

DATA.ML.200 Pattern Recognition and Machine Learning

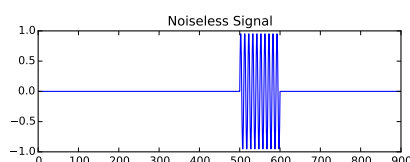
Exercise Set 3: Detection theory

Be prepared for the exercise sessions (watch the demo lecture). You may ask TAs to help if you cannot make your program to work, but don't expect them to show you how to start from the scratch.

1. **python** Implement a sinusoid detector. (10 pts)

In this exercise we generate a noisy sinusoid with known frequency and see how the sinusoid detectors of your homework perform.

- a) Create a vector of zero and sinusoidal components that looks like the plot below. Useful commands: `np.zeros`, `np.concatenate`. Sinusoid is generated by `np.cos(2 * np.pi * 0.1 * n)`.



- b) Create a noisy version of the signal by adding Gaussian noise with variance 0.5: `y_n = y + np.sqrt(0.5) * np.random.randn(y.size)`.
- c) Implement the two detectors from your homework (using convolution) and plot i) the noise free signal $x[n]$, ii) noisy $x[n] + w[n]$ and iii) detector output (see Figure 1).

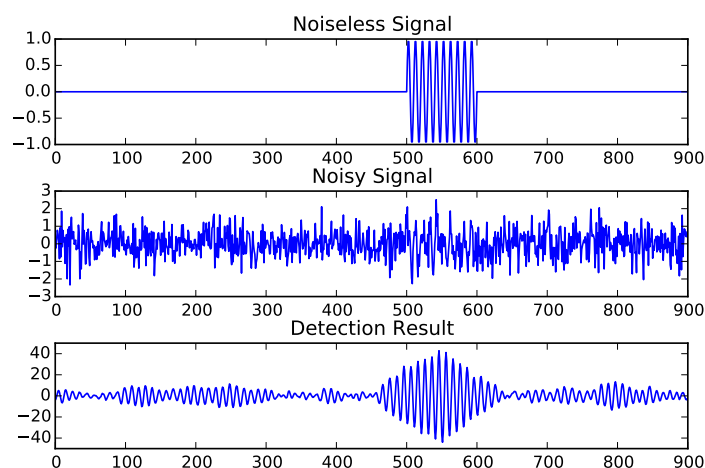


Figure 1: Example of what your code should produce.