Guide: <http://www.mathworks.com/academia/student_center/tutorials/signal-processing-tutorial-launchpad.html?s_tid=ac_sp_tut_til>

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| --- | --- |
| Session | Topic |
| 1 | Simple summary statistics |
| 2 | Print outs |
| 3 | Flow control |
|  | smoothing |
|  | Peak detection |
|  |  |
|  |  |
|  | QRS statistics |

Ideas:

1. Load EEG single channel
2. Plot it: <https://www.mathworks.com/help/signal/examples/signal-generation-and-visualization.html?prodcode=SG&language=en>
3. Signal smoothing: <https://www.mathworks.com/help/signal/examples/signal-smoothing.html?prodcode=SG&language=en>
4. Filtering
   1. IIR: <https://www.mathworks.com/help/signal/ug/iir-filter-design.html>
   2. Digital: <https://www.mathworks.com/help/signal/examples/practical-introduction-to-digital-filtering.html?prodcode=SG&language=en>
   3. Make notch filter
5. Spectral analysis
   1. Power spectrum: <https://www.mathworks.com/help/signal/examples/practical-introduction-to-frequency-domain-analysis.html?prodcode=SG&language=en>
   2. <https://www.mathworks.com/help/signal/examples/measuring-the-power-of-deterministic-periodic-signals.html?prodcode=SG&language=en>
   3. Spectrogram: <https://www.mathworks.com/help/signal/examples/practical-introduction-to-time-frequency-analysis.html?prodcode=SG&language=en>
   4. <https://www.mathworks.com/help/signal/examples/spectral-analysis-of-nonuniformly-sampled-signals.html?prodcode=SG&language=en>
6. Peak analysis: <https://www.mathworks.com/help/signal/examples/peak-analysis.html?prodcode=SG&language=en>
7. Signal statistics: <https://www.mathworks.com/help/signal/descriptive-statistics.html>
8. Pulse/transition characteristics: <https://www.mathworks.com/help/signal/examples/measurement-of-pulse-and-transition-characteristics.html?prodcode=SG&language=en>
9. Linear Prediction and Autoregressive Modeling: <https://www.mathworks.com/help/signal/examples/linear-prediction-and-autoregressive-modeling.html?prodcode=SG&language=en>
10. Wavelets:
    1. <https://www.mathworks.com/examples/wavelet/mw/wavelet-ex38647771-visualizing-wavelets-wavelet-packets-and-wavelet-filters>
    2. <https://www.mathworks.com/examples/wavelet/mw/wavelet-ex77408607-r-wave-detection-in-the-ecg>
    3. <https://www.mathworks.com/examples/wavelet/mw/wavelet-ex11554099-continuous-wavelet-analysis>
11. QRS detection:
    1. What is QSR? Can we detect it? How to define the detection?
    2. Rising
    3. Falling
    4. Humps (positive, negative)
    5. <http://www.mathworks.com/help/dsp/examples/real-time-ecg-qrs-detection.html>
    6. <https://www.mathworks.com/matlabcentral/fileexchange/45840-complete-pan-tompkins-implementation-ecg-qrs-detector>
    7. [RR Intervals, Heart Rate, and HRV Howto](https://physionet.org/tutorials/hrv/). A brief overview of how to obtain inter-beat (RR) interval and heart rate time series, and of some basic methods for characterizing heart rate variability, using freely available PhysioToolkit software.
    8. [Heart Rate Variability Analysis with the HRV Toolkit: Basic Time and Frequency Domain Measures](https://physionet.org/tutorials/hrv-toolkit/). This tutorial describes how to use the HRV toolkit (available here) to select and prepare time series of inter-beat intervals and to calculate measurements of the basic time- and frequency-domain HRV statistics that are widely used in the literature. Particular attention is given to techniques for identifying and dealing with outliers, in order to permit reliable determination of measurements.
    9. [Morphology Representation Using Principal Components](https://physionet.org/tutorials/pr-comp/). Using the QRS complex of the ECG as an example, this tutorial presents practical methods for principal component analysis of waveforms, including software that can be used as is or customized as desired.
    10. [Evaluating ECG Analyzers](https://physionet.org/physiotools/wag/eval.htm). How to use PhysioToolkit software and data available from PhysioBank and other sources to measure the performance of a QRS detector or classifier, in accordance with protocols prescribed by current ANSI standards and the US FDA (ANSI/AAMI EC38 and EC57).