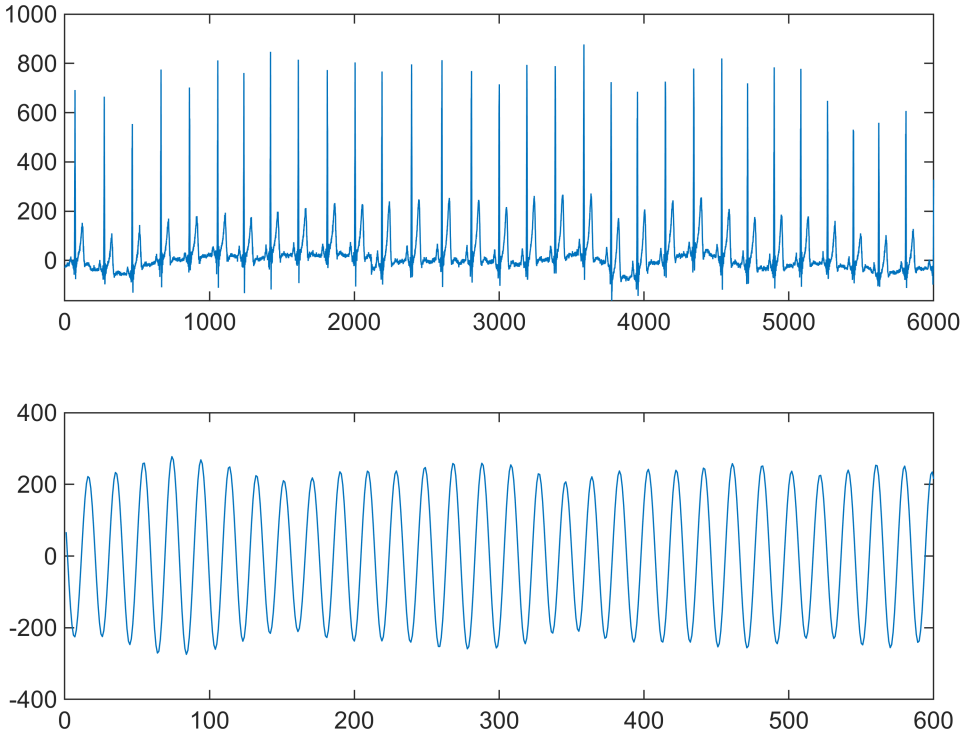
```
clc;clear;close all;
```

```
% a)
data = readtable('data.csv');
ECG = table2array(data(:,1));
PPG = table2array(data(:,2));
PPG = PPG(1:600);
subplot(2,1,1)
plot(ECG)
subplot(2,1,2)
plot(PPG)
```




```
% b)
fs_ecg = 200;
fs_ppg = 20;
window_size = 2;
step_size = 1;
window_ecg = window_size * fs_ecg;
step_ecg = step_size * fs_ecg;
window_ppg = window_size * fs_ppg;
step_ppg = step_size * fs_ppg;
hr_ecg = [];
hr_ppg = [];
```

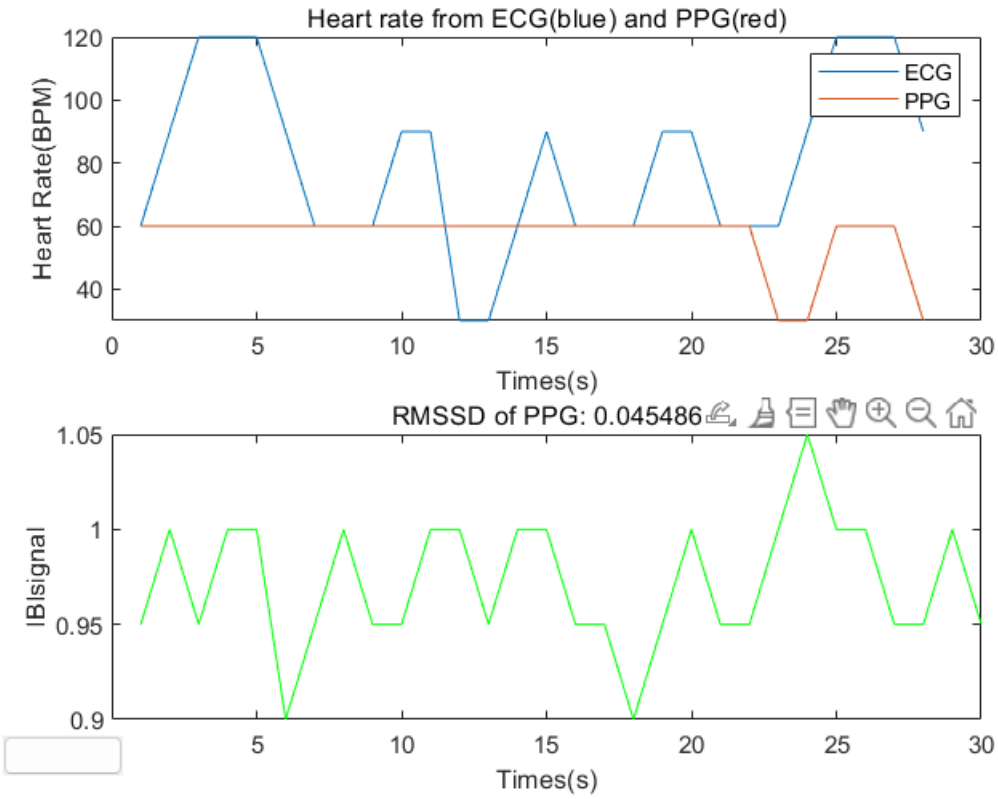
```
% 滑动窗口计算心率
for i = 1:step_ecg:length(ECG) - window_ecg
    % ECG
    ecg_window = ECG(i:i+window_ecg-1);
    peaks_ecg = findpeaks(ecg_window,"MinPeakHeight",0.5*max(ECG));
    num_peaks_ecg = length(peaks_ecg);
    hr_ecg = [hr_ecg, (num_peaks_ecg / window_size) * 60];
end
for i = 1:step_ppg:length(PPG) - window_ppg
    % ECG
    ppg_window = PPG(i:i+window_ppg-1);
    peaks_ppg = findpeaks(ppg_window,"MinPeakHeight",0.5*max(PPG));
    num_peaks_ppg = length(peaks_ppg);
    hr_ppg = [hr_ppg, (num_peaks_ppg / window_size) * 60];
end
```

```
% c)
% 计算 MAE
mae = mean(abs(hr_ecg - hr_ppg));
fprintf('平均绝对误差 (MAE) 为: %.2f\n', mae);
```

```
平均绝对误差 (MAE) 为: 27.86
```

```
% d)
[peaks_ppg, locs_ppg] = findpeaks(PPG); % 阈值可调整
ibi = diff(locs_ppg) / fs_ppg;
% 计算 RMSSD
rmssd = sqrt(mean(diff(ibi).^2));
```

```
% e)
figure
subplot(2,1,1)
plot(hr_ecg)
hold on
plot(hr_ppg)
hold on
title('Heart rate from ECG(blue) and PPG(red)');
xlabel('Times(s)');
ylabel('Heart Rate(BPM)');
legend('ECG','PPG');uicontrol
subplot(2,1,2)
plot(ibi,'g-')
title(sprintf('RMSSD of PPG: %f',rmssd));
xlabel('Times(s)');
ylabel('IBIsignal');
```


Heart rate from ECG(blue) and PPG(red)
Heart Rate(BPM)
120
100
80
60
40
0
5
10
15
20
25
30
Times(s)
ECG
PPG
RMSSD of PPG: 0.045486
IBIsignal
1.05
1
0.95
0.9
5
10
15
20
25
30
Times(s)