

# ECE-497/BME-491: Applied Biomedical Signal Processing

## Laptop Day #7

Due at the end of class, January 16, 2007

Today we have the following goals

- select a template from an EEG signal
- perform template matching to detect spike and wave complexes

At the end of class you should turn in three plots.

1) Go to the class website and download the programs *laptop7.m* and the data files *eeg2-c3.dat*, *eeg2-f3.dat*, and *eeg2-p3.dat*.

2) The first thing we need to do is get a template to use. The program *select\_eeg\_template.m* will help you do this. The only argument to this program is the name of the file you want to use. In our case, this will initially be *eeg2-c3.dat*, so you should type:

```
template = select_eeg_template('eeg2-c3.dat');
```

For this example, you should select your template to be the part of the signal from 600 to 820 milliseconds. Note that the template will actually be a bit longer than this due to the way I wrote the program. The template is the segment of the data we will be analyzing to determine if *spike and wave* complexes are present .

3) The program *laptop7.m* has three input arguments:

- the template to use (analyze). You determined this in part 2.
- the name of the data file to use, in quotes.
- the index the template starts at. Since the data is sampled at 100 Hz, in our example this will be 1, since we want to start at the beginning of the data.

4) Assume the template  $x(n)$  contains  $N$  points, and we are comparing the template with the signal  $y(n)$  starting at index  $k$ . If the template and signal are zero mean, the correlation coefficient  $\rho$  between the template and the signal is given as

$$\rho(k) = \frac{\sum_{i=0}^{i=N-1} x(i)y(k+i)}{\sqrt{\sum_{i=0}^{i=N-1} x(i)^2} \sqrt{\sum_{i=0}^{i=N-1} y(k+i)^2}}$$

Some important properties of the correlation coefficient are:

- $\rho$  is independent of amplitude differences between the template and the signal
- $\rho$  is bounded between 1 and -1

Implement the correlation coefficient in *laptop7.m*

5) If you have done everything correctly, you should get a plot like the first three graphs shown in Figure 1.

6) Utilize files *eeg2-f3.dat* and *eeg2-p3.dat* to compute the correlation coefficient between the template and the signals to look for *spike and wave complexes*.

*Turn in your plots and your code.*

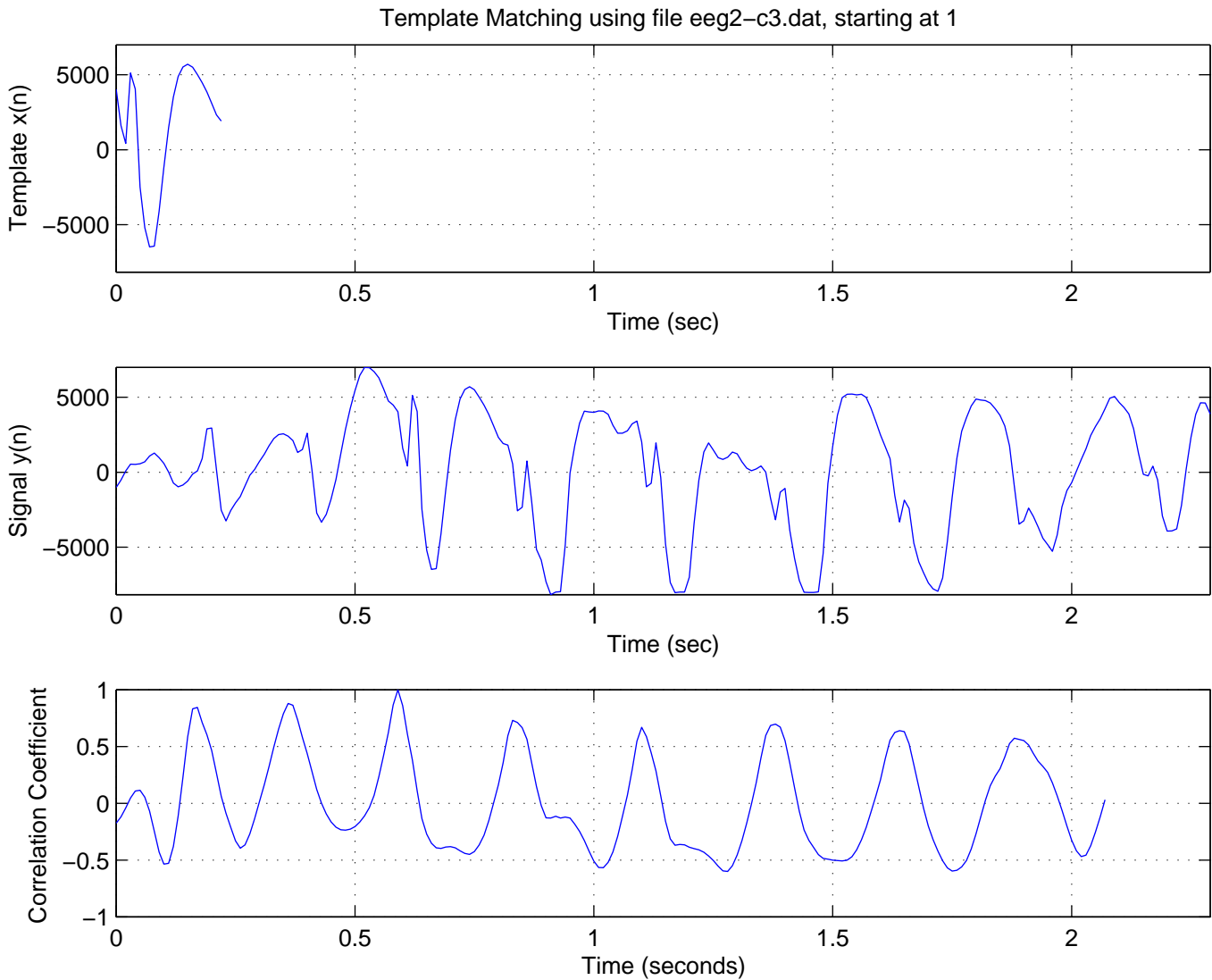


Figure 1: Template constructed from c3 channel, the c3 signal (same as the template was constructed from), and the correlation coefficient between the template and the signal.