**Practical exercise 2: Motor Unit Territory**

On StudOn, you will find the file ‘Exercise2’. This file contains a signal that has been already decomposed in its motor units. To load the file in matlab, type load(‘filename.mat’)). You will use the variables: **SIG** (EMG data), **MUPulses** (motor unit firings), **fsamp** (sampling frequency) and **IED** (interelectrode distance in mm).

1. Spike triggered averaging is a useful event detection tool that is often used in neural signal processing. The aim is to investigate the temporal relation between a spike train and a continuous signal (EMG in this case) in order to reveal the response in electrophysiological activity preceding a spike. To compute the STA,
   1. For each spike round to the nearest integer a time window that is centred at the spike and holds values from (-X to: +X) with X being 15 and 30 milliseconds.
   2. Compute this average for all set of electrodes (EMG channels) and plot the motor unit action potential waveforms.
2. To obtain the motor unit location, first, it is necessary to identify where (spatially) the motor unit activity is focused. For that:
   1. Compute the RMS value of each motor unit action potential (for each motor unit). Plot the results as a spatial map (heat map – 2D). Consider the interelectrode distance (IED) in the map.
   2. Calculate the barycenter (centroid) of each spatial map obtained in exercise 1, plot its coordinates.
3. To evaluate the spatial territory of the motor units (how are far or close they are located from each other), we use a metric called Standard Distance (the 2D analogous of the standard deviation):
   1. Calculate the standard distance of the set of motor units. Plot the centroid coordinates, mean center (, ) and the standard distance in the same plot.
   2. (optional) Suggest other solutions.