# Evoked potentials

## Simulation

1. Simulate a signal model to understand the need for ensemble averaging of neural data in an evoked potential based study
2. Use sampling rate of 1000 Hz, 200+ trials of a known signal superimposed with random (white) noise of specified amplitude
3. Use ensemble averaging to obtain the evoked potential
4. Were you able to retrieve the original signal?
5. How does the number of epochs affect the quality of the retrieved signal?
6. Increase the noise amplitude and redo 3-5 and answer the questions.
7. Jitter the signals in each epoch by a known time (randomly sampled between -3 to 3 ms) and show how latency jitter alters the ensemble averaged evoked potential.

**Optional**

- Implement a latency-jitter correction algorithm and implement on the simulated signal to reliably retrieve the signal

## Real EP data

1. Use epData.txt for this exercise
2. Sampling frequency = 3200 Hz; First stimulus at 0 ms and inter-stimulus interval is 160 ms
3. Epoch the data and plot them and comment
    a. Is any pattern visible on a line plot?
    b. How about an image plot of the M*N matrix? Is any pattern visible now?
    c. Plot the ensemble average on top of the individual epoch and look for possible similarities in the raw traces of epochs.
4. How does the quality of the ensemble average vary with the number of epochs?
5. Now plot the probability density functions of the original signal epochs, noise epochs, combined epochs (signal+noise) and the ensemble averaged signals. What is the pattern you see?

**Optional**

- Calculate the SNR of the ensemble average and plot it against the number of epochs used

Data credits: IMT-LiU