FILTERS AND FREQUENCIES 3

CSE 152: INTRO TO COMPUTER VISION

October 19, 2018

1 Filters

1. What does it mean for a filter to be shift-invariant?

2. Convolve the image **F** with filter **h**. Assume ones beyond the boundaries.

F

1	0	5	2
0	0	3	5
0	0	5	4
2	2	0	1

h

0	0	0
0	0	0
0	0	1

3. Match the images to the descriptions.

original image

filtered with
`[[1, -1]]` kernel

filtered with
`[[1], [-1]]` kernel

filtered with
Gaussian kernel

4. One application of filtering/convolution is template matching: finding regions in an image that are similar to a given patch. How would you imagine that this is done?

5. Give a 3×3 linear filter that shifts an image one pixel to the right and increases the image brightness by 50%.

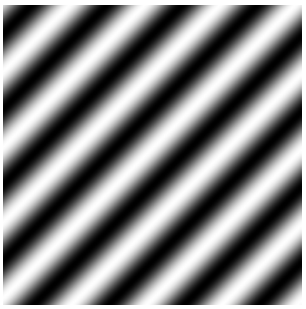
6. How do you obtain an edge image if you're only allowed a blurring filter?

2 Frequencies

1. Say you have a linear filter as a 3×3 convolution kernel. How do you apply your filter in frequency space? Why might it be advantageous to do so?

3 Fourier Domain Visualizations

1. Sketch the corresponding Fourier image for this function. For convenience, when drawing you can pretend that brightnesses are inverted (i.e. draw black as white, and white as black). Assume that the peak-to-peak (white to white) distance is 64 pixels. Label significant points on the Fourier image with their frequencies.



2. These are frequency representations of image filters. What does each filter do?