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1 %-----
2 % Tony Hyun Kim
3 % 6.555: Lab 1
4 % This script will run an "oscilloscope trace" with colors
5 % that indicate arrhythmia detection:
6 %     -- Blue: normal
7 %     -- Red: arrhythmia detected
8 % It looks really neat (especially with 'n_424'); try it!
9 %-----
10 clear all; close all;
11
12 % Select data:
13 source = 'n_424';
14 load(source);
15 data = eval(source);
16
17 % No need to touch anything below
18 %-----
19 sourceTxt = strep(source, '_', '\_');
20 fs = 250; % Sampling rate [Hz]
21 Ts = 1/fs; % Sampling period [s]
22
23 Ndata = length(data);
24 t = Ts*(0:(Ndata-1));
25 data = 10.24/2048*data; % Convert to [mV]
26 data = [t data];
27
28 % Prefilter
29 % 1. Remove baseline wander
30 N = 256;
31 fc = 3;
32 Tdelay = N/2*Ts;
33 h = fir1(N,fc/(fs/2),'high');
34 dataf = filter(h,1,data(:,2));
35 % 2. Normalize signal
36 Et = Ts*sum(dataf.^2);
37 dataf = dataf/Et;
38 data = [t-Tdelay dataf];
39 yrange = 1.1*[min(dataf) max(dataf)];
40
41 % Define segment length
42 Tseg = 10; % [s]
43 Ns = fs*Tseg;
44
45 Nsubdivide = 10; % This factor makes the scanning more smooth
46 Tpause = 0.025; % Framerate
47
48 Nwindow = 1024; % Define filter window
49 Nfft = Nwindow;
50
51 Pthresh = 0.25; % Arrhythmia threshold
52
53 fSize = 16; % Prepare plots
54 subplot(211);
55 set(gca,'FontSize',fSize);
56 subplot(212);
57 set(gca,'FontSize',fSize);
58
59 % Analyze segments
60 for i = 1:Ns/Nsubdivide:(Ndata-Ns)
61     % Define segment indices

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62     iStart = i;
63     iEnd   = iStart+Ns;
64     iRange = iStart:iEnd;
65
66     % Grab data
67     seg = data(iRange,:);
68     [P f] = pwelch(seg(:,2),Nwindow,[],Nfft,fs);
69     P = abs(P); % Show linear scale
70     Pt = sum(P);
71     P = P/Pt; % PSD normalization
72
73     % Arrhythmia detection
74     Pm = max(P);
75     color = 'b';
76     if(Pm > Pthresh)
77         aMsg = sprintf('%s: Arrhythmia detected in t=[%.1f %.1f]!',...
78                       source,Ts*iStart,Ts*iEnd);
79         disp(aMsg);
80         color = 'r';
81 %         break; % This will end the analysis if arrhythmia is detected
82     end
83
84     % Time domain
85     subplot(211);
86     plot(seg(:,1),seg(:,2),color);
87     xlim([seg(1,1) seg(Ns,1)]);
88     ylim(yrange);
89     xlabel('Time (s)'); ylabel('Amplitude (a.u.)');
90     title(sourceTxt);
91     grid on;
92
93     % Frequency domain
94     subplot(212);
95     plot(f,P,color);
96     xlim([0 fs/2]);
97     ylim([0 0.5]);
98     xlabel('Frequency (Hz)'); ylabel('PSD (a.u.)');
99     grid on;
100    drawnow;
101    pause(Tpause);
102 end
103

```