L20: class exercises – Try to implement/solve the following problems in MATLAB.

Correlation

Write your own correlation coefficient computation using the equation

$$r = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{n(\sum x^2) - (\sum x)^2}\sqrt{n(\sum y^2) - (\sum y)^2}}.$$

Write a function to compute this correlation coefficient given two inputs x and y.

Test this function with the following:

- Make an x-vector from -10:10
- Compute the function $y(x) = 20x - 5$
- Add random Gaussian noise to this y-vector with an amplitude of 10
- Use **polyfit()** to to estimate the coefficients of the first order polynomial
- Compute the correlation coefficient between x and your noisy y
- Compute the correlation coefficient between x and your predicted y after you estimate the polynomial coefficients

Now that you have an estimate of the polynomial coefficients and have predicted a new y-vector based on these coefficients, we can look at the properties of the noise we added.

- Subtract the estimated y-vector from the noisy y-vector. Call this new vector *yDiff*.
- Plot this new vector.
- Compute the mean of this vector. What is it?
- Compute the standard deviation. What is it?
- Try increasing the number of points in the x-vector and recomputing the above values. What do you notice about the standard deviation and the mean?