CIS580 Problem Set 6

Sheil Sarda <sheils@seas.upenn.edu>
CIS580 Spring 2021

Contents

1 Convolution of image with a Gaussian

(a) Original Image   (b) $\sigma = 1$ (c) $\sigma = 0.1$
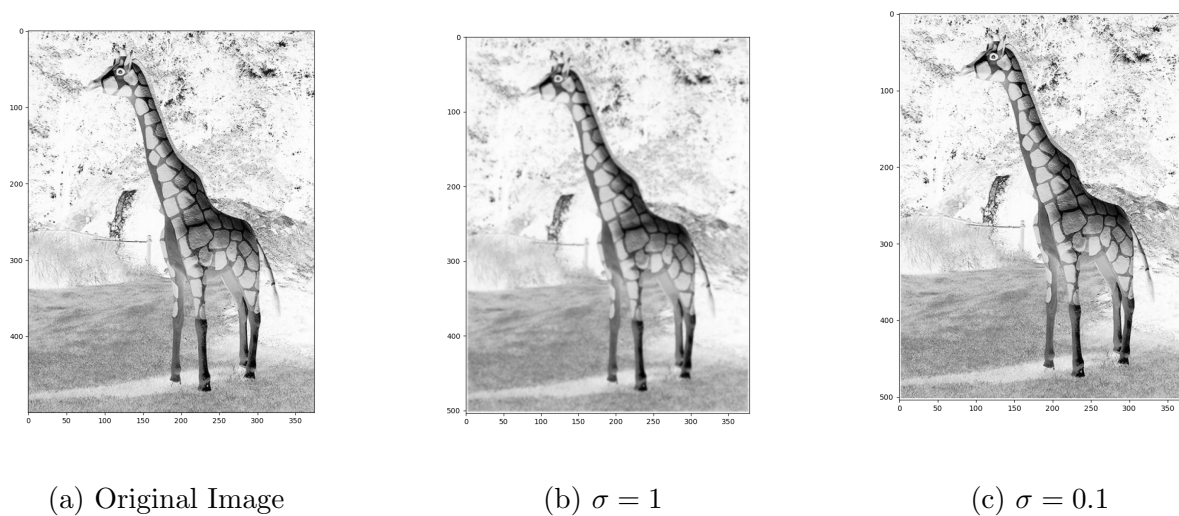
Figure 1: Three simple graphs

The difference between the three images included above is that by increasing σ from $\sigma = 0$ (original image) to 0.1 and 1, we increase the Gaussian blur applied to the image. This blurring reduces the image noise and detail.

2 Convolution of Gaussians
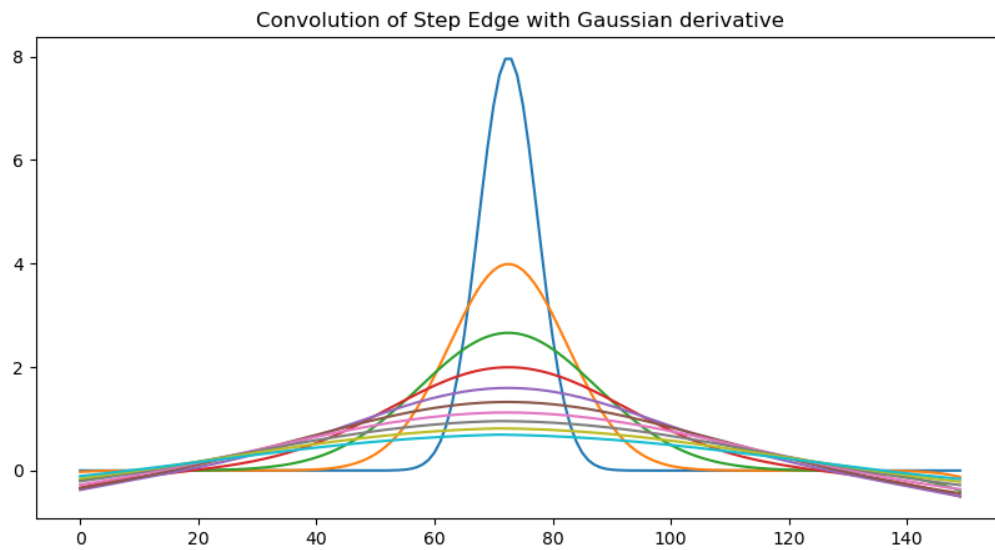
3 Convolution of Step Edge with Gaussian derivative

Figure 2

4 Box Function
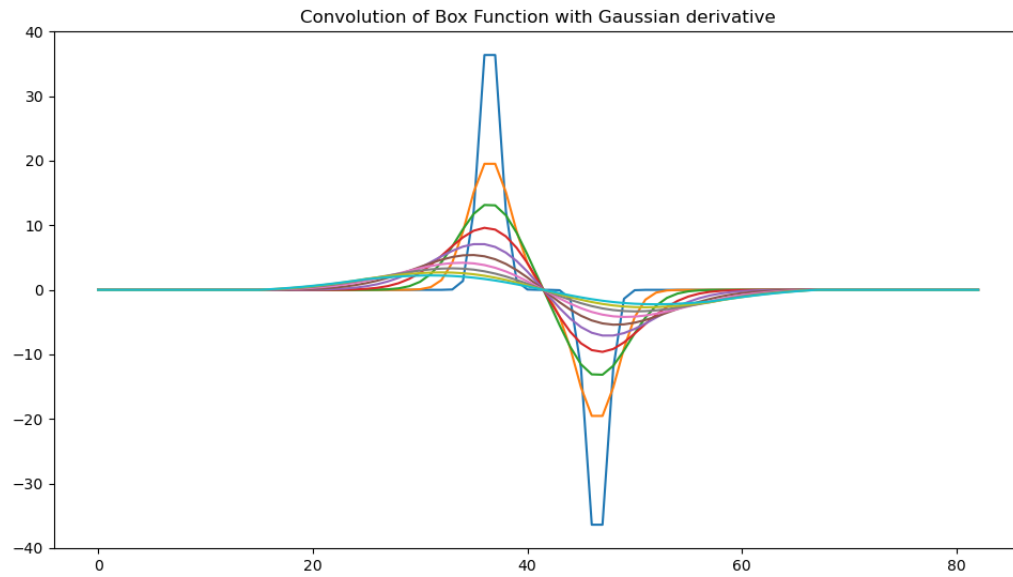

Convolution of Box Function with Gaussian derivative

Figure 3

5 1D FFT Quiz

Figure 4

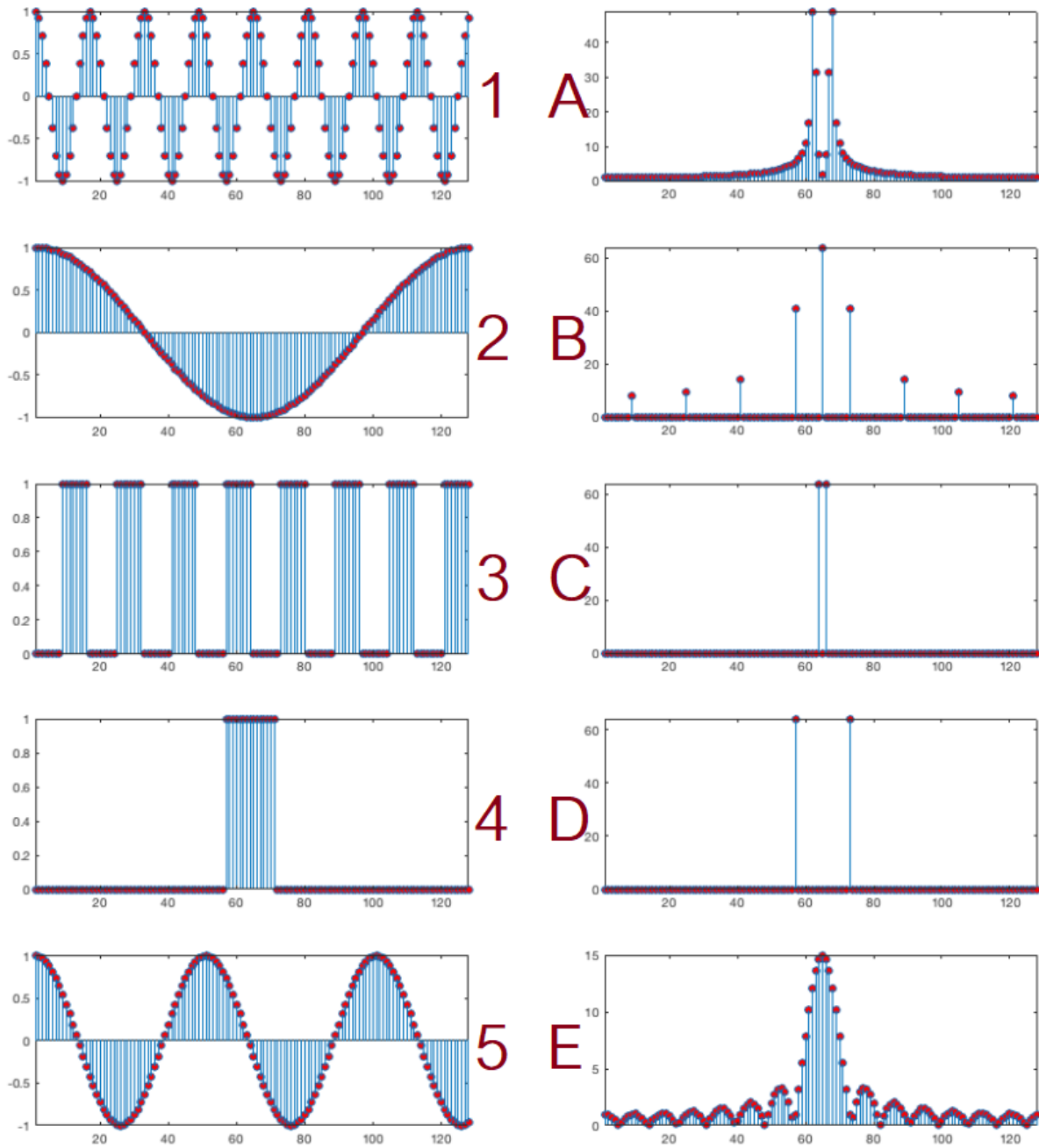| Function	FFT Plot
1	D
2	C
3	B
4	E
5	A

My reasoning for the above matching is that in frequency domain, the distance between the two peaks is proportional to the frequency of the curves.
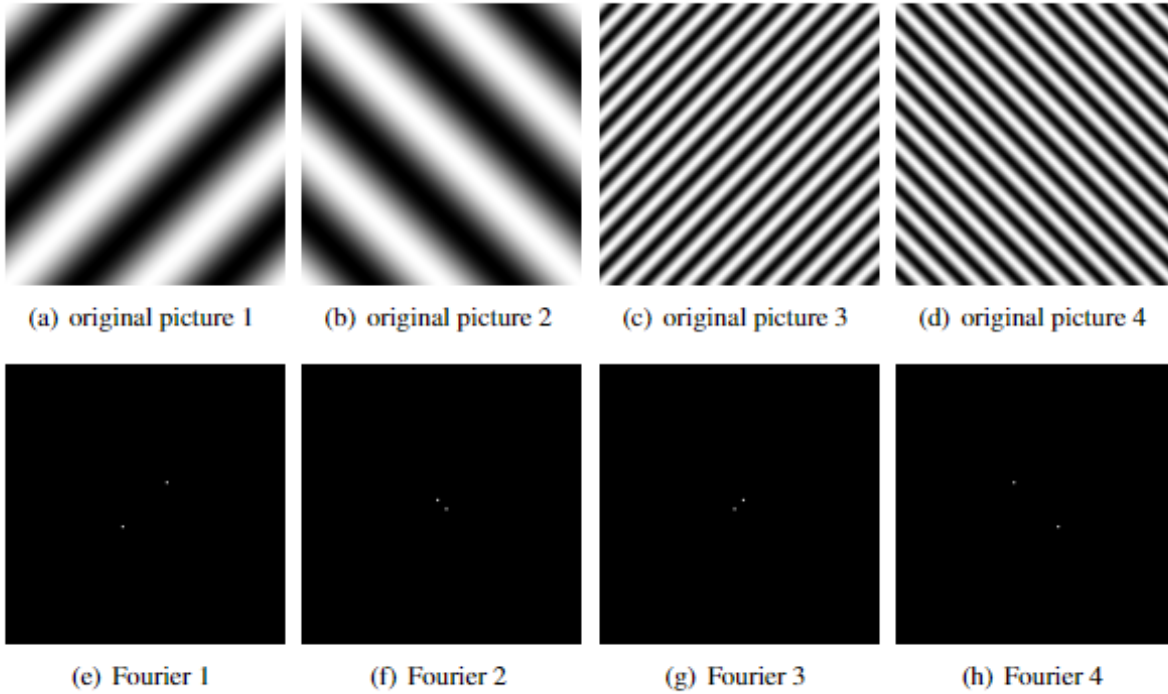
6   2D Fourier Transform

(a) original picture 1   (b) original picture 2   (c) original picture 3   (d) original picture 4

(e) Fourier 1   (f) Fourier 2   (g) Fourier 3   (h) Fourier 4

Figure 5: Functions and corresponding FFTs

Function	FFT Plot
A	F
B	G
C	H
D	E

My reasoning for the above matching is that the separation of the white dots in the frequency domain is proportional to the frequency of the black and white signals. This reasoning is similar to the 1-dimensional case where the distance between the two peaks in the frequency domain was proportional to the frequency of the curves.

7   Filter Design