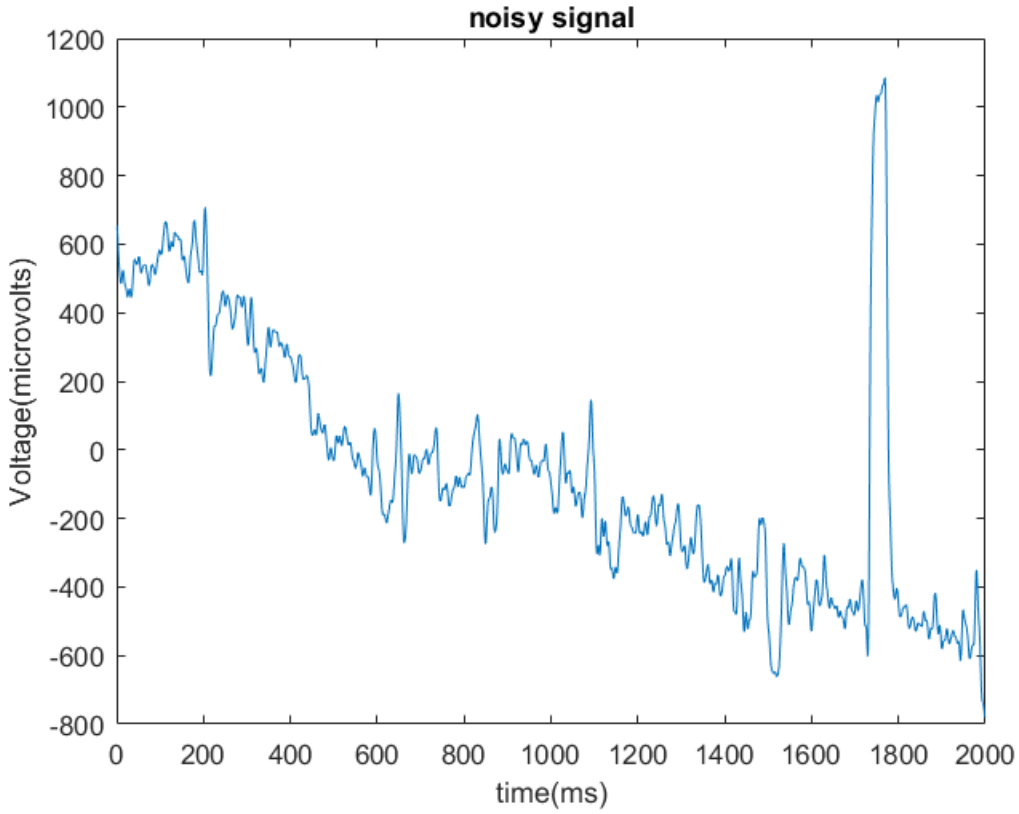
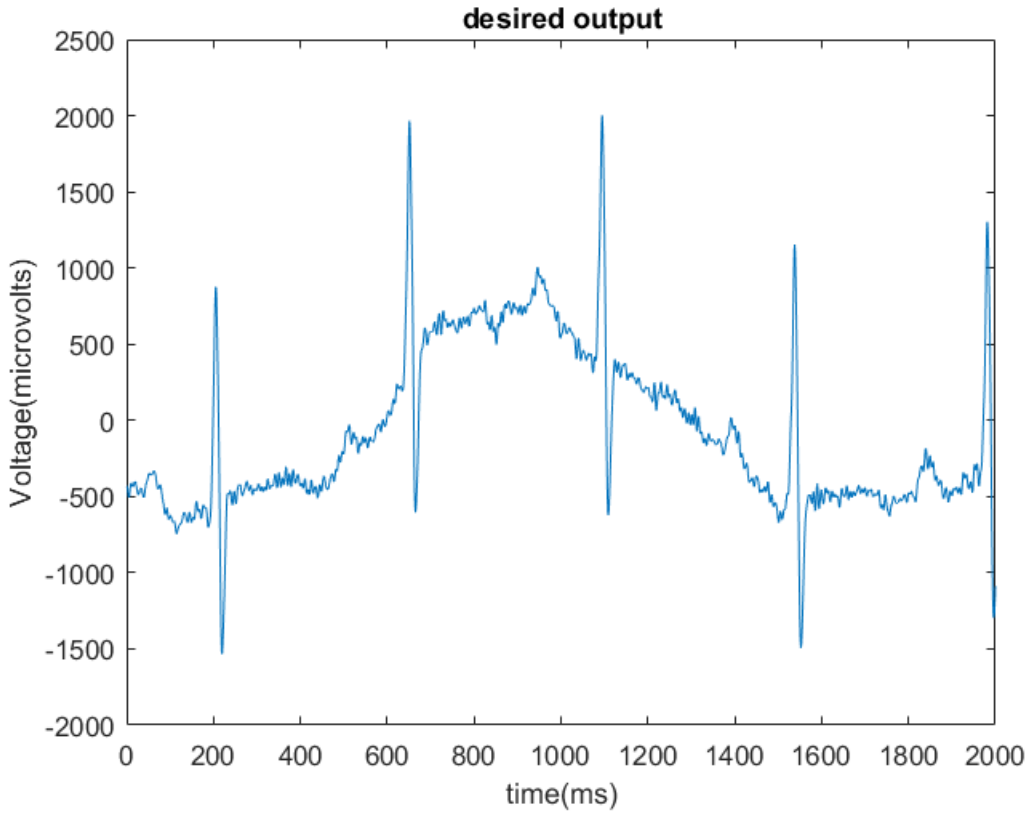
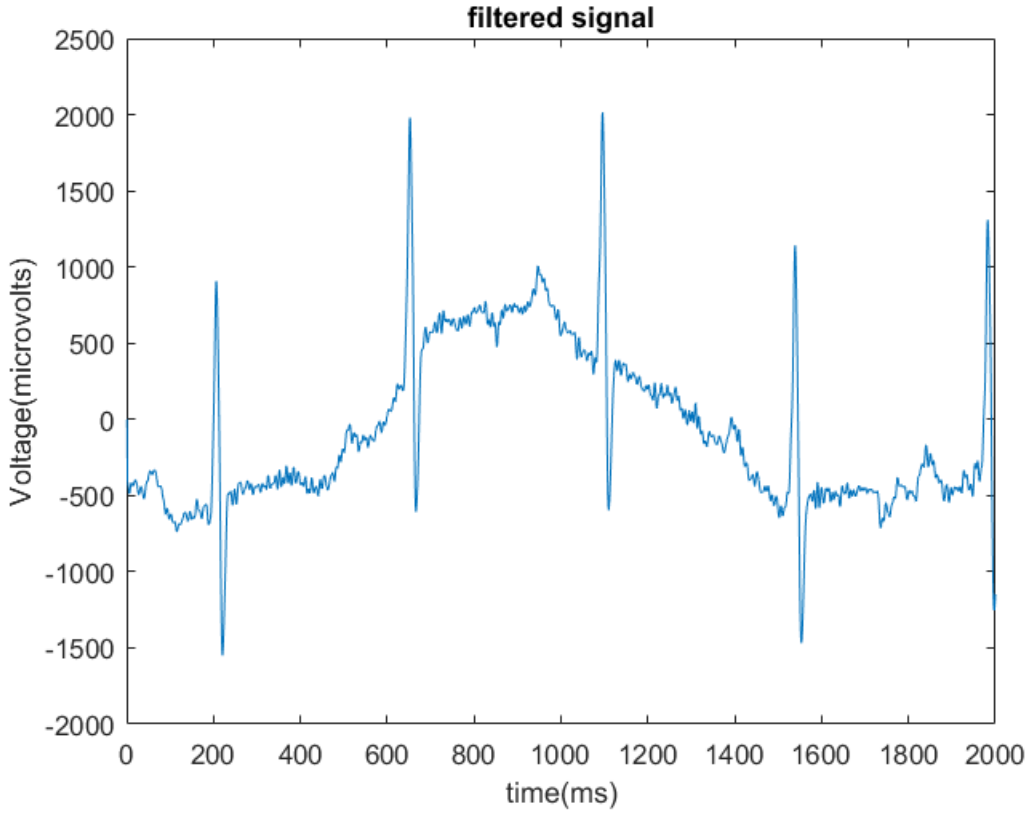
```
clear

close all

A = load('r08_edfm.mat');
B = load('r08_edfm.mat');
d = A.val(1,:);
d_T = d';
input_channel = 3;  % this is where you change the input channel
noisy_sig = B.val(input_channel,:);
noisy_sig_T = noisy_sig';

Fs = 1000;
Ts = 1/Fs;
order = 4000;       %this is where you can adjust the order
mu = 0.99;            %this is where you can adjust mu (0.4 < mu <
 0.99)

lms = dsp.LMSFilter(order + 1, 'StepSize', mu, 'Method', 'Normalized
 LMS', 'WeightsOutputPort', true);
[mu_max, mu_min] = maxstep(lms, noisy_sig)
[y,e,w] = step(lms, noisy_sig_T, d_T);

figure(1)
plot(noisy_sig(1:2000))
title('noisy signal')
xlabel('time(ms)')
ylabel('Voltage(microvolts)')

figure(2)
plot(d(1:2000))
title('desired output')
xlabel('time(ms)')
ylabel('Voltage(microvolts)')

figure(3)
plot(y(1:2000))
title('filtered signal')
xlabel('time(ms)')
ylabel('Voltage(microvolts)')

figure(4)
plot(e(1:2000))
title('error')
xlabel('time(ms)')
ylabel('Voltage(microvolts)')

[qrs_amp_raw , qrs_i_raw , delay] = pan_tompkin(y,Fs,1);
[qrs_amp_raw2 , qrs_i_raw2 , delay2] = pan_tompkin(d,Fs,1);

total_loc = 0;
for i = 2:length(qrs_i_raw)
```

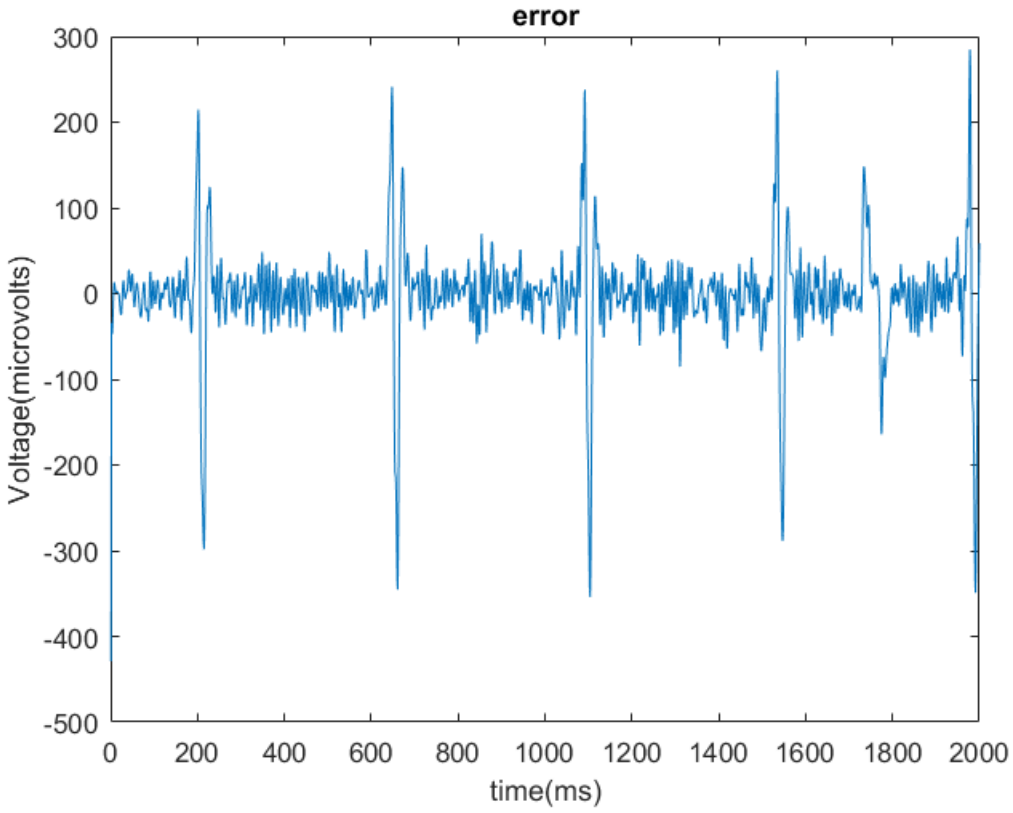
```
    range = abs(qrs_i_raw(1,i) - qrs_i_raw(1,i-1));
    total_loc = total_loc + range;
end

total_loc2 = 0;
for i = 2:length(qrs_i_raw2)
    range2 = abs(qrs_i_raw2(1,i) - qrs_i_raw2(1,i-1));
    total_loc2 = total_loc2 + range2;
end

mean_loc = total_loc/(length(qrs_i_raw) - 1);
mean_loc2 = total_loc2/(length(qrs_i_raw2) - 1);
bpm_abdomen = (60*1000)/mean_loc
bpm_direct = (60*1000)/mean_loc2
```

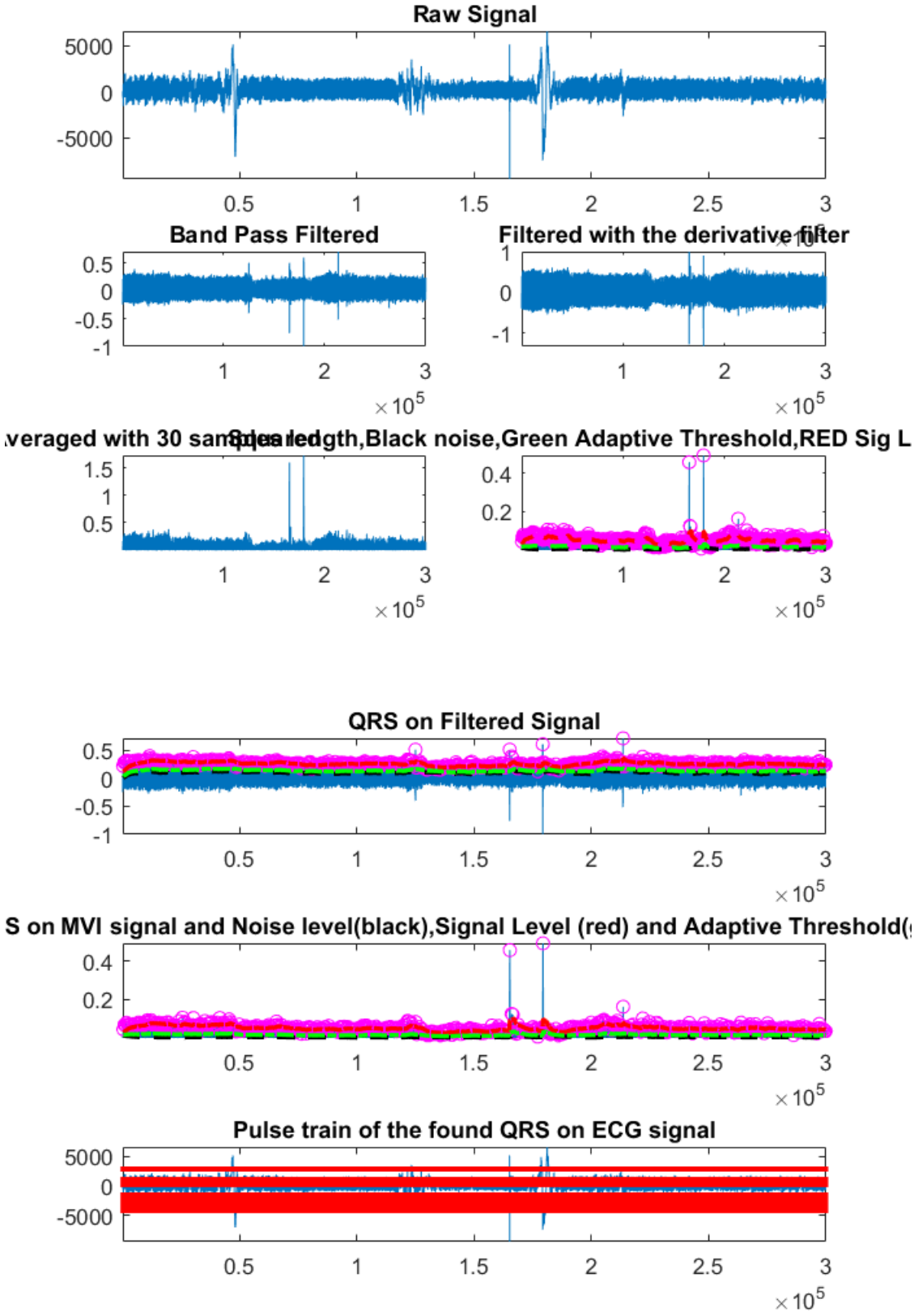
```
mu_max =

     2


mu_min =

     2


bpm_abdomen =

  129.5170


bpm_direct =

  130.1175
```

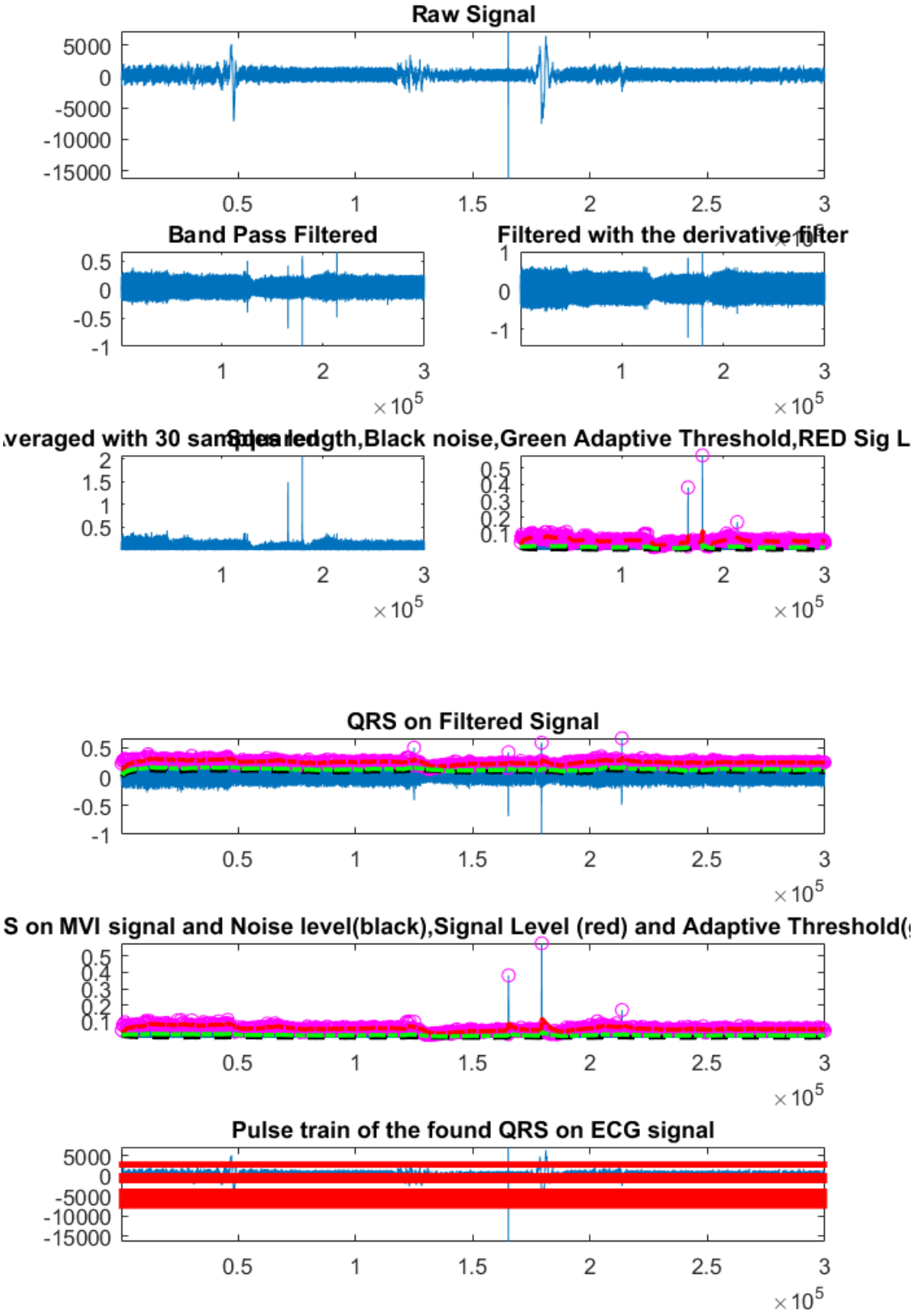

noisy signal
Voltage(microvolts)
time(ms)
1200
1000
800
600
400
200
0
-200
-400
-600
-800
0
200
400
600
800
1000
1200
1400
1600
1800
2000


desired output
Voltage(microvolts)
time(ms)
2500
2000
1500
1000
500
0
-500
-1000
-1500
-2000
0
200
400
600
800
1000
1200
1400
1600
1800
2000


filtered signal
Voltage(microvolts)
time(ms)
2500
2000
1500
1000
500
0
-500
-1000
-1500
-2000
0
200
400
600
800
1000
1200
1400
1600
1800
2000


error
Voltage(microvolts)
time(ms)
300
200
100
0
-100
-200
-300
-400
-500
0
200
400
600
800
1000
1200
1400
1600
1800
2000


Raw Signal
Band Pass Filtered
Filtered with the derivative filter
veraged with 30 samples length,Black noise,Green Adaptive Threshold,RED Sig L
QRS on Filtered Signal
S on MVI signal and Noise level(black),Signal Level (red) and Adaptive Threshold(
Pulse train of the found QRS on ECG signal


Raw Signal
Band Pass Filtered
Filtered with the derivative filter
veraged with 30 samples length,Black noise,Green Adaptive Threshold,RED Sig L
QRS on Filtered Signal
S on MVI signal and Noise level(black),Signal Level (red) and Adaptive Threshold(
Pulse train of the found QRS on ECG signal

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