EECS 16A Designing Information Devices and Systems I
Spring 2015 Discussion 9F

1. Noise Cancellation Headphones (HW Problem)

2. Auto-Correlation

Auto-correlation is the cross-correlation of a signal with itself. Find the auto-correlation of the following sequences:

(a) $\begin{bmatrix}-1 & 1 & 1 & -1 & 1\end{bmatrix}$

(b) $\begin{bmatrix}1 & -1 & -1 & 1 & -1\end{bmatrix}$

(c) $\begin{bmatrix}0.2 & 0.5 & 0.6 & 0.4 & -0.2\end{bmatrix}$

3. Cross-Correlation

The cross-correlation of two signals $x[n]$ and $y[n]$ is given by the signal $c[n] = \sum_{i=-\infty}^{\infty} x[i]y[i+n]$

(Demo with Python Script)

The following images show the first three steps of the sliding window technique to find the cross correlation between $\begin{bmatrix}1 & 0 & 1 & 1 & 0 & 1\end{bmatrix}$ and $\begin{bmatrix}1 & 1 & 0\end{bmatrix}$

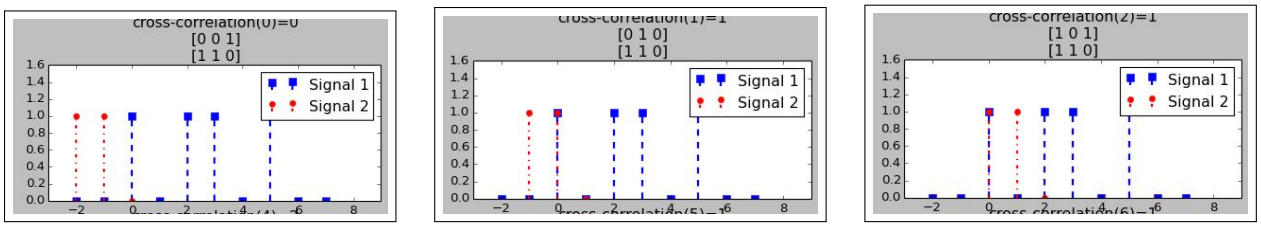

Figure 1: Sliding Window Cross Correlation

Find the cross-correlation between the following signals. When a shorter signal is correlated with a longer signal, the values at each time point are determined by sliding the shorter signal along the longer one.

(a) $\begin{bmatrix}1 & 1 & 0 & 1\end{bmatrix}$ and $\begin{bmatrix}0 & 1 & 0 & 0\end{bmatrix}$

(b) $\begin{bmatrix}1 & 0 & 1 & 1 & 0 & 1 & 1 & 1 & 0\end{bmatrix}$ and $\begin{bmatrix}1 & 0 & 1\end{bmatrix}$

(c) $\begin{bmatrix}0.5 & 0.3 & 2 & 0.5\end{bmatrix}$ and $\begin{bmatrix}0.8 & 0.1 & 5\end{bmatrix}$