I would like to request to use the one-time free extension.

No collaborators for any exercises.

Exercise 1:

1. A discrete convolution is given by the following formula:

A number and symbols of mathematical equations

Description automatically generated with medium confidence

Assuming all indexes start from 0, this means for two arrays of length Nf and Nw, as long as n < Nf  + Nw, there will be at least one value in the summation that could be non-zero.

Taking Nf  ≥ Nw, or swapping f and w if the inverse, for n = 0, the k = 0 case could be non-zero. Then as n increases, while n < Nf, the k = 0 case continues to hold potential non-zero values. As soon as n ≥ Nf, subtracting k from n by the minimum amount to make n – k < Nf, will also continue to hold potential non-zero values as long as k < Nw. Logically, this can continue all the way until k = Nw – 1.This means that for two arrays of length Nf and Nw, the resulting discrete convolution array has a maximum possible length of Ng = Nf + Nw – 1 non-zero values.

A computer screen shot of a program code

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A black background with text

Description automatically generated

A graph of a graph

Description automatically generated



A graph with a line

Description automatically generated

A screen shot of a computer code

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For large arrays, the Numpy convolution is clearly faster than my own function. There are many possible explanations for this, but most generally it is likely the built into function of Numpy uses different methods of optimization as opposed to the most simplistic approach I used.

Exercise 2:



A paper with writing on it

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A screen shot of a computer program

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A graph with blue dotted line

Description automatically generatedA graph with blue and orange lines

Description automatically generated

A computer screen with many colorful text

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Exercise 3:



A graph showing a blue line

Description automatically generated

A graph of a gaussian distribution

Description automatically generated



A graph of a graph showing a number of different colored lines

Description automatically generated with medium confidence

The most obvious difference between the 10s and 20s half-duration convolutions is that the 20s half-duration generally has a lower amplitude over the range of values. This makes sense as the 20s half-duration gaussian takes more from values surrounding the data at a specific point in time, while the 10s half-duration gaussian is more influenced by the closest values at a specific point.