EW202 Distance Learning Assignment #2

- Using MATLAB mobile, collect some sensor data while your phone is simply **lying still** on a flat surface.
  - Pick **one** sensor (Acceleration, Magnetic Field, etc) and for **all** the components (e.g. X,Y,Z),
  - compute the mean ✪ and standard deviation ✪.
  - Plot the histogram ✪
  - Note either an observation or question that regarding the data ✪
- Select a **data analysis task** (see ideas/options on the next page)
  - Collect data
  - Process the data using MATLAB
  - Display your results (don't forget to label!) ✪
- Submit your results (✪ denotes required submission elements)
- Aim for concise, readable, and as professional as your resources permit
- **Due: 4/2/2020 11:59pm**

Data Analysis Tasks (pick one)

- Using MATLAB, compute the number of steps taken on a walk
- Using MATLAB, compute the number of rotations (run repeatedly around your house, spin on chair, walk in circles in your room, etc)
- Using MATLAB, compute the frequency of a swing or pendulum (be careful with your phone)
- Move or drive a known distance and integrate the Positon.speed data for comparison
- Do a study of sampling time. Collect data for one of the above ideas at different sampling rates and identify where too low of a sampling period degrades the data
- Your idea (check with your instructor)

Data Struggles?
Send me an email - If we can't troubleshoot the problem, I'll run the experiment for you and send it back.

Lecture plan for week of 3/30

Monday 3/30

- Review of solutions from previous week
- Demonstration in MATLAB of how to manipulate data
- Q: What's your favorite shelter-in-place food you've eaten?

Wednesday 4/1

- MATLAB questions answered
- Show and tell - show us your data you've collected. Try the animation code. We can use the share screen option if you're on a computer.
- Q: What movies are you watching?

Lab: EI available on request

Late in week (Thursday or Friday):
Short quiz

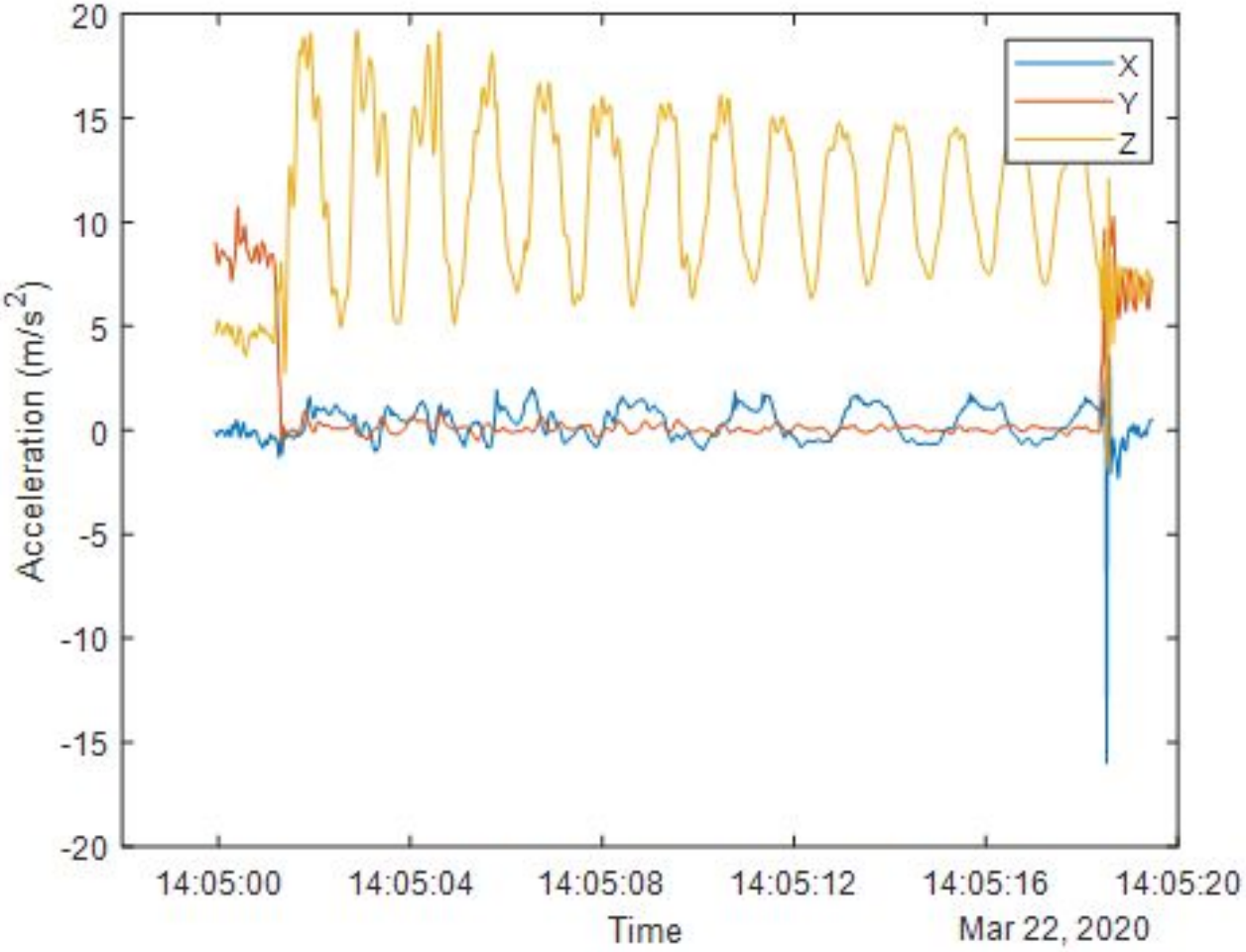
Using the data

```
load('lowswing2_50Hz.mat')
t=Acceleration.Timestamp
y=Acceleration.Y;
x=Acceleration.X;
z=Acceleration.Z;
plot(t,x,t,y,t,z)
legend('X','Y','Z'),shg
```

Acceleration | Position | AngularVelocity | MagneticField

1820x3 timetable

	Timestamp	1 X	2 Y	3 Z	4
1	24-Mar-2020 18:56:48.955	-1.6035	0.0416	11.7890	
2	24-Mar-2020 18:56:48.975	-1.2920	-0.4935	12.6908	
3	24-Mar-2020 18:56:48.995	-0.6794	-0.1350	12.5999	
4	24-Mar-2020 18:56:49.015	0.1066	0.5878	10.7825	
5	24-Mar-2020 18:56:49.035	0.5678	0.5303	8.8119	
6	24-Mar-2020 18:56:49.055	0.8592	0.5142	7.9649	
7	24-Mar-2020 18:56:49.075	1.2246	0.7523	8.2399	
8	24-Mar-2020 18:56:49.095	1.1251	0.9712	8.8508	
9	24-Mar-2020 18:56:49.115	0.3877	1.3394	9.1303	
10	24-Mar-2020 18:56:49.135	-0.0828	1.5138	9.1481	

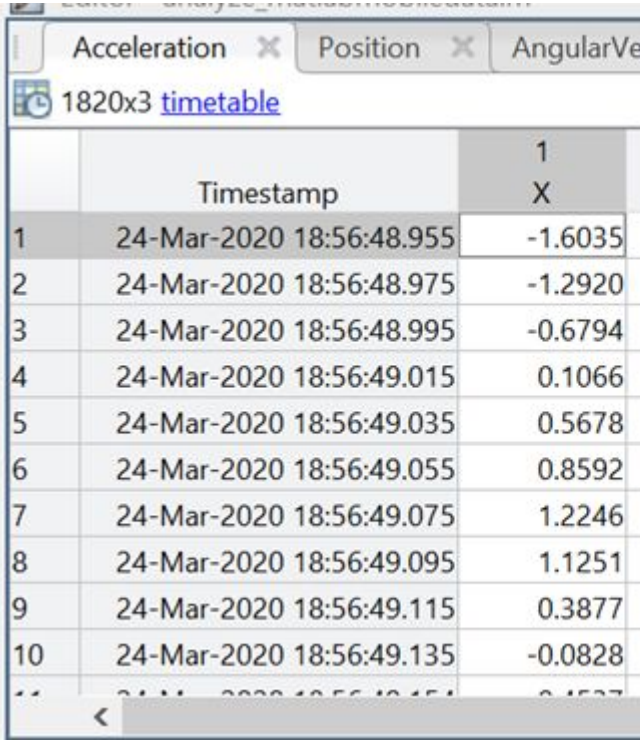

20
15
10
5
0
-5
-10
-15
-20
Acceleration (m/s^2)
X
Y
Z
14:05:00
14:05:04
14:05:08
14:05:12
14:05:16
14:05:20
Time
Mar 22, 2020

Converting Timestamp Data

```
% Convert Timestamp to seconds and
% reset starting time to zero

t=posixtime(Acceleration.Timestamp);
t=t-t(1);
```

Link for [posixtime help]


Acceleration | Position | AngularVe

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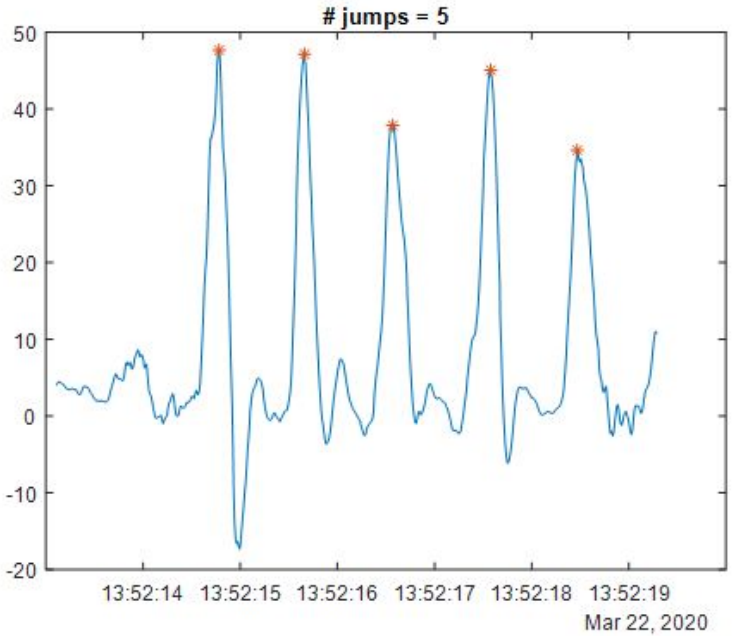
Finding peaks: `islocalmax`

```
% plot reveals big jumps on y data
idx=islocalmax(y,'Minprominence',10)
plot(t,y,'-',t(idx),y(idx),'*'),shg
```

Link for islocalmax help

Minprominence
Fancy way of saying how much bigger the peaks should be compared to the rest of the data.

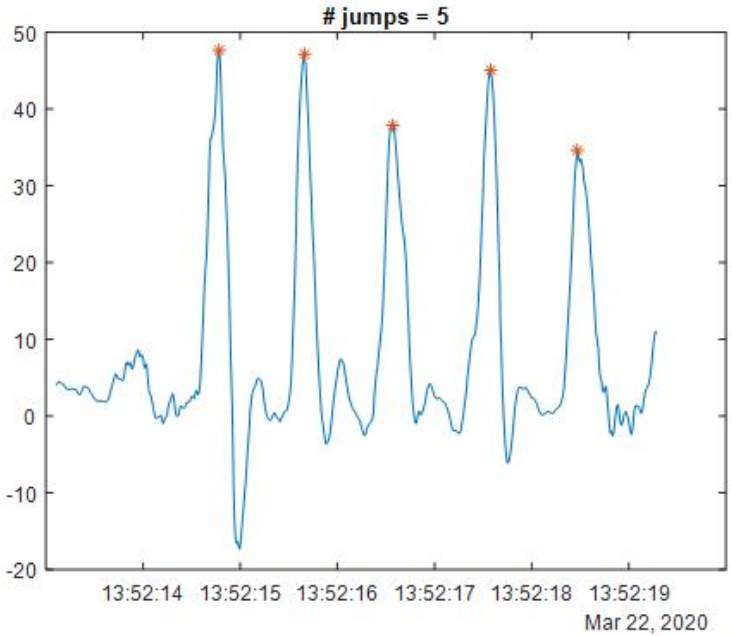
Q: what would be the effect of Minprominence setting of 5 for the data on the right?



Finding peaks: `findpeaks`

```
% plot reveals peaks in y data (three different usage cases)
pks = findpeaks(data)
[pks,locs] = findpeaks(data)
[pks,locs,w,p] = findpeaks(data)
```

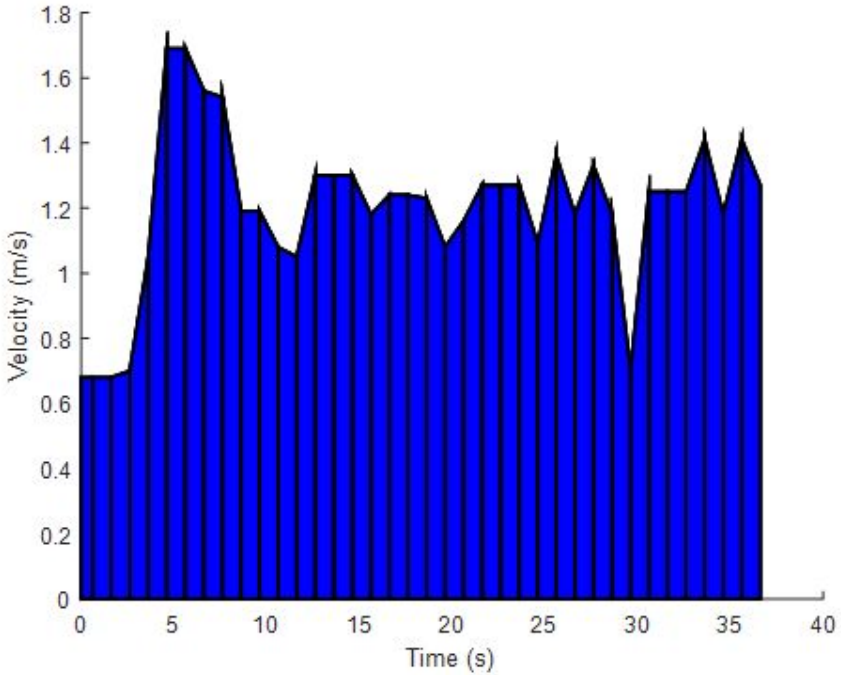
Link for findpeaks help



Integrating Discrete Data

```
t2=posixtime(Position.Timestar
v=Position.speed;
dist_traveled = trapz(t2,v)
```

Link for [trapz help]



Optional: Animating the orientation of your phone

See file IMUPlotter.m in the Google Drive folder for this assignment for sample code to make a .gif

Dig Deeper: Articles, Ideas, etc.

- https://phyphox.org/
- https://www.wired.com/story/how-to-easily-locate-the-accelerometer-in-an-iphone/
- https://emantpl.github.io/scratch-sensor-2.0/
- https://learn.sparkfun.com/tutorials/accelerometer-basics/all
- https://en.wikipedia.org/wiki/Inertial_measurement_unit