iSpy: Detection of Signals in Noise
(EECE4688)
Spring 2019

Homework 6
(Assigned Mar.13, 2019; due Mar.20, 2019 in class.)

Objective: The objective of this exercise is to experiment with time-of-arrival estimation.

Task: The recording $v(t)$ is known to contain a signal in zero-mean white Gaussian noise. The signal shape $g(t)$ is known (a clip of a sinc pulse). However, its delay (position) within the recording $v(t)$ is not known. In other words, $v(t) = g(t - \tau) + w(t)$, where τ is the unknown delay, and $w(t)$ is noise.

1) Specify the maximum-likelihood (ML) estimate of τ.

2) The Matlab file `hwk6.mat` contains the noisy recording $v(t)$ and the signal $g(t)$. Both are represented by samples taken at $f_s = 50$ Hz. Estimate the delay τ.

Reporting: Your report should be typed, and not exceed two single-sided pages. It should be written in a professional manner. Figures and mathematical expressions should be used whenever meaningful. Figures should always have axes labeled in appropriate units (e.g. time [s], time [ms], frequency [Hz], frequency [kHz], SNR or SNR [dB], etc.). Include any Matlab code as an appendix. Please put your name on top of the report.