Matlab Profiler

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Code Performance Analysis (Profiling)

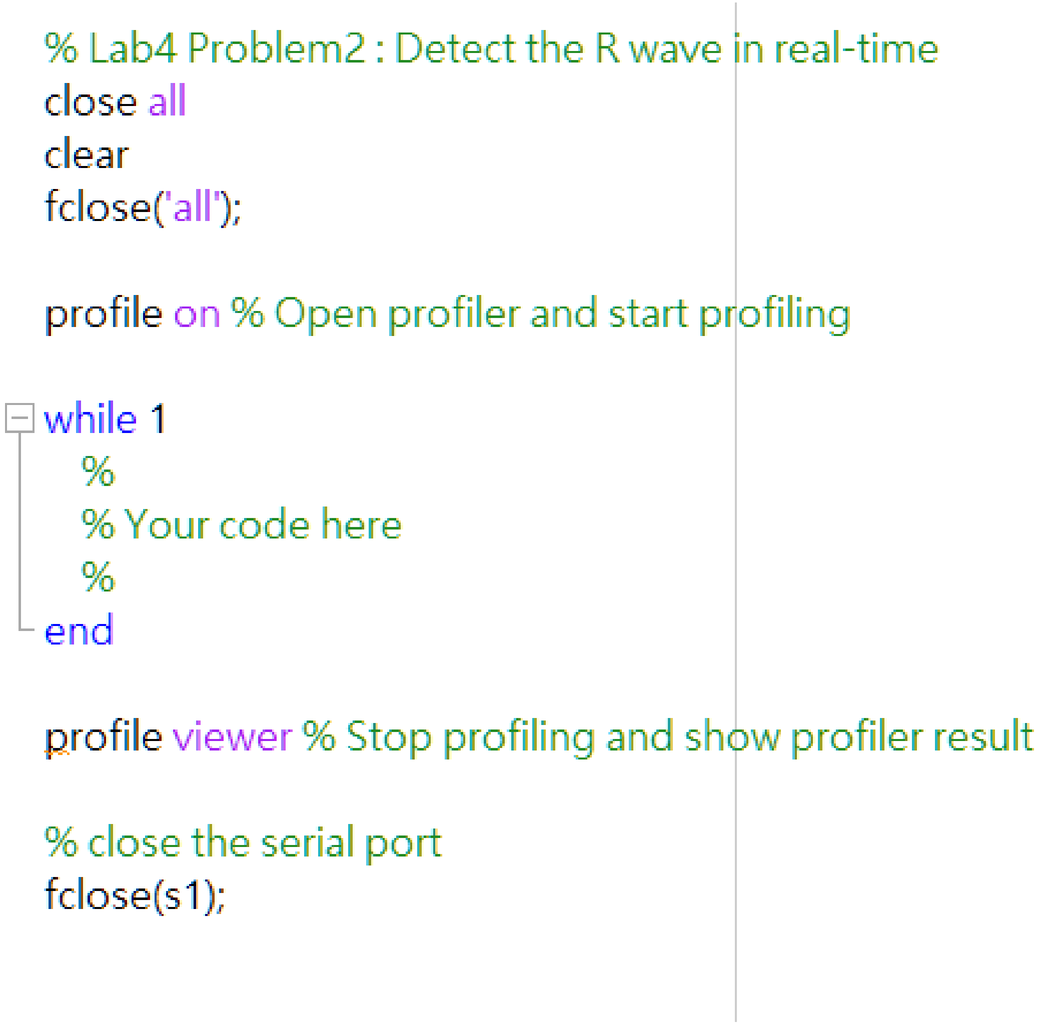
- The tool used to analyze code performance : Profiler

  1. Function execution time
  2. Function Execution calls （呼叫了幾次）
  3. CPU usage
  4. Memory usage
  5. Etc …

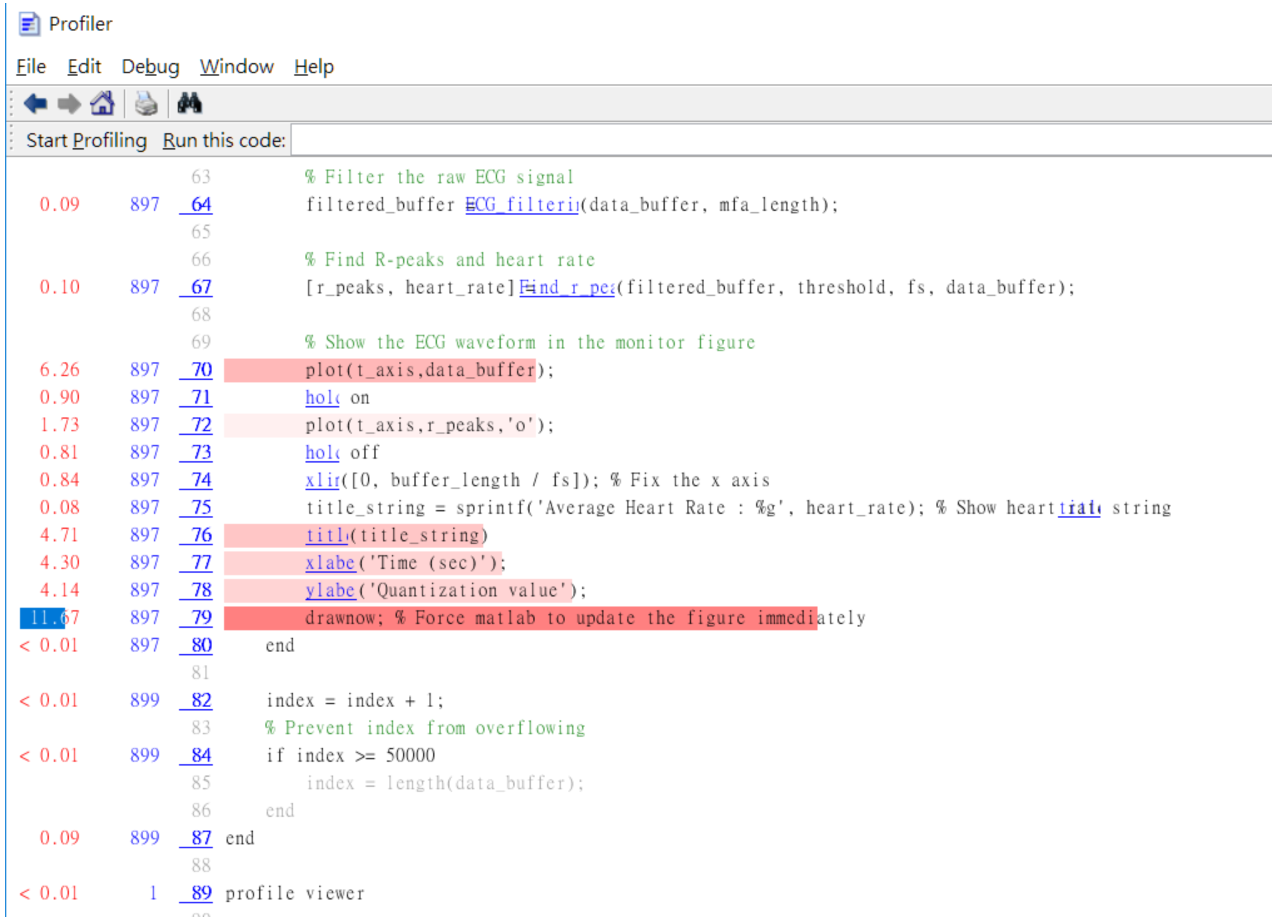
- Many IDEs have built-in profiler.

- Matlab also has its own profiling tool.

Usage

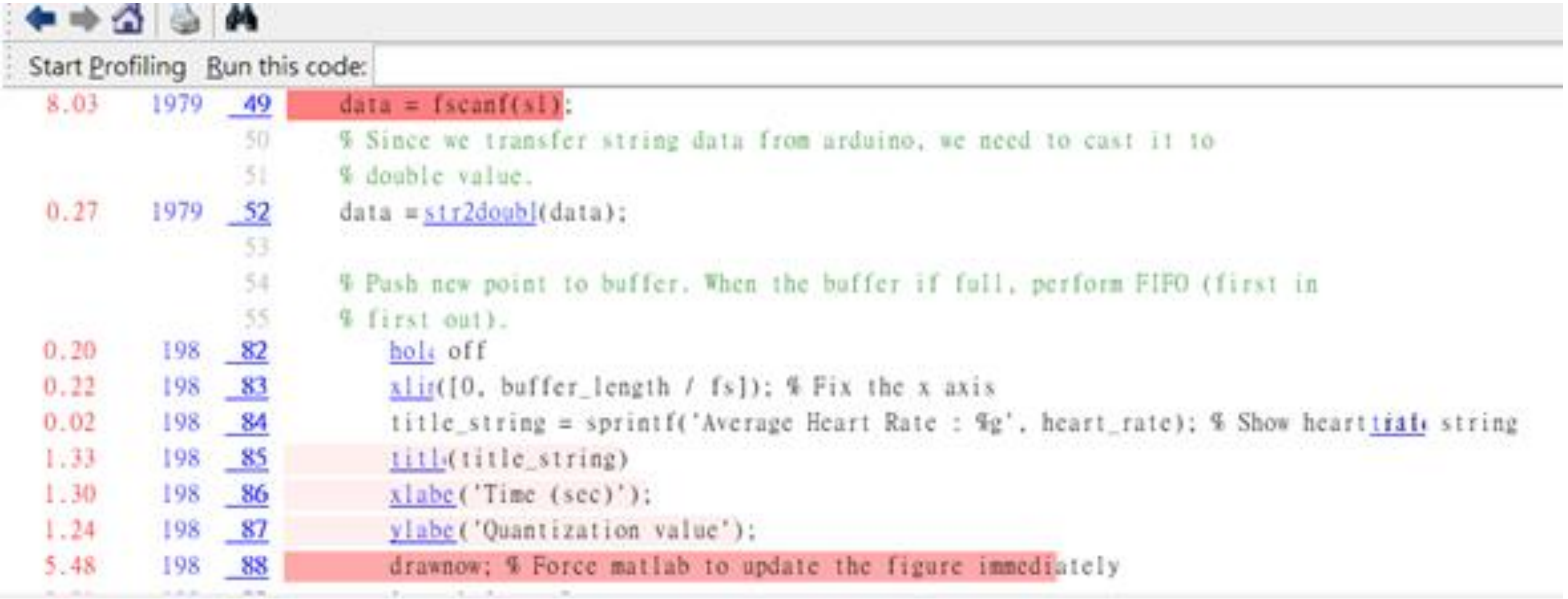


```
% Lab4 Problem2 : Detect the R wave in real-time
close all
clear
fclose('all');

profile on % Open profiler and start profiling

while 1
    %
    % Your code here
    %
end

profile viewer % Stop profiling and show profiler result

% close the serial port
fclose(s1);
```



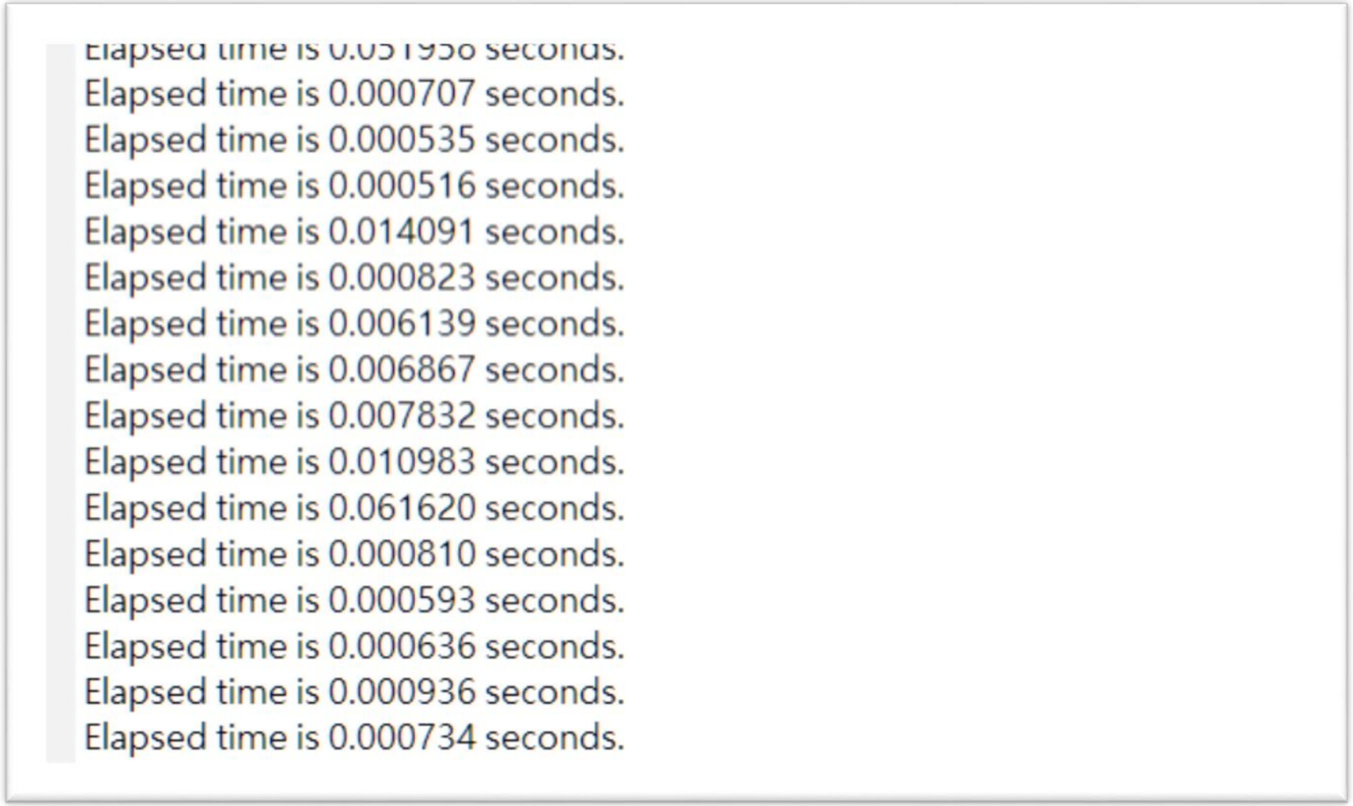
```
                   63         % Filter the raw ECG signal
 0.09      897     64         filtered_buffer ECG_filteri(data_buffer, mfa_length);
                   65
                   66         % Find R-peaks and heart rate
 0.10      897     67         [r_peaks, heart_rate]Find_r_pea(filtered_buffer, threshold, fs, data_buffer);
                   68
                   69         % Show the ECG waveform in the monitor figure
 6.26      897     70         plot(t_axis,data_buffer);
 0.90      897     71         hol( on
 1.73      897     72         plot(t_axis,r_peaks,'o');
 0.81      897     73         hol( off
 0.84      897     74         xlir([0, buffer_length / fs]); % Fix the x axis
 0.08      897     75         title_string = sprintf('Average Heart Rate : %g', heart_rate); % Show hearttiat( string
 4.71      897     76         titl(title_string)
 4.30      897     77         xlabe('Time (sec)');
 4.14      897     78         ylabe('Quantization value');
11.67      897     79         drawnow; % Force matlab to update the figure immediately
< 0.01     897     80     end
                   81
< 0.01     899     82     index = index + 1;
                   83     % Prevent index from overflowing
< 0.01     899     84     if index >= 50000
                   85         index = length(data_buffer);
                   86     end
 0.09      899     87 end
                   88
< 0.01       1     89 profile viewer
```

- We can see the most time spent are on “drawnow” and other plotting functions



```
8.03   1979  49    data = fscanf(s1);
                50    % Since we transfer string data from arduino, we need to cast it to
                51    % double value.
0.27   1979  52    data =str2doubl(data);
                53
                54    % Push new point to buffer. When the buffer if full, perform FIFO (first in
                55    % first out).
0.20    198  82        hol off
0.22    198  83        xlir([0, buffer_length / fs]); % Fix the x axis
0.02    198  84        title_string = sprintf('Average Heart Rate : %g', heart_rate); % Show heart[illegible] string
1.33    198  85        titl(title_string)
1.30    198  86        xlabe('Time (sec)');
1.24    198  87        ylabe('Quantization value');
5.48    198  88        drawnow; % Force matlab to update the figure immediately
```

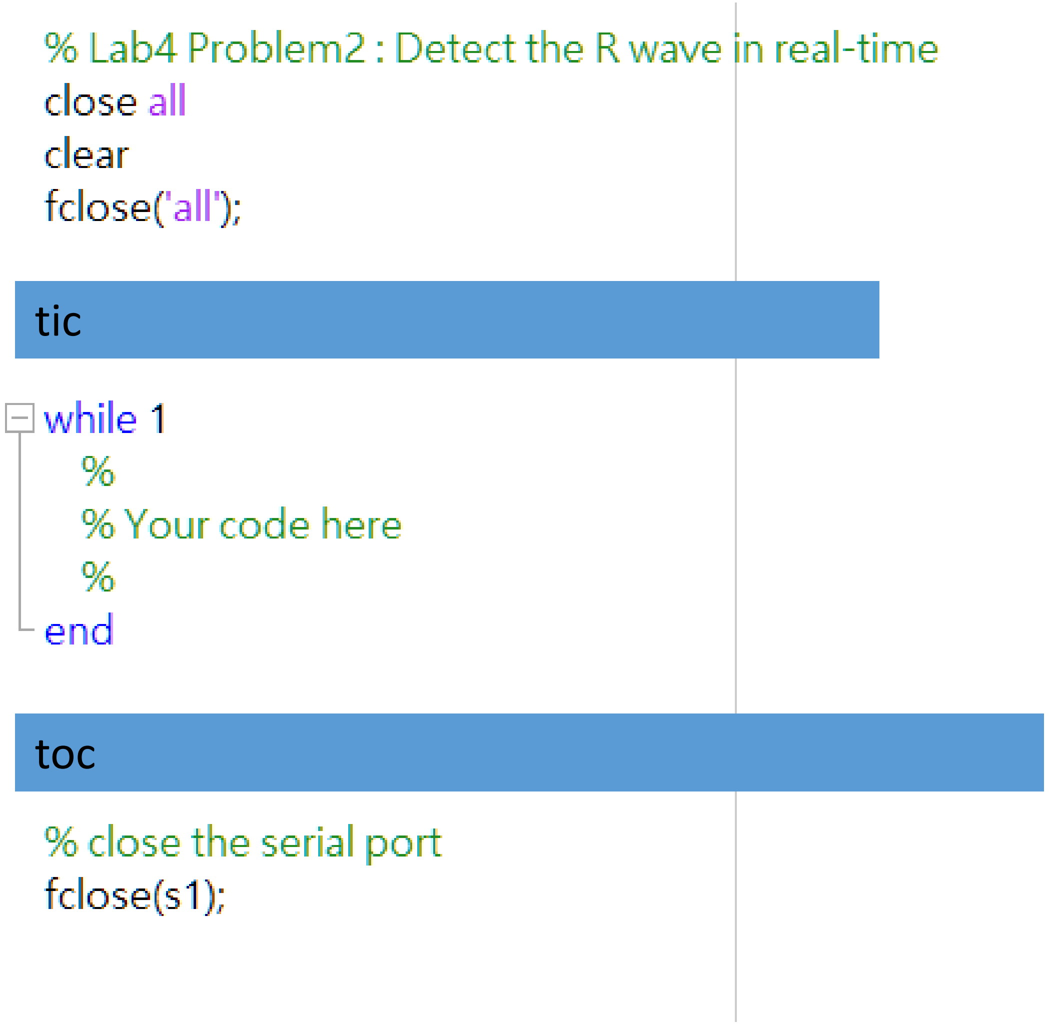
- After some optimization, we can see now the time is bound by transferring data.



```
Elapsed time is 0.031958 seconds.
Elapsed time is 0.000707 seconds.
Elapsed time is 0.000535 seconds.
Elapsed time is 0.000516 seconds.
Elapsed time is 0.014091 seconds.
Elapsed time is 0.000823 seconds.
Elapsed time is 0.006139 seconds.
Elapsed time is 0.006867 seconds.
Elapsed time is 0.007832 seconds.
Elapsed time is 0.010983 seconds.
Elapsed time is 0.061620 seconds.
Elapsed time is 0.000810 seconds.
Elapsed time is 0.000593 seconds.
Elapsed time is 0.000636 seconds.
Elapsed time is 0.000936 seconds.
Elapsed time is 0.000734 seconds.
```

- We can also use tic-toc function to see elapsed time for each loop.
- Average of the elapsed time for 100 loops will be used for Lab 4 evaluation (Demo to your TAs)
- (MATLAB function “tic” “toc”)

Usage



```
% Lab4 Problem2 : Detect the R wave in real-time
close all
clear
fclose('all');

tic

while 1
    %
    % Your code here
    %
end

toc

% close the serial port
fclose(s1);
```

Hint on some optimization

- Filter length
- Sampling rate
- Buffer handling : FIFO means you have to shift the whole buffer for each data acquisition
- Screen update rate : Plotting take much time, so you might not want to update the screen for each data acquisition.