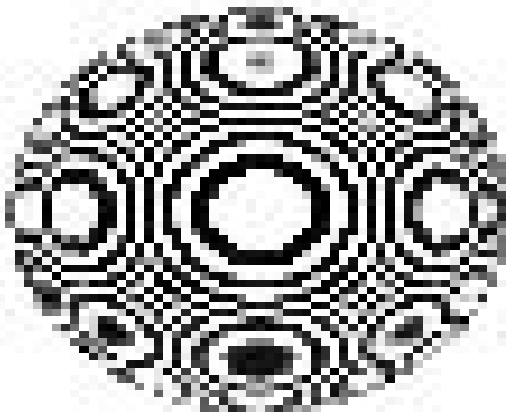
1. Run GaussianBlurImage and SeparableGaussianBlurImage with sigma = 2, 4, 8 on Seattle.jpg. How many seconds does it take to run each function? How long do you think it would take to run each with
sigma = 32?

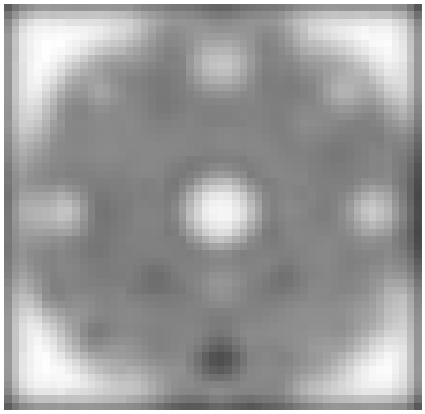
GaussianBlurImage scales very badly with sigma but with separable gaussian it scales linearly.

Sigma	GaussianBlurImage (Run time in sec)	Separable Gaussian BlurImage
2	7.732722997665405	9.07219409942627
4	Time Taken(sec): 2 9.817840576171875	Time taken(sec):1.01 9.239795923233032
6	Time Taken(sec): 12.232642412185669	Time taken(sec): 9.818939208984375
8	Time Taken(sec):5 14.840339183807373	Time taken(sec): 10.886235475540161
10	Time Taken(sec): 18.3835346698761	Time taken(sec): 10.77964186668396
16	Time Taken(sec):16.9 31.79379916191101	Time taken(sec): 12.682673215866089
32	My guess was around 160. Actual time is 99.91536	Time taken(sec): 14.907732009887695

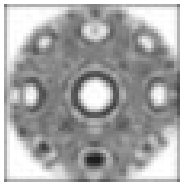
2. What is the best amount of blur to apply when downsampling Moire.jpg by 8x (pressing Half Size 3 times)? Does downsampling Seattle.jpg require the same amount of blur?



Down sampled image



for sigma is 2



for sigma 1

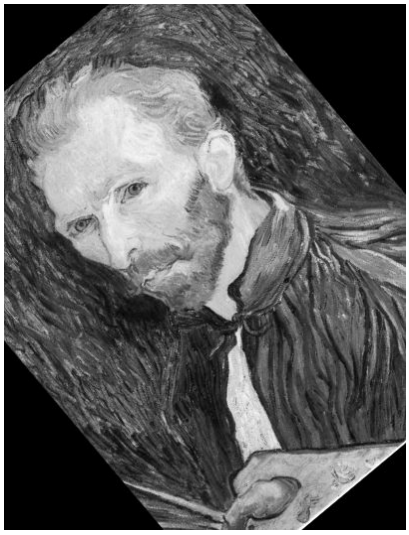
Aliasing is badly seen in this image due low sampling frequency which is less than Nyquist sampling rate. Even though gaussian blur does not fix this image, I think sigma two or 1 gives better looking image than other even though effects of aliasing are not completely removed. Anything higher does not resemble the original image.

3. Can you find an edge in TightRope.png that is visible to the human eye, but does not have a strong
response from the Sobel edge detector?

The small water body which is directly below palm of the guy in image does not give strong response.

4. If you rotate the image 20 times by 2 degrees, does it produce the same result as rotating the image
by 40 degrees? If not, why? Please use ”imrotate” command in Matlab.

Multiple small rotations



one rotation 40 degrees

We see that lines that are supposed to be parallel are no longer parallel when small multiple rotations are made. This is due to loss of image info when it is rotated. The other thing is that when multiple rotations are performed image is getting more blurred than single rotated image. This is because when an image is rotated its new location is continuous value which when computed there might be loss of detail. When done multiple times image will be blurred by considerable amount.

5. If you apply blur before applying FindPeaksImage you can remove many noisy edges. What is the
best amount of blur to apply to Gogh.png to find the cleanest edges? In addition to answering these
questions, please turn in your best peak edge image called GoghEdge.png.

Sigma 2

sigma 4

Sigma 6

By looking at the images we can see that not only sigma 4 reduced noise significantly, it still maintained edges without much distortion.