

BPHS 4090 (Fall 2013) - Computer Exercise 2: Noise and autocorrelations

Due Date: Sept. 27, 2013 5:00 PM

Questions

According to the wikipedia page for autocorrelation: “The autocorrelation of a continuous-time white noise signal will have a strong peak (represented by a Dirac delta function) at $\tau = 0$ and will be absolutely 0 for all other τ .” Your task will be to clearly demonstrate this numerically.

- a. Using your programming language of choice, generate a noise waveform. You need not make noise from scratch: a built-in routine (e.g., `randn` in Matlab) is sufficient.
- b. Write a routine, from scratch, that computes the autocorrelation of this waveform. Make sure to clearly explain what your code is doing.
- c. Vary things up a bit and choose some particular aspect to explore further. For example, repeat for different noise waveforms. Or a different type of noise (e.g., ‘pink’ noise). Or a different amplitude. Or embed a periodic signal in the noise. Or try to cross-correlate two different noise waveforms. Explain how the autocorrelation does or does not differ for what you choose to explore.
- d. Think (carefully) about some way to creatively and clearly visualize the ‘data’ from the previous part (e.g., a raster plot). Conversely, determine some sort of useful statistic(s) that demonstrates what changed (if anything) and how.
- e. Comment briefly on at least two areas in biology where you think this sort of routine would be useful. Try to be as specific as possible as to what sort of scientific question this would allow you to address. Note that ‘auto’-correlation need not always be done on the same signal per se....