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* start here for doing homework *

load .mat data (calculated and saved in the previous section)

```
clearvars -except basepath filenames
load('hr_data.mat','hr_day_x_minute');
load('steps_data.mat','steps_day_x_minute');
load('all_dates.mat','all_dates');
```

fill in the missing data

fill empty cells with the mean interpolation would be better, but this is ok challenge question: fill empty cells by interpolation instead

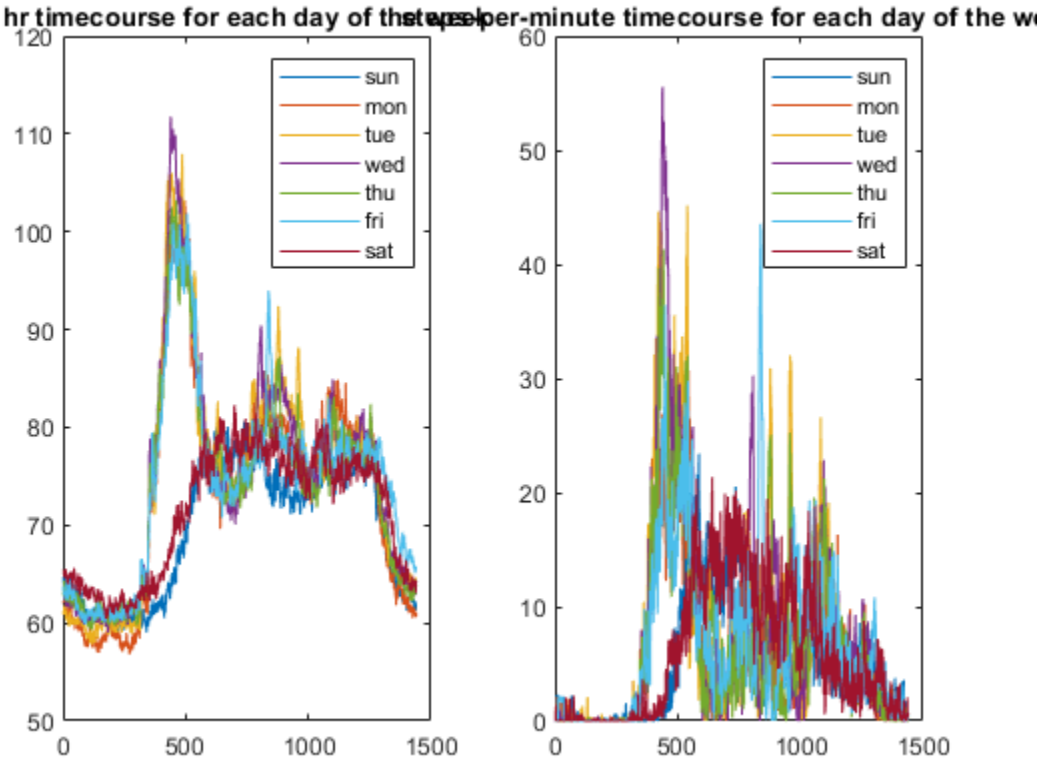
```
hr_missing_values = isnan(hr_day_x_minute);
hr_day_x_minute(hr_missing_values) = nanmean(hr_day_x_minute(:)); %
 the (:) notation turns the 2d array into 1d
steps_missing_values = isnan(steps_day_x_minute);
steps_day_x_minute(steps_missing_values) =
 nanmean(steps_day_x_minute(:));
```

homework exercise 1

calculate nick's average heart rate and step timecourse for each day of the week first average together all the timecourses for each day, eg for monday then calculate the correlations between days

```
dayofweek = weekday(all_dates); % values 1-7
meanEveryday1=zeros(7,1440);
for j=1:7
    for i = 1:1440
        meanEveryday1(j,i)= mean(hr_day_x_minute(dayofweek==j,i));
    end
end

figure(1); clf

daynames = {'sun','mon','tue','wed','thu','fri','sat'};
subplot(1,2,1)
plot(1:1440,meanEveryday1)
legend(daynames)
title('hr timecourse for each day of the week')
```

```
for j=1:7
    for i = 1:1440
        meanEveryday2(j,i)= mean(steps_day_x_minute(dayofweek==j,i));
    end
end

subplot(1,2,2)
plot(1:1440,meanEveryday2)
legend(daynames)
title('steps-per-minute timecourse for each day of the week')
```

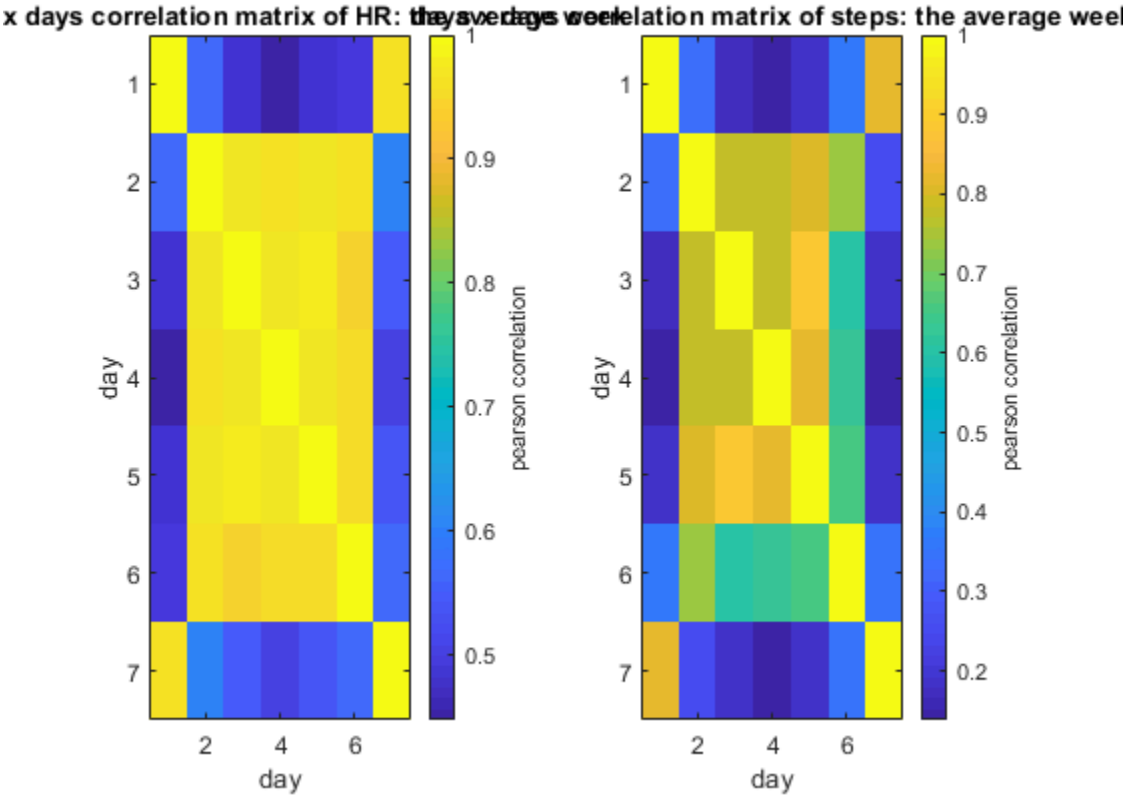


homework exercise 2

calculate and plot the average week correlation matrix for heart rate and for steps (make a figure 10 with 2 subplots) note: make use of the timecourses you generated above! after plotting the correlation matrix, you'll need this command:

```
meanCorrEveryday1=corr(meanEveryday1');

figure(2); clf
subplot(1,2,1)
imagesc(meanCorrEveryday1); ch = colorbar; ch.Label.String = 'pearson
 correlation';
title('days x days correlation matrix of HR: the average week')
xlabel('day'); ylabel('day');
```

```
meanCorrEveryday2=corr(meanEveryday2');
subplot(1,2,2)
imagesc(meanCorrEveryday2); ch = colorbar; ch.Label.String = 'pearson
 correlation';
title('days x days correlation matrix of steps: the average week')
xlabel('day'); ylabel('day');
```



investigate how his heart rate during running changes over the course of

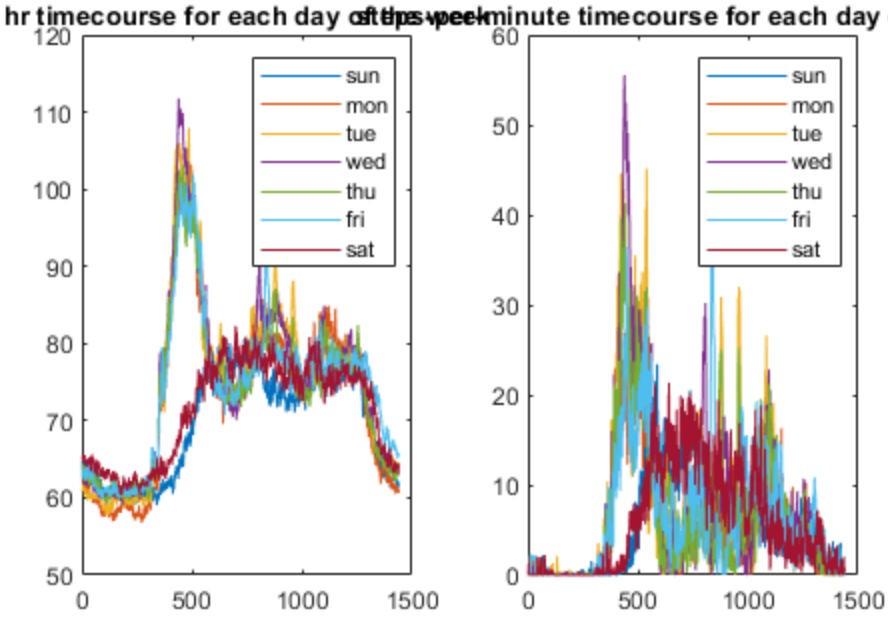
the year, eg by month. does it increase steadily, or is there a u-shaped effect, which might suggest a seasonal influence?

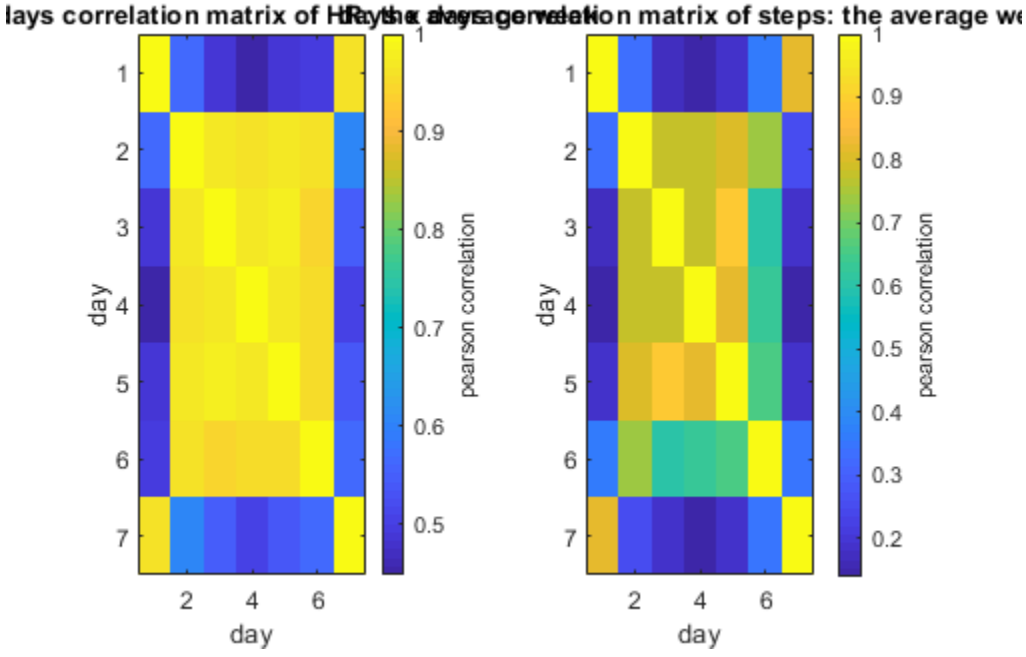
```
month_start = [1:30:360]; % approximate months at 30 days each
PTcolors = flipud(PTrainbow(12)); % find PTrainbow in the helpers
 folder; we use flipud to make lower values red, higher values purple
```

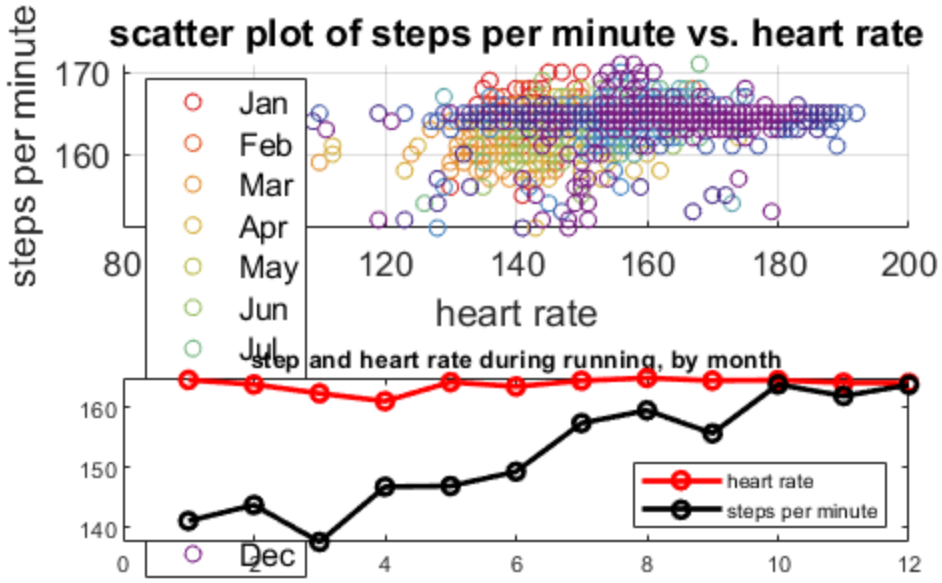
homework exercise 3

```
figure(3); clf
subplot(2,1,1)
runningColor=PTrainbow(12);
month_start=[month_start(1:12) []];
month_start=[month_start 360];
```

```
monthOnePoint=zeros(1,12);
for i=1:12

    runningIndex=(steps_day_x_minute(month_start(i):(month_start(i
+1)-1),:)>150) & ...
        (steps_day_x_minute(month_start(i):(month_start(i
+1)-1),:)<175);

    pointsMonth=sum(sum(runningIndex));

    meanMonthHr(i)=0;
    meanMonthStep(i)=0;

    for d=1:(month_start(i+1)-month_start(i))


 meanMonthHr(i)=sum(hr_day_x_minute(month_start(i)+(d-1),runningIndex(d,:)))+meanM

 meanMonthStep(i)=sum(steps_day_x_minute(month_start(i)+(d-1),runningIndex(d,:)))+


 plt=plot(hr_day_x_minute(month_start(i)+(d-1),runningIndex(d,:)),steps_day_x_minu
            'o','Color',runningColor(12-i+1,:)); hold on

        if ~isempty(plt)
            monthOnePoint(i)=plt(1);
        end

    end

    meanMonthHr(i)=meanMonthHr(i)/pointsMonth;
    meanMonthStep(i)=meanMonthStep(i)/pointsMonth;

end
    title('scatter plot of steps per minute vs. heart rate');
    set(gca,'FontSize',13);
    xlabel('heart rate'); ylabel('steps per minute'); grid on
    legend(monthOnePoint,
{'Jan','Feb','Mar','Apr','May','Jun','Jul','Aug','Sep','Oct','Nov','Dec'},'Locatio

subplot(2,1,2)
set(gca,'FontSize',14);
ylim([135 170])
plot(1:12,meanMonthStep,'-o','color','red','LineWidth',2)
hold on
plot(1:12,meanMonthHr,'-o','color','black','LineWidth',2)
title('step and heart rate during running, by month')
legend('heart rate', 'steps per minute','Location','SouthEast')
autoArrangeFigures
```


hr timecourse for each day of the week
minute timecourse for each day of the
sun
mon
tue
wed
thu
fri
sat


day
day
pearson correlation



conceptual questions

```
% 1. What is displayed in each panel of Figure 4? Describe the axes,
 the units, and what the colors indicate.
% How would I locate the information for Sep 22, 2017?

%The first figure shows the heart rate by minutes (x axes) in 360 days
 (y axes).
%To know what the color indicates, we need to look at the bar
 value(which is also the heart rate value measured in minutes)
%on the right hand side, and check what color does it belong to.

%The second figure shows the steps walked by minutes (x axes) in 360
 days (y axes).
%To know what the color indicates, we need to look at the bar
 value(which is also the steps walked measured in minutes)
%on the right hand side, and check what color does it belong to.

%To find information for sep 22,2017, we need to first find the the
 index
%for sep 22,2017 in saved variable "all_dates", and locate that index
 on the
%y axes.

% 2. What is displayed in Figure 6? Describe the axes and what the
 colors indicate. Why are the diagonal values
% all equal to 1? How would I locate the cell that compares Sep 22,
 2017 to Sep 25, 2017?

%This is the heart rate corrlation coefficient matrix captured by
 days.
```

```
%The x and y axes are both days information in 360 days.
%To know what the color indicates, we need to look at the bar
 value(which is the corrlation coefficient)
%on the right hand side, and check what color does it belong to.
%The diagonal values all equal to 1 because the corrlation coefficient
 with
%oneself is always 1.
%To compare information for sep 22,2017 and Sep 25, 2017?, we need to
 first find the the index
%for sep 22,2017 and Sep 25, 2017 in saved variable "all_dates", and
 locate those index on the
%y axes, and lastly compare the color with the corrlation coefficient
 value
%bar on the right hand side.

% 3. What is displayed in Figure 90? Describe the axes and what the
 colors indicate. Why is there a vertical
% strip of data points around x=73?

% This is the scatter plot that shows the the simutanous realtionship
% between heart rate and walking steps. The x axes is heart rate and
 the y
% axes is steps per minute.
% The vertical strip might be casued by sudden increase in walking
 steps but the
% heart rate did not kick in or correctly measured until later.
```

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