

BME3161 Biosignal Processing

Homework 1

Find or devise an algorithm for QRS detection. An example algorithm is given in [1]. ECG data is given in data.mat (data is taken from <https://physionet.org/content/apnea-ecg/1.0.0/>). This file contains raw ECG data (ecg_data) and the sampling rate (fs). Run your algorithm for ECG data given in data.mat. Additionally, add artificial noise to the data and check the robustness of your algorithm to noise. You will hand in a report and all files related to your code (functions, m-file, data etc.).

Report should include;

- 1) Flowchart and detailed explanation for your algorithm
- 2) If you are using a reference in your algorithm, make sure to cite your sources
- 3) Results of your algorithm with real ECG
- 4) Results of your algorithm with noisy ECG
- 5) Discuss the effectiveness of your algorithm according to steps 3,4

All MATLAB files (main script, used functions, data etc.) should be in a single folder (named **StudentID**). Your main script should be named main.m. When grading your work, main.m file will be checked. **If main.m file cannot be run, you will get a score of zero.** m-file should give the following outputs when run;

- 1) Plot the first 10s of raw ECG data
- 2) Plot heartrate (in bpm) as a function of time
- 3) Number of QRS complexes between 45min and 50min (print on command window)
- 4) Plot the results of each step in your algorithm using subplots.

- 5) Add random noise (between -0.5 and 0.5) to the original data and repeat steps 1-4

You should program each step of your algorithm yourself and not use predefined functions (such as findpeaks() etc).

Hints:

- 1) To load the data into MATLAB, you can use;

load data.mat
- 2) If the length of the signal is too large for your computer you can shorten the data to first 1 hour.
- 3) You can use rand() function to generate noise

Upload your homeworks to <https://forms.gle/B3vPm5PBpcf4wmev5>

Make sure to upload the final version of your homework. You won't be able to change your submission after uploading.

[1] J. Pan and W. Tompkins, A Real-Time QRS Detection Algorithm, IEEE Transactions on Biomedical Engineering, 32(3): 230-236, March 1985