Contents

Assignment 1 - Biosignals Processing;

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


close all; clear; clc; % just doing some house keeping;
load('edbe0103'); % loading the file;
fc=sig(:,1);    % setting my own variable to the signal captured in channel 1;
    % fc= first channel;
I=find(fc>1); % using the find function from matlab to help us find all of
    % the item that are above 1, where 1 is our treshold;
    %x=zeros(length(I));
x=ones(1800000,1); % here we initiate the first dummy var x, which will
    % contain all the values on their respective indexes coming from I;
n=1; % our main iterative variable
while n<=length(I)
    x(I(n))=fc(I(n)); % here we have a the index and value setting.
    n=n+1;
end
    %figure,plot(fc),hold,plot(x,'r*'); % this was mainly for test purposes.
n=1; % resetting our iterative variable to keep some consistency.
mx=[];% denotes the maxima; first row is the spot, second is the value.
s=1;v=2; % (s)pot, (v)alue;
j=1;    % our second iterative variable used;
    % this loop basically sets up the maxima array so we have maxima and
    % positions.
while n<(length(x)-1)
    diff=x(n+1)/x(n)-1; % this is the logic we follow to find the where
    % the maxima is located. Basically where there occured a change of
    % signs from positive to negative.

    if diff<0
       mx(s,j)=n;
       mx(v,j)=x(n);
       j=j+1;
       %n=n+1;
       %diff=x(n+1)/x(n)-1;

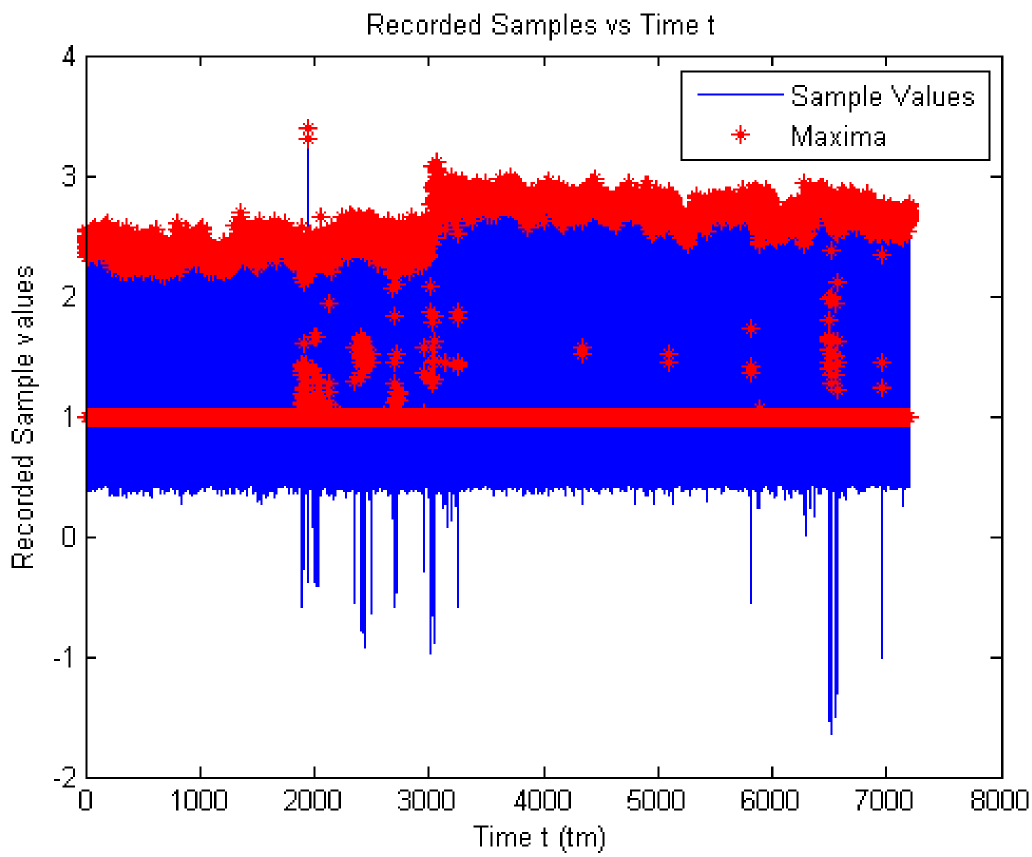
       % below is the iterative logic to get to the next positive position.
       while diff<=0 && n<(length(x)-1)
           diff=x(n+1)/x(n)-1;
           n=n+1;
       end
    else
        n=n+1;
    end
end
n=1;
```

```
    % we now create another dummy matrix to store only the maxima.
    % we then plot it against the original first channel samples.
y=ones(1800000,1);
while n<length(mx)
    y(mx(s,n))=mx(v,n);
    n=n+1;

end
figure,
plot(tm,fc),hold,plot(tm,y,'r*'),xlabel('Time t (tm)'),
ylabel('Recorded Sample values'),title('Recorded Samples vs Time t'),
legend('Sample Values','Maxima'); % our maxima are denoted as red stars.

% Above is the main algorithm and execution to reach the TH vector
% which shall be filled with the maxima.
```

```
Current plot held
```



Plot, var and std of TH.

```
n=1;j=1;
TH=[];
% we will use the maxima (mx) vector that we created earlier with all
% the values in their corresponding spots.

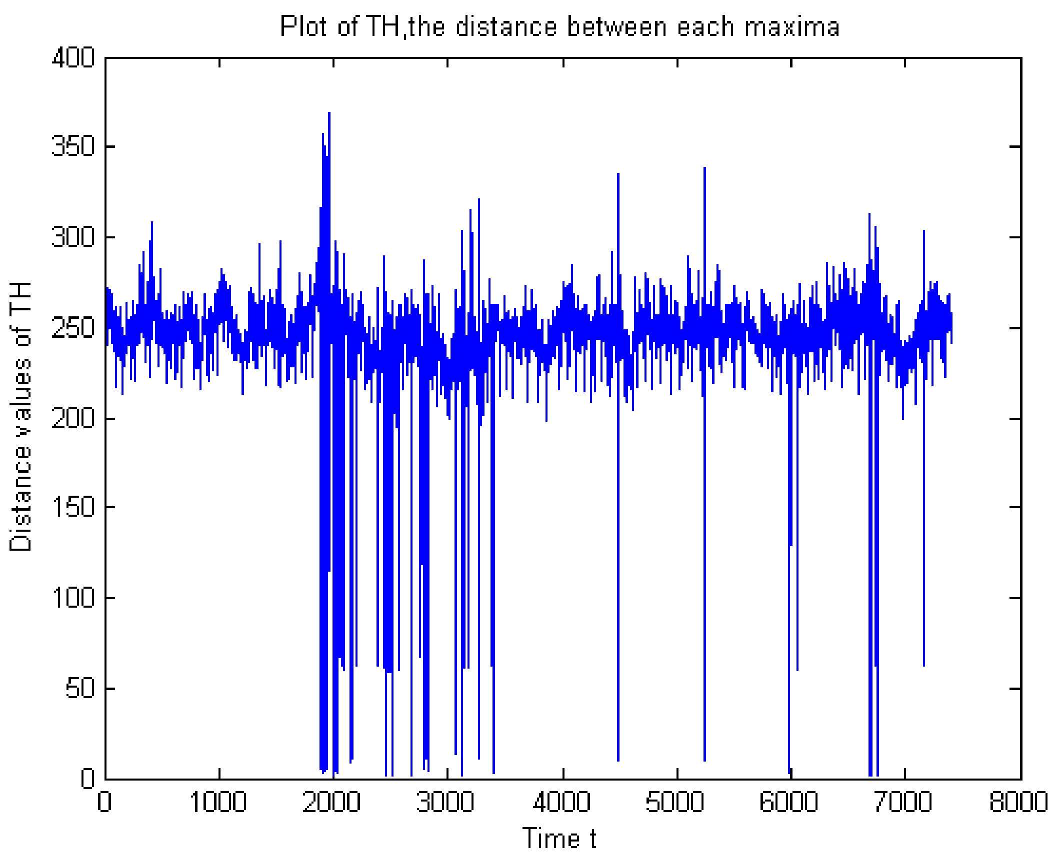
while n<(length(mx)-1)
    TH(n)=mx(s,n+1)-mx(s,n);
    n=n+1;
```

```
end
figure,
% below is the formatted plot in relation to its time domains.
plot(TH),title('Plot of TH,the distance between each maxima'),
xlabel('Time t'),ylabel('Distance values of TH');
varTH=var(TH);
stdTH=std(TH);
meanTH=mean(TH);
disp('This is the mean of TH: '),disp(meanTH);
disp('This is the variance of TH: '),disp(varTH);
disp('This is the standard deviation of TH: '),disp(stdTH);
```

```
This is the mean of TH:
  243.3544

This is the variance of TH:
  930.7230

This is the standard deviation of TH:
   30.5078
```



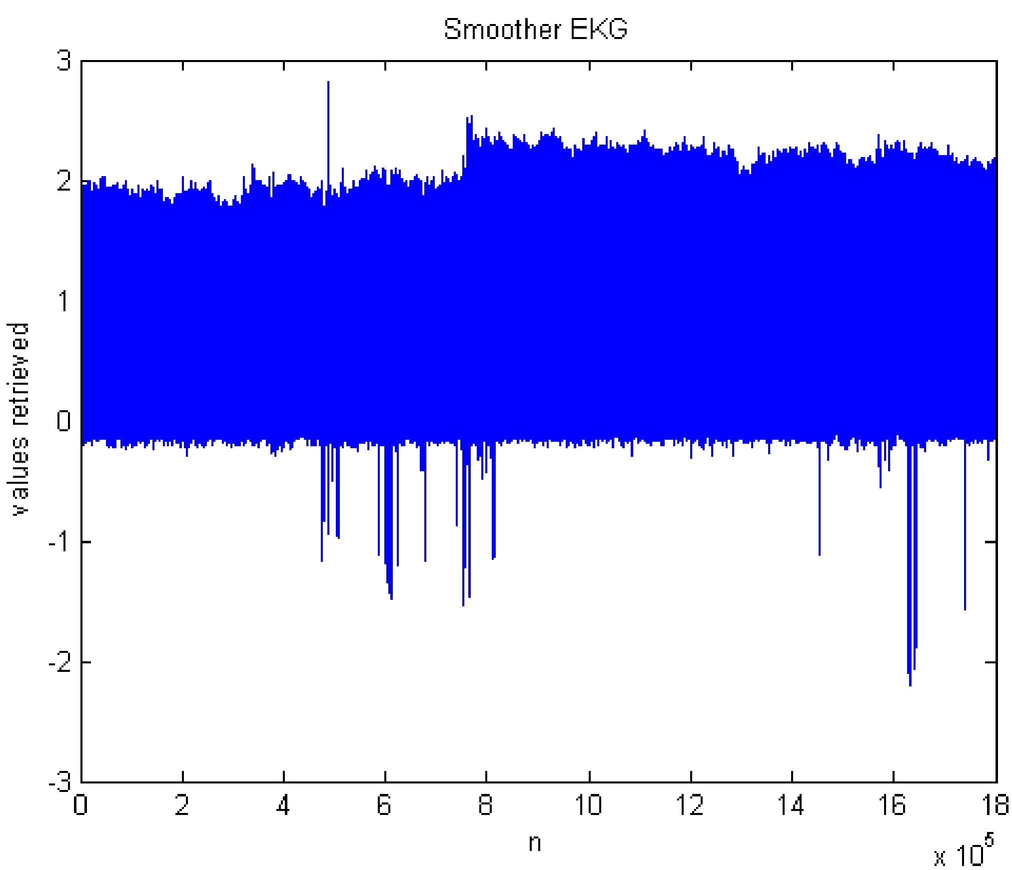
Question 2;

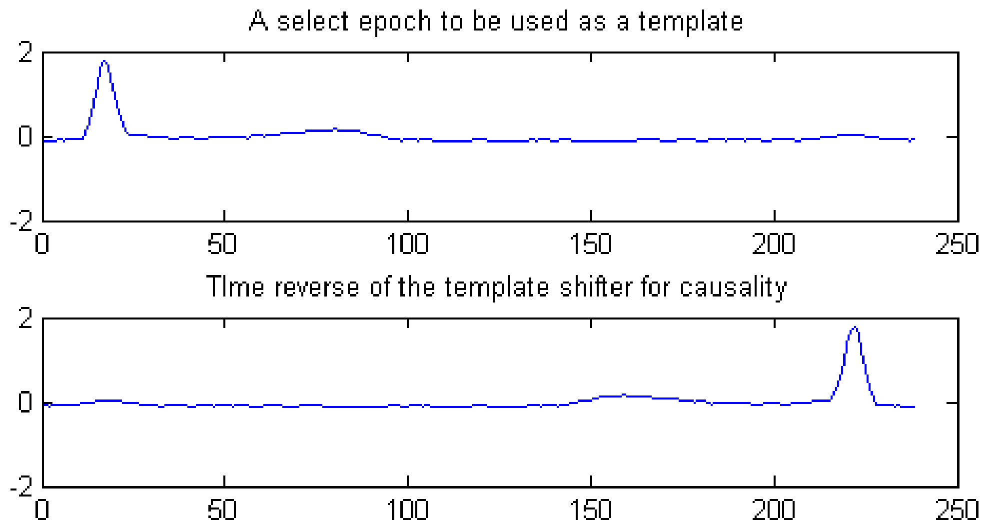
```
clear;close all;clc;
load('edbe0103.mat'); % Here we are again loading everything for the
% second set of computations;
x=sig(:,1);
x=x-mean(x); %This smoothes the signal.
% We will now output a smother version of the EKG signal;
```

```
figure,
plot(x),title('Smoother EKG'),xlabel('n'),ylabel('values retrieved');
% below is a series of procedure that demonstrates one presumed period
% of our signal.
n1=222838; n2=223075;
tx=x(n1:n2);
ltx=length(tx);
figure(2)
subplot(311),plot(tx), title('A select epoch to be used as a template')
% flipud instruction reverses the matrix for cross checking and
% correlation;
b=flipud(tx); a=1;
figure(2)
subplot(312), plot(b), title('TIme reverse of the template shifter for causality')

rtx=xcorr(tx);      %Autocorrelation of the template
ctx=conv(tx,b);     %Convolution of the template with its time reverse. The result should be th
e same as rtx.
% subplot(313), plot(-ltx+1:ltx-1,rtx), hold,plot(-ltx+1:ltx-1,ctx,'r'), legend('autocorrealtio
n', 'convolution')
%filter the EKG data with the correlation filter
% The above plot is demonstrating the close relationship between the
% convolution and autocorelation concepts, as discussed previously.

xx=filter(b,a,x);
% figure(1)
% subplot(212), plot(xx), title('Correlation filter output')
```





Now we will employ the previous worked algorithm in vector xx;

```
fc=xx;    % setting my own variable to the signal captured in channel 1;
    % fc= first channel;
I=find(fc>1); % using the find function from matlab to help us find all of
    % the item that are above 1, where 1 is our treshold;
    %x=zeros(length(I));
x=ones(1800000,1); % here we initiate the first dummy var x, which will
    % contain all the values on their respective indexes coming from I;
n=1; % our main iterative variable
while n<=length(I)
    x(I(n))=fc(I(n)); % here we have a the index and value setting.
    n=n+1;
end
    %figure,plot(fc),hold,plot(x,'r*'); % this was mainly for test purposes.
n=1; % resetting our iterative variable to keep some consistency.
mx=[];% denotes the maxima; first row is the spot, second is the value.
s=1;v=2; % (s)pot, (v)alue;
j=1;    % our second iterative variable used;
    % this loop basically sets up the maxima array so we have maxima and
    % positions.
while n<(length(x)-1)
    diff=x(n+1)/x(n)-1; % this is the logic we follow to find the where
    % the maxima is located. Basically where there occured a change of
    % signs from positive to negative.

    if diff<0
       mx(s,j)=n;
       mx(v,j)=x(n);
       j=j+1;
       %n=n+1;
```

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        %diff=x(n+1)/x(n)-1;

        % below is the iterative logic to get to the next positive position.
        while diff<=0 && n<(length(x)-1)
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            n=n+1;
        end
    else
         n=n+1;
    end
end
n=1;
    % we now create another dummy matrix to store only the maxima.
    % we then plot it against the original first channel samples.
y=ones(1800000,1);
while n<length(mx)
    y(mx(s,n))=mx(v,n);
    n=n+1;

end
figure,
plot(tm,fc),hold,plot(tm,y,'r*'),xlabel('Time t (tm)'),
ylabel('Recorded Sample values'),title('Recorded Samples vs Time t'),
legend('Sample Values','Maxima'); % our maxima are denoted as red stars.

% Above is the main algorithm and execution to reach the TH vector
% which shall be filled with the maxima.
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Current plot held
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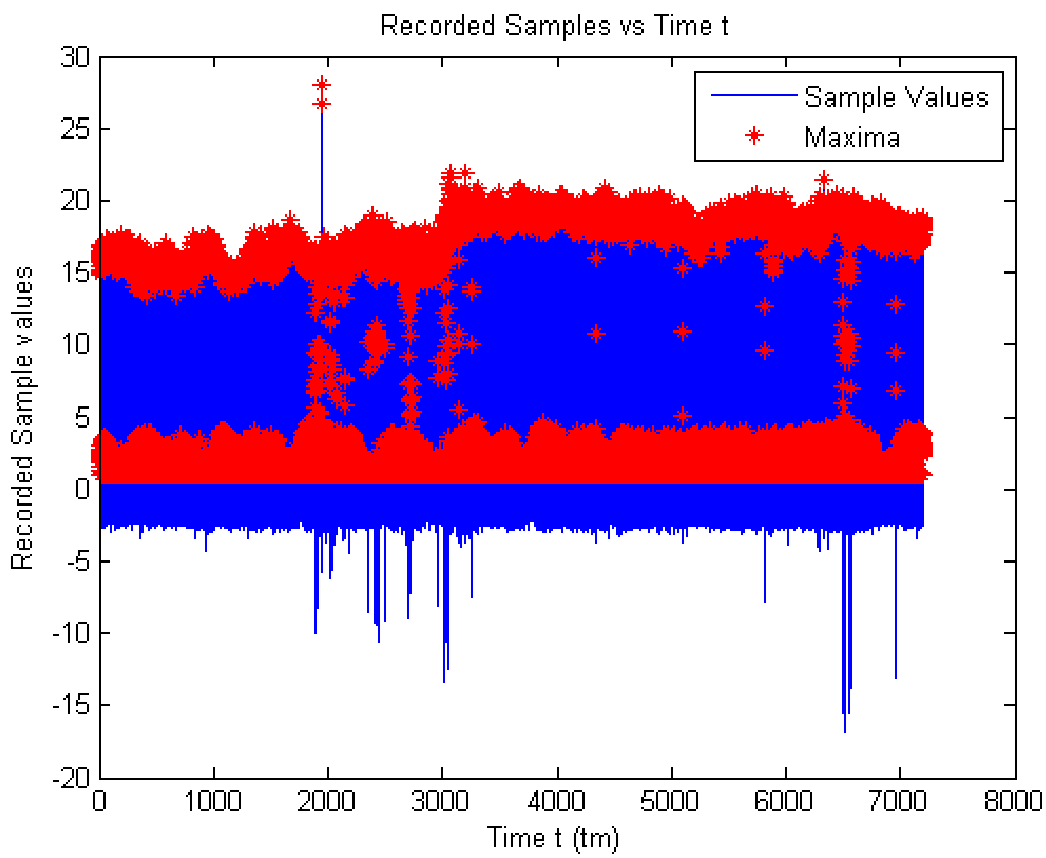


Computing the Correlation Coefficient;

According to the research paper, the correlation Coefficient may be defined as follows:
Covariance of (Template signal , Test signal)/sqrt(Template signal* Test signal);

```
cf=transpose(fc);
mfc=mean(fc);
my=mean(y);
coVar=cov(fc,y)
r=sqrt(my*mfc)
R=coVar./r
figure,
plot(fc),
hold,plot(y,'r*')
```

```
coVar =

    9.8007    1.1949
    1.1949    1.1158


r =

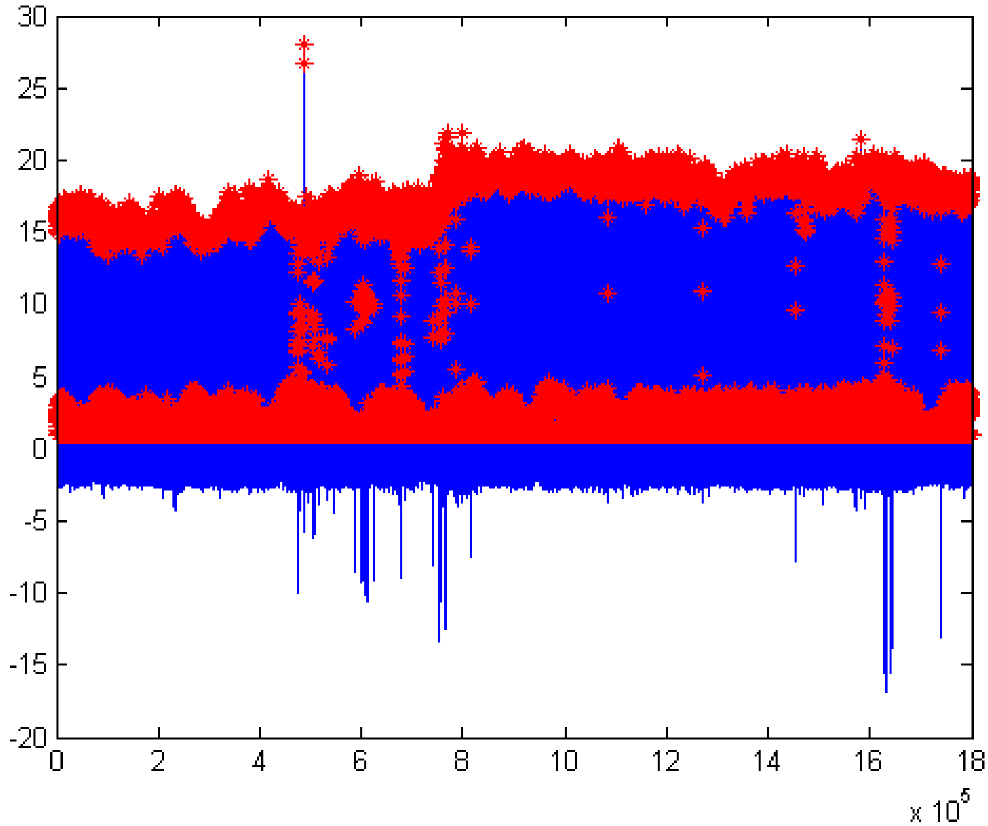
    0.0022


R =

  1.0e+003 *

    4.4609    0.5439
    0.5439    0.5079

Current plot held
```



Now, on to be more specific with one epoch

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