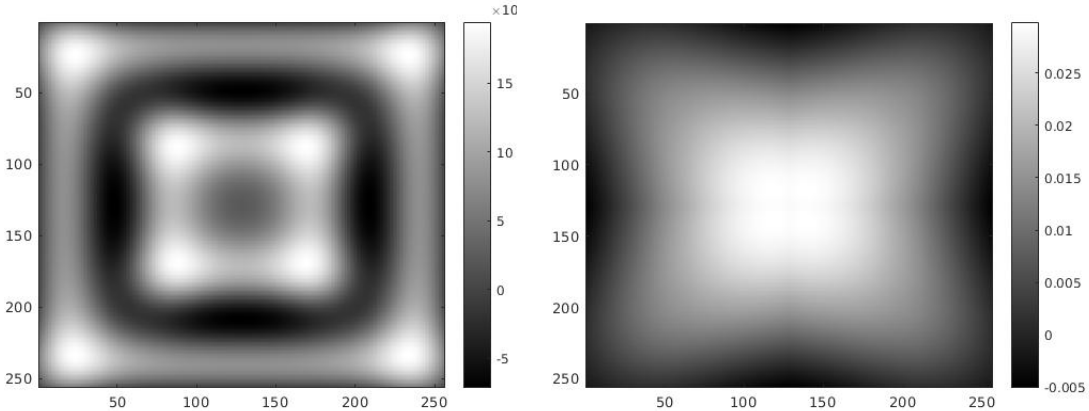
Question 2

(a) The spatial frequency of 2 is, by far, provides the largest RMS filter output of 0.04281. The RMS rapidly increases with spatial frequency until it hits around cos(1.5).

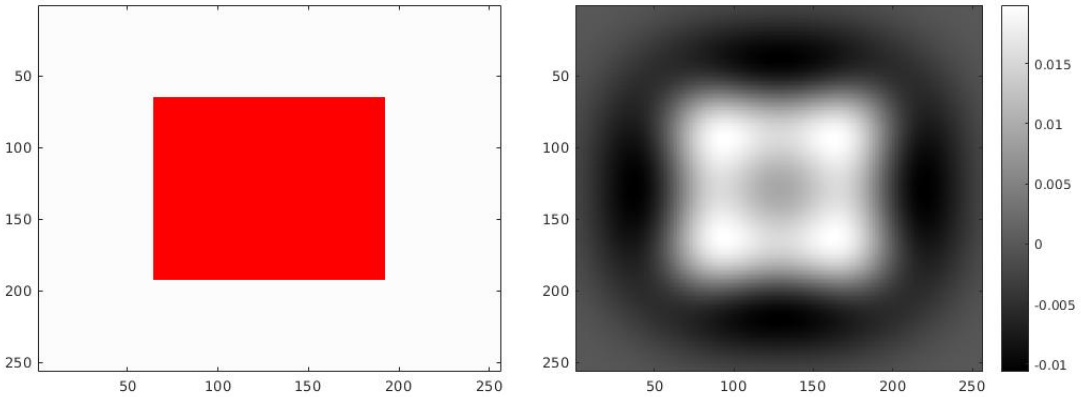


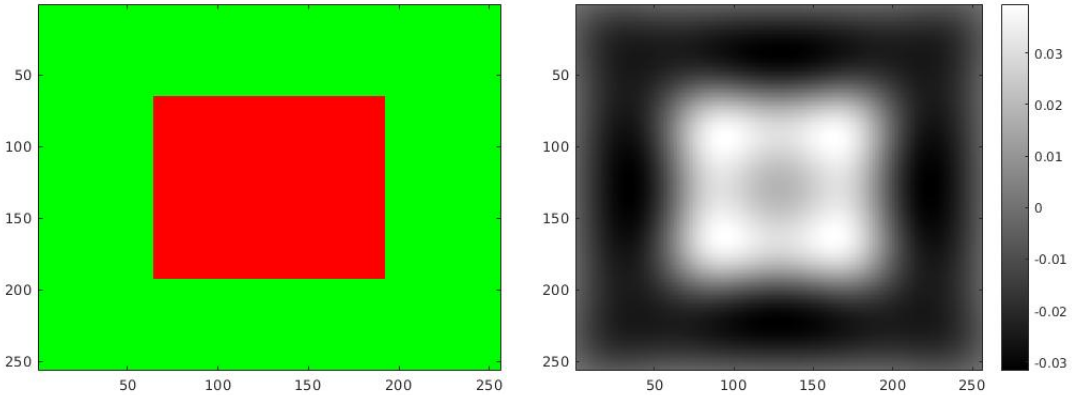
(b) When the sigma is set to a low value, and in turn making the square smaller then the center region, you obtain an image with very high intensities, making the difference in boundary between the square and the background very apparent. While when the square is larger then the center region you get a very low intensity image, with it being hard to distinguish the square and the background. When the square is approximately the same size as the DOG filter, you get a result that somewhere in between. Though it is clear where the square exactly is, there is still a bit of a blur in the area between the square and the background. The effect of which gets worse and worse as you raise the sigma value. This is very similar to viewing an object closely vs. from a distance,as the DOG model is meant to replicate the retinal cell.

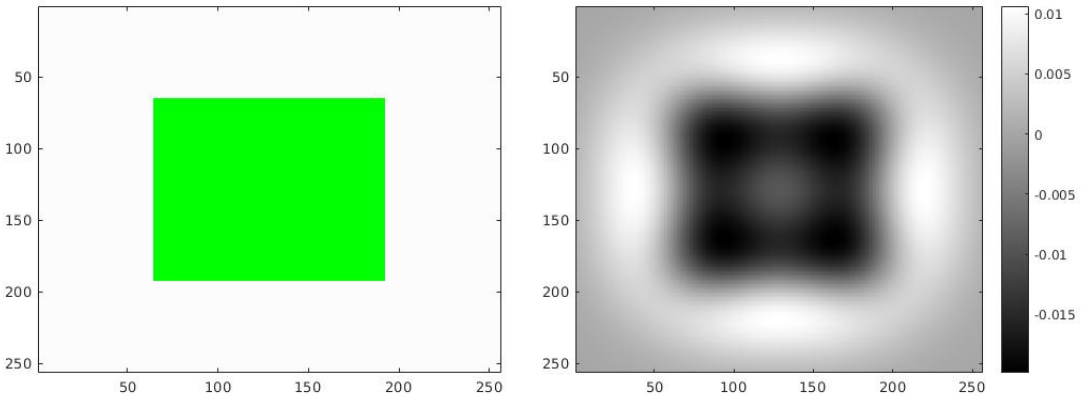


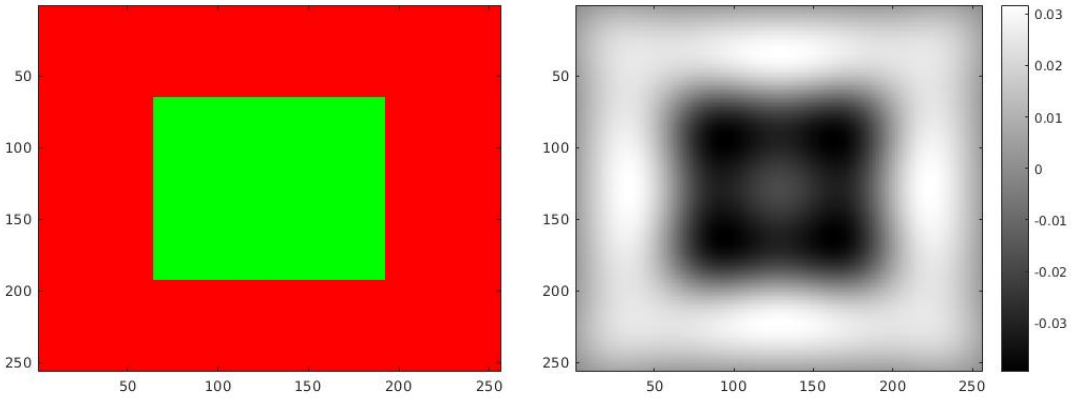


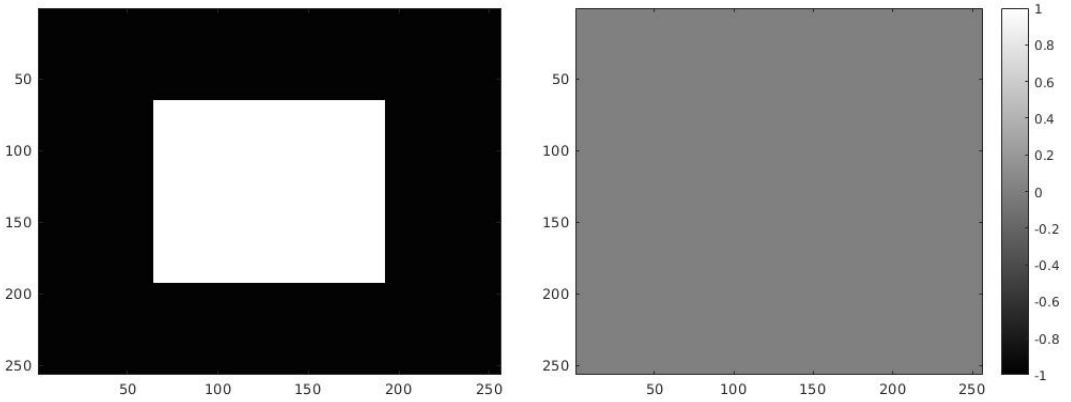
(c)


50
100
150
200
250
0.015
0.01
0.005
0
-0.005
-0.01


50
100
150
200
250
0.03
0.02
0.01
0
-0.01
-0.02
-0.03


50
100
150
200
250
0.01
0.005
0
-0.005
-0.01
-0.015





Question 3

Knew how to calculate the blur width, wasn't quite sure how to program the image blurring. Calculated by calculating the absolute distance between the object and the focal point * 5mm, due to the distances distance from the object to the viewer canceling out when subtracting the two values in the formula.