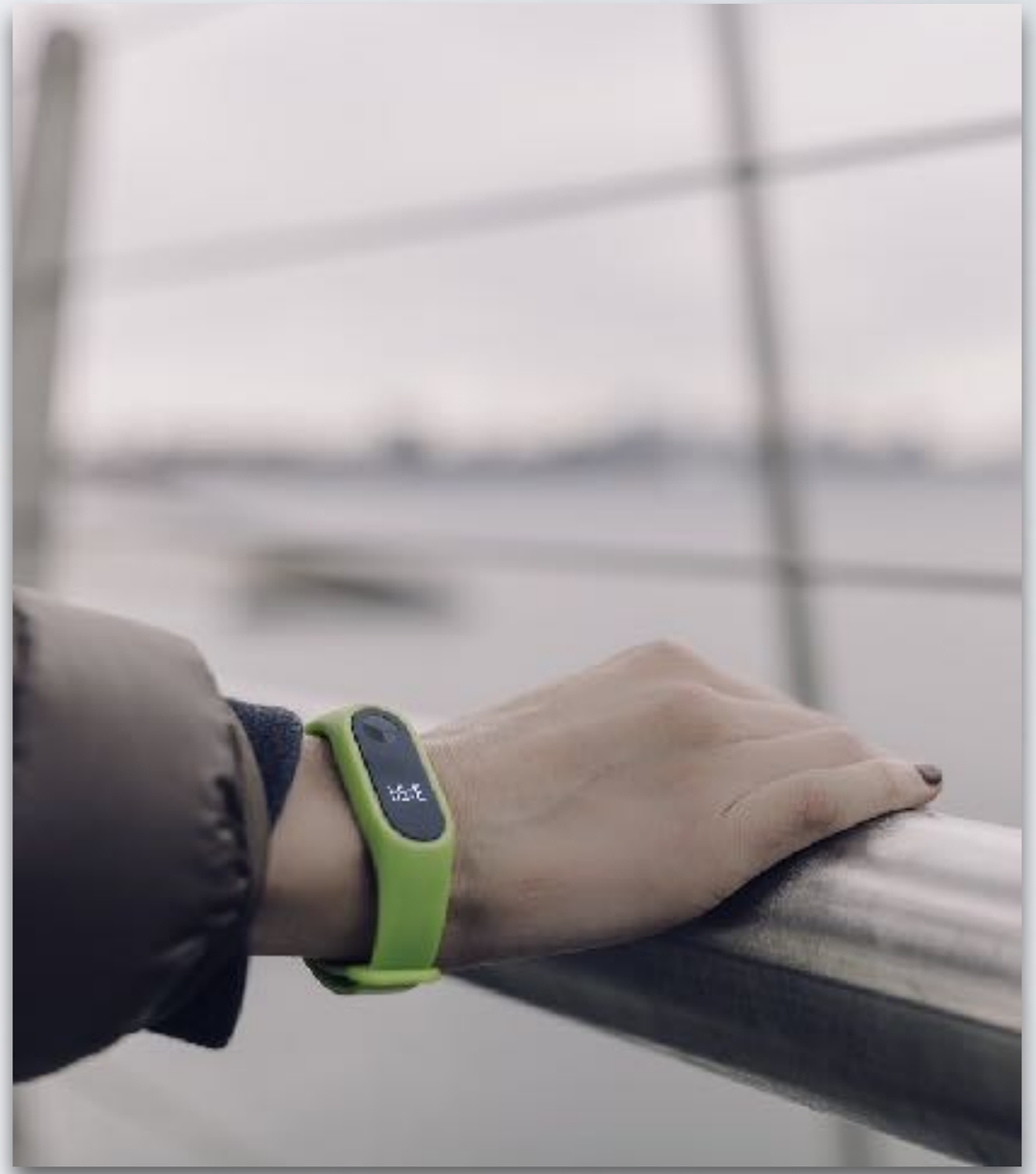
WALK OR RUN

Activity Classifier

Carlie Badder

ACTIVITY TRACKERS ARE ALL THE RAGE

- **Most trackers are activity specific.**
- Can we at least automatically distinguish walking from running?
- **Wearables are small with limited computing power.**
- Is there a method that would work for a live stream of data?

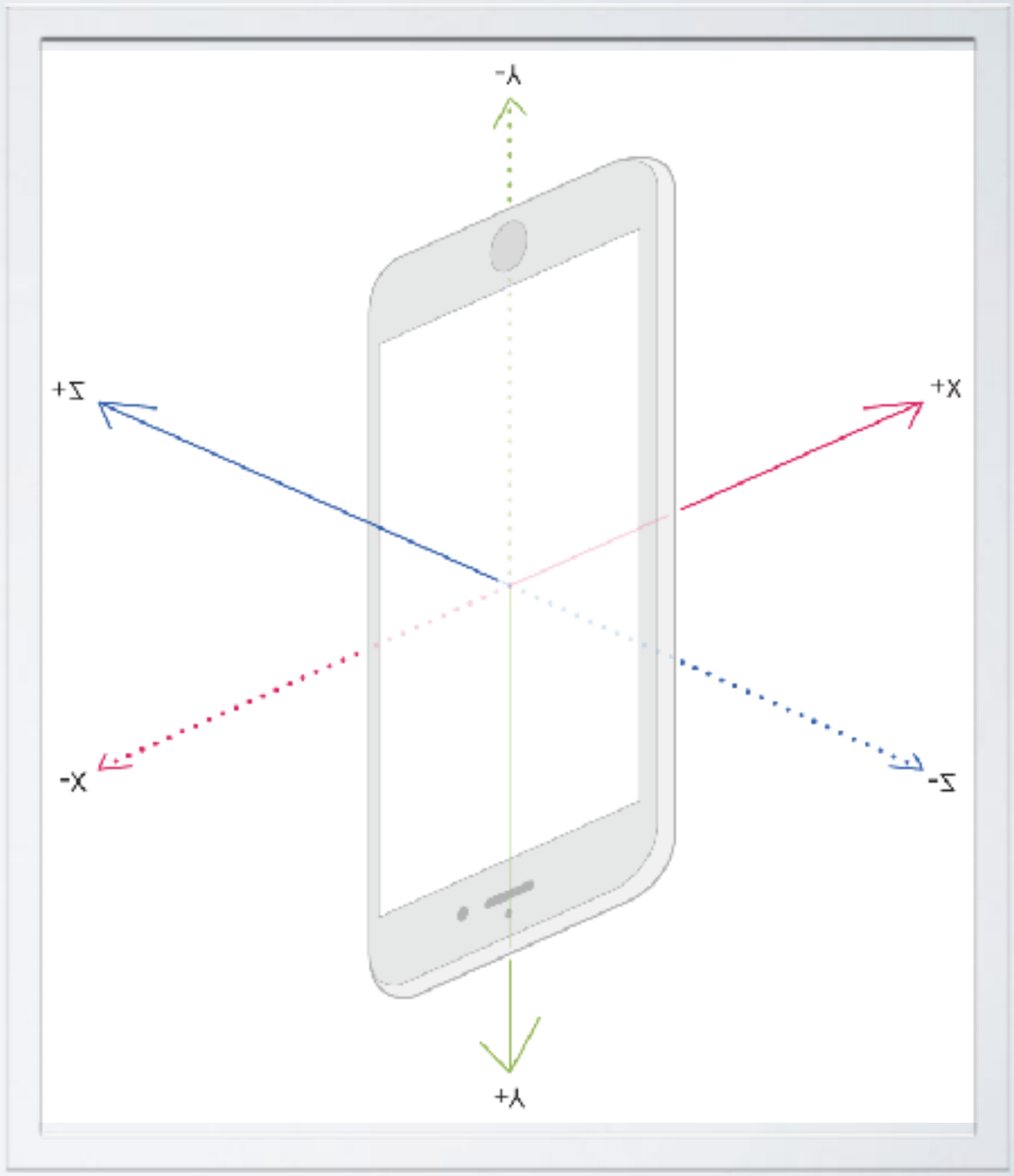


"All our knowledge begins with the senses…"

–Immanuel Kant, Critique of Pure Reason

THE SENSORS AND THE DATA

- Kaggle Dataset
- Recorded on an iPhone
- Accelerometer
- Gyroscope
- Left & Right Wrist
- Running & Walking

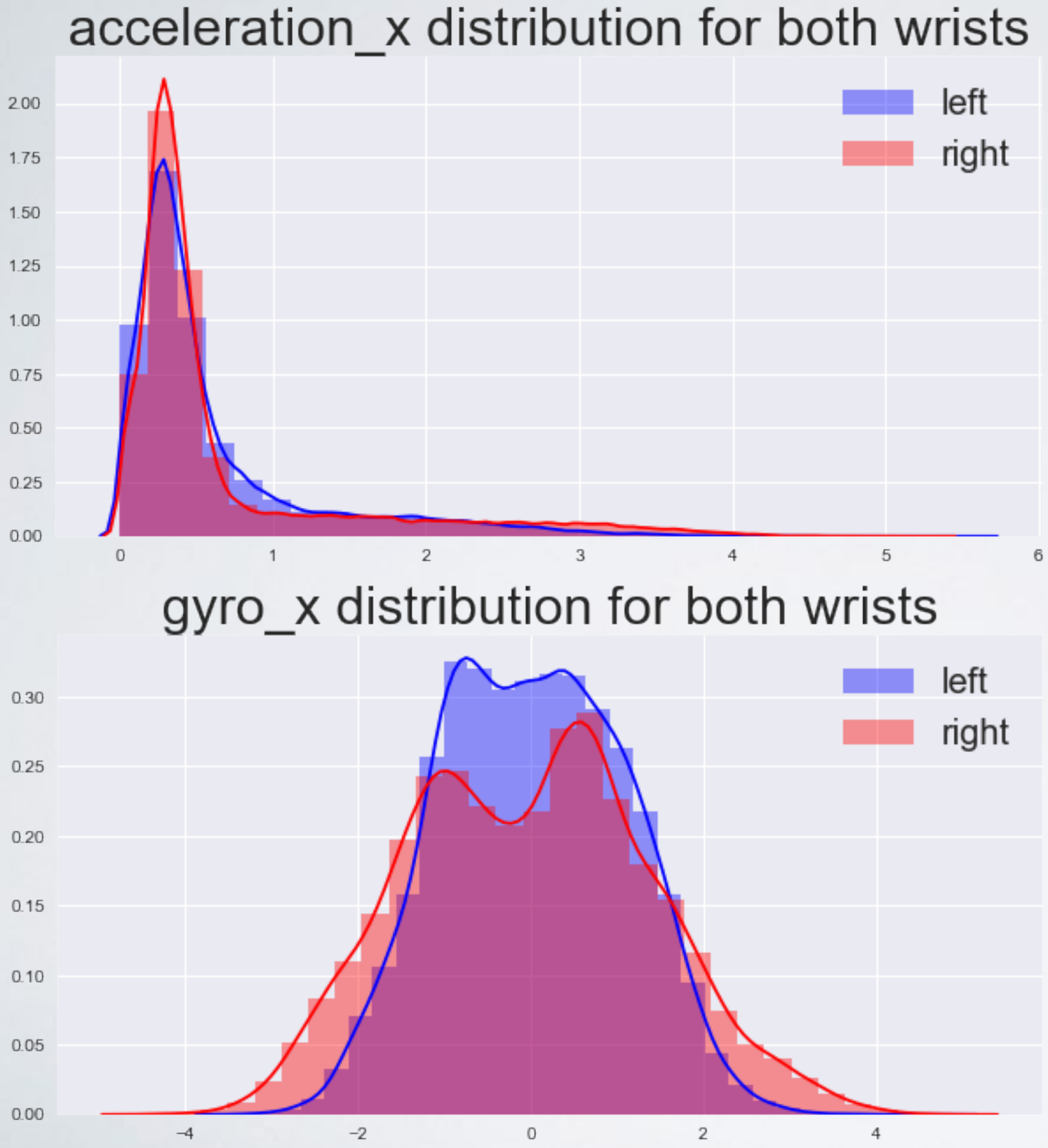


OFF TO A GOOD START

	Left Wrist	Right Wrist	
Running	23,708	20,657	44,365
Walking	18,622	25601	44,223
	46,258	42,330	88,588

Observations evenly distributed

OFF TO A GOOD START



Wrist placement had no effect on sensor data

"…all models are wrong, but some are useful."

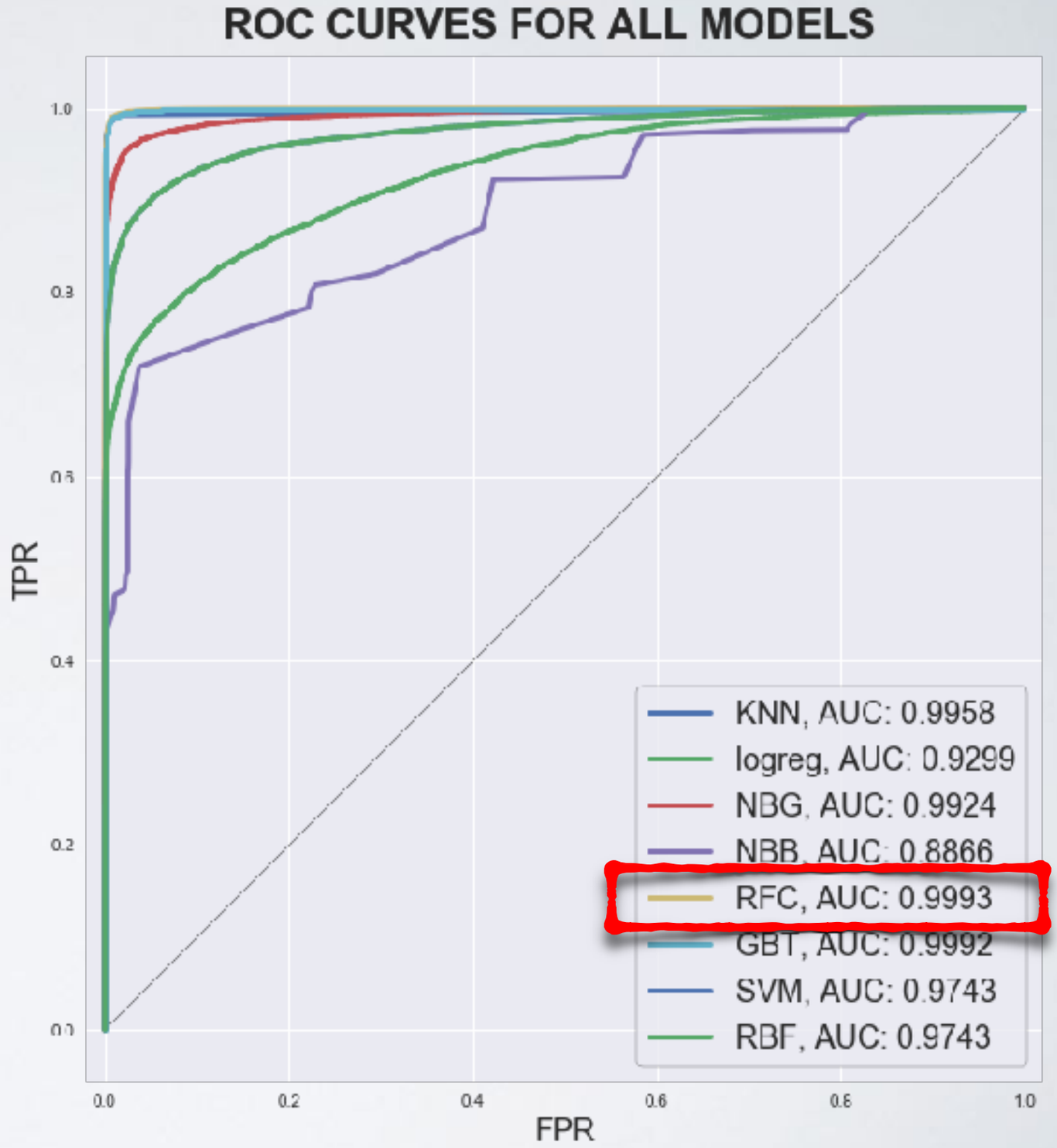
–George Box

WE TRIED ALL THE THINGS

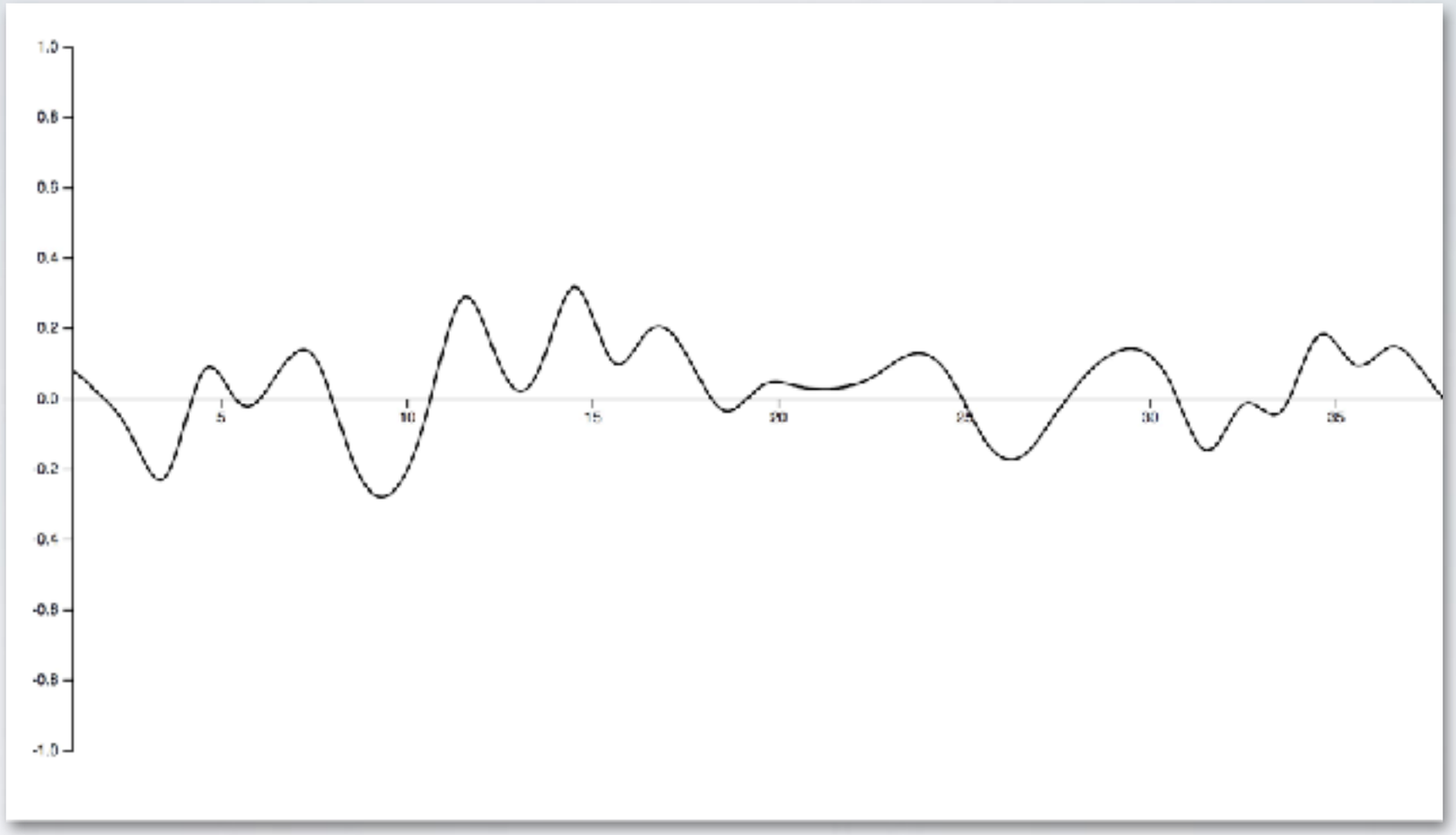
The best model was the

Random Forest Classifier

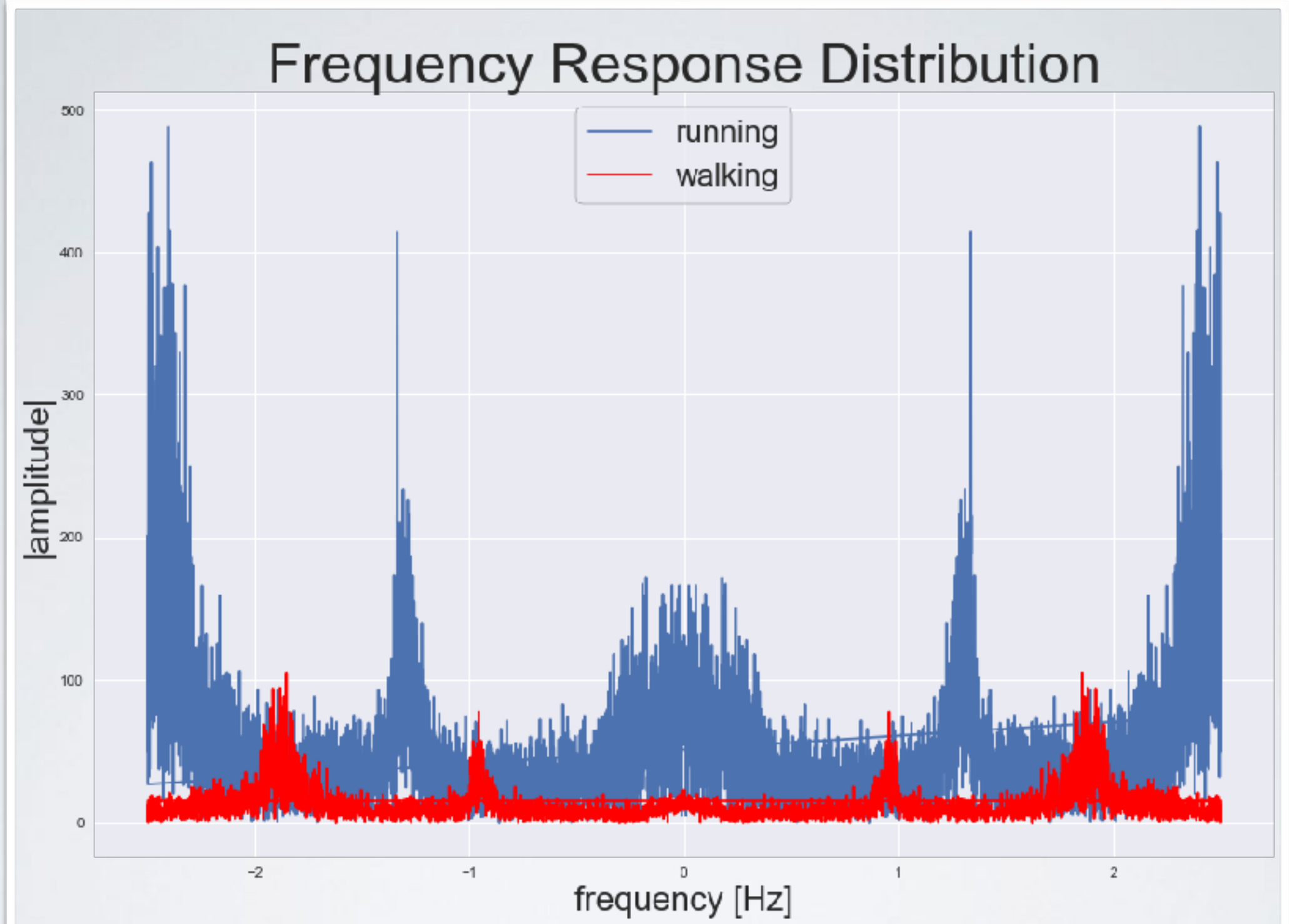
AUC: **99.9%**
Accuracy: **99.1%**
Precision: **99.1%**
Recall: **99.1%**



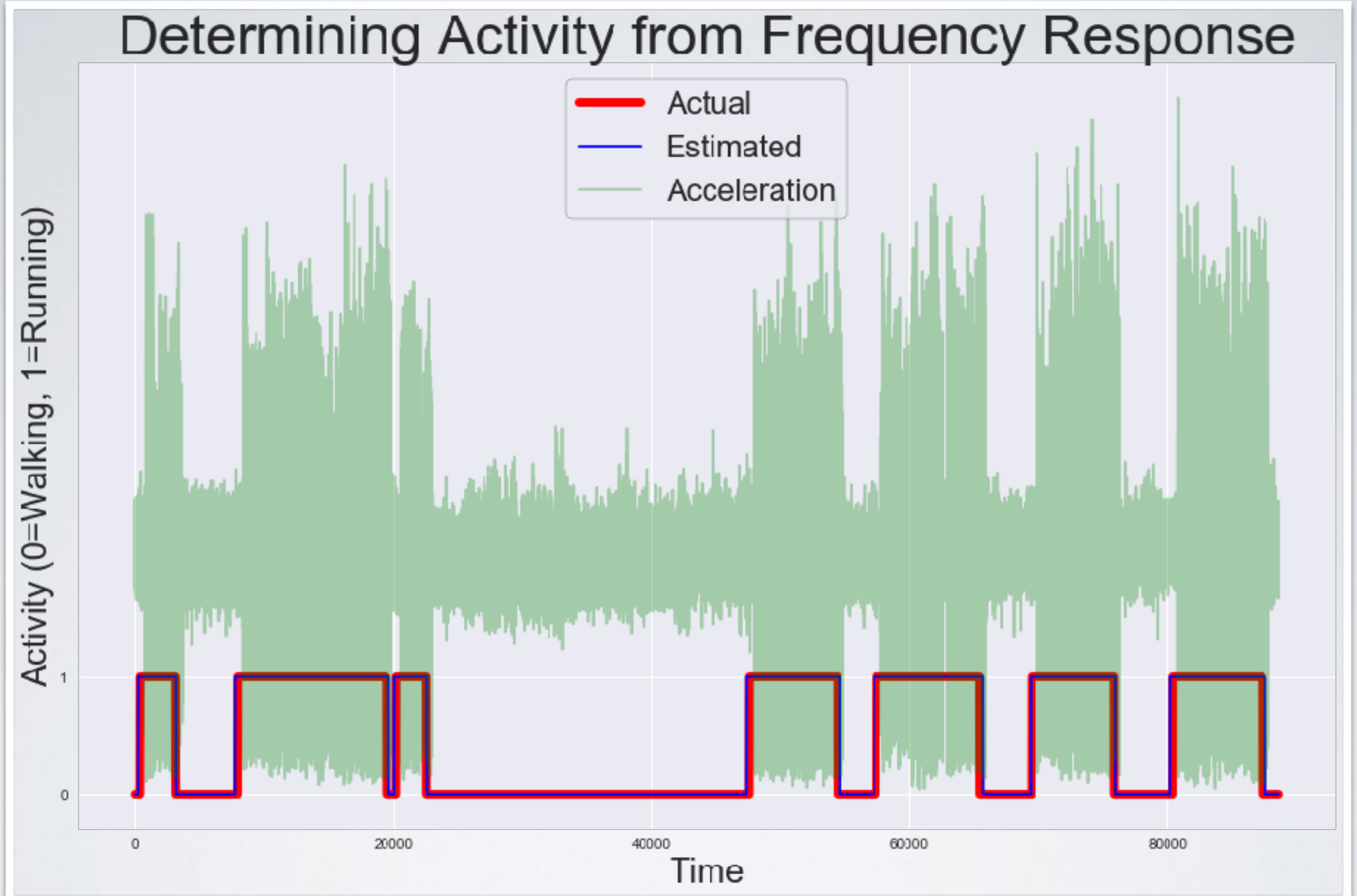
. . . **BUT** THIS IS A TIME SERIES,



and the models implemented do not necessarily take that into consideration, **SO** . . .



TIME SERIES METRICS

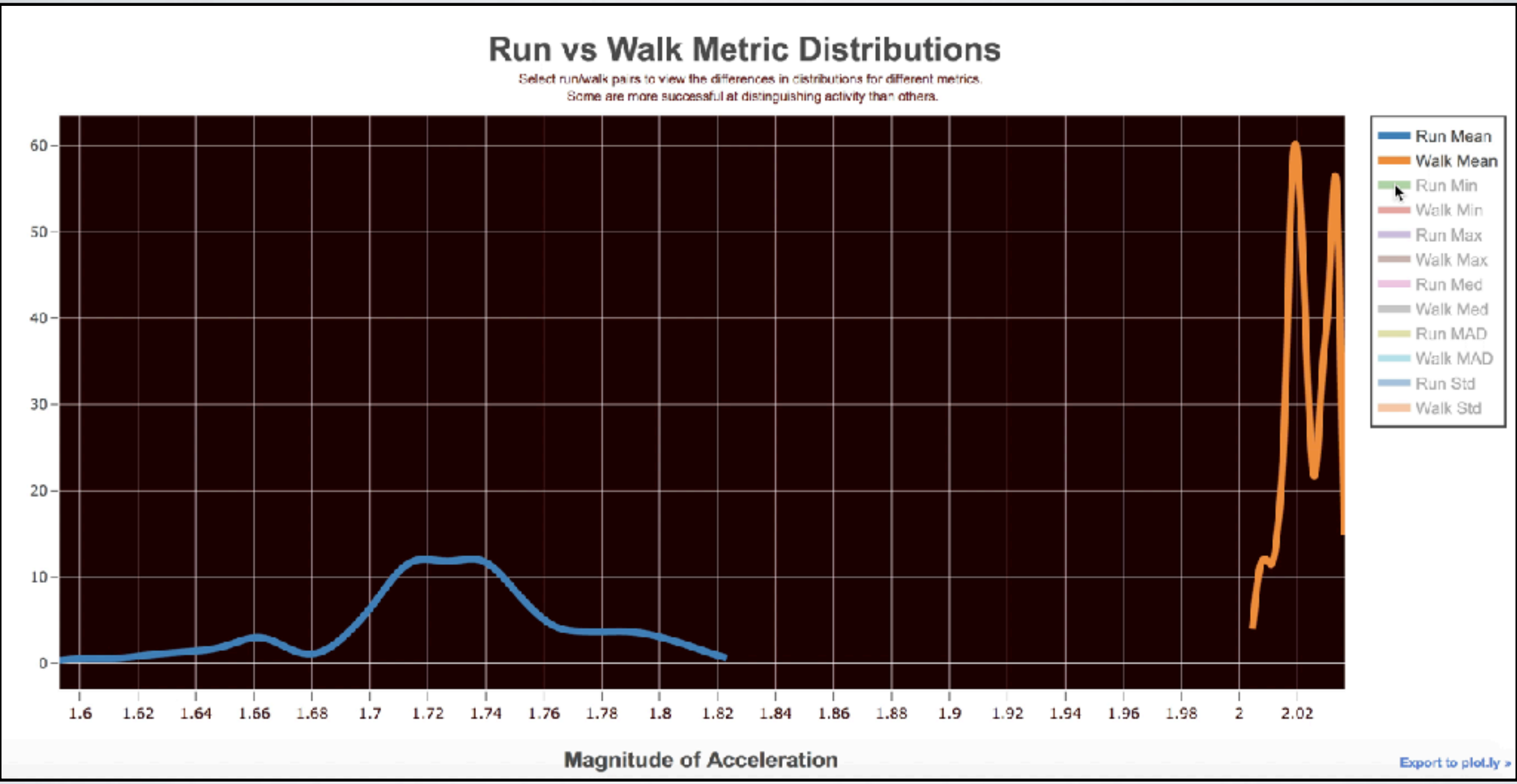


FFT IS ACCURATE…BUT COSTLY

"Everything should be made as simple as possible, but no simpler."

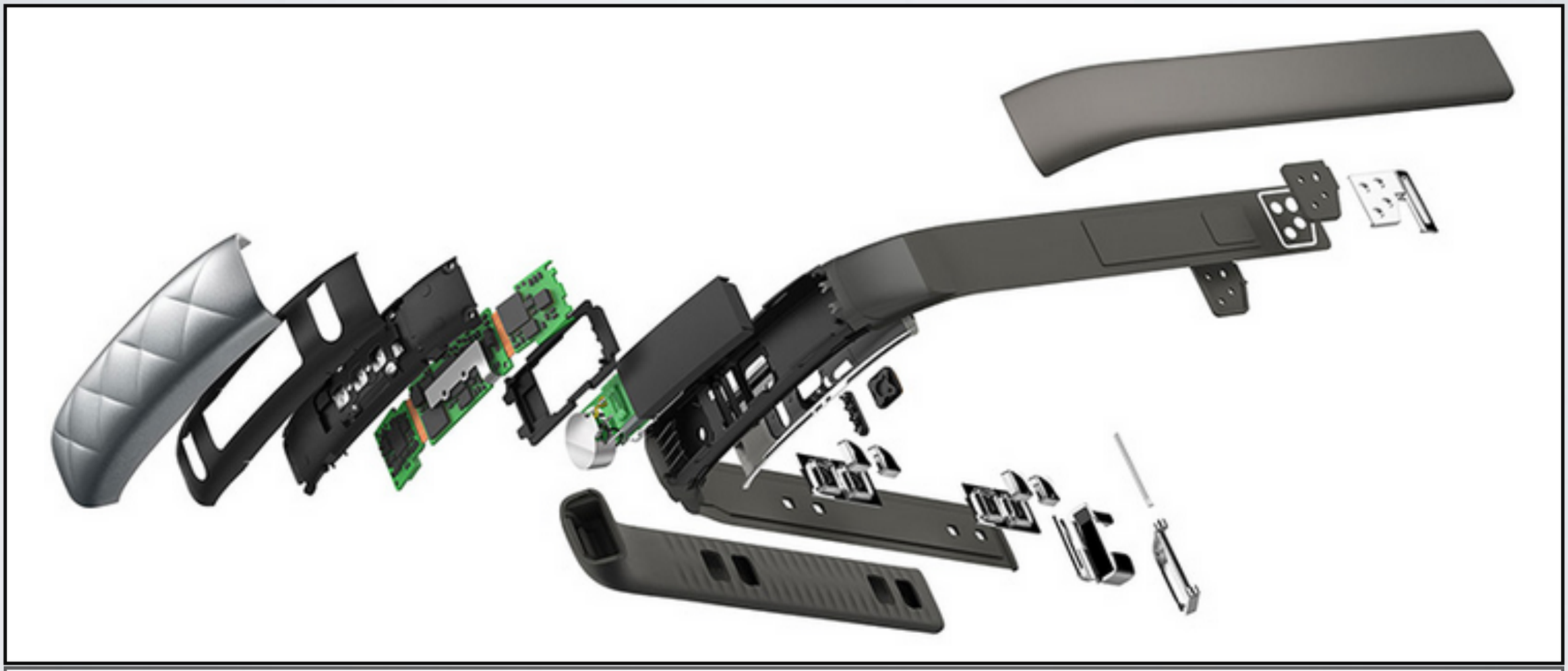
–Albert Einstein

USING SIMPLER METRICS



Mean, minimum, maximum, standard deviation, median, median absolute deviation

LOWER COMPLEXITY WORKS

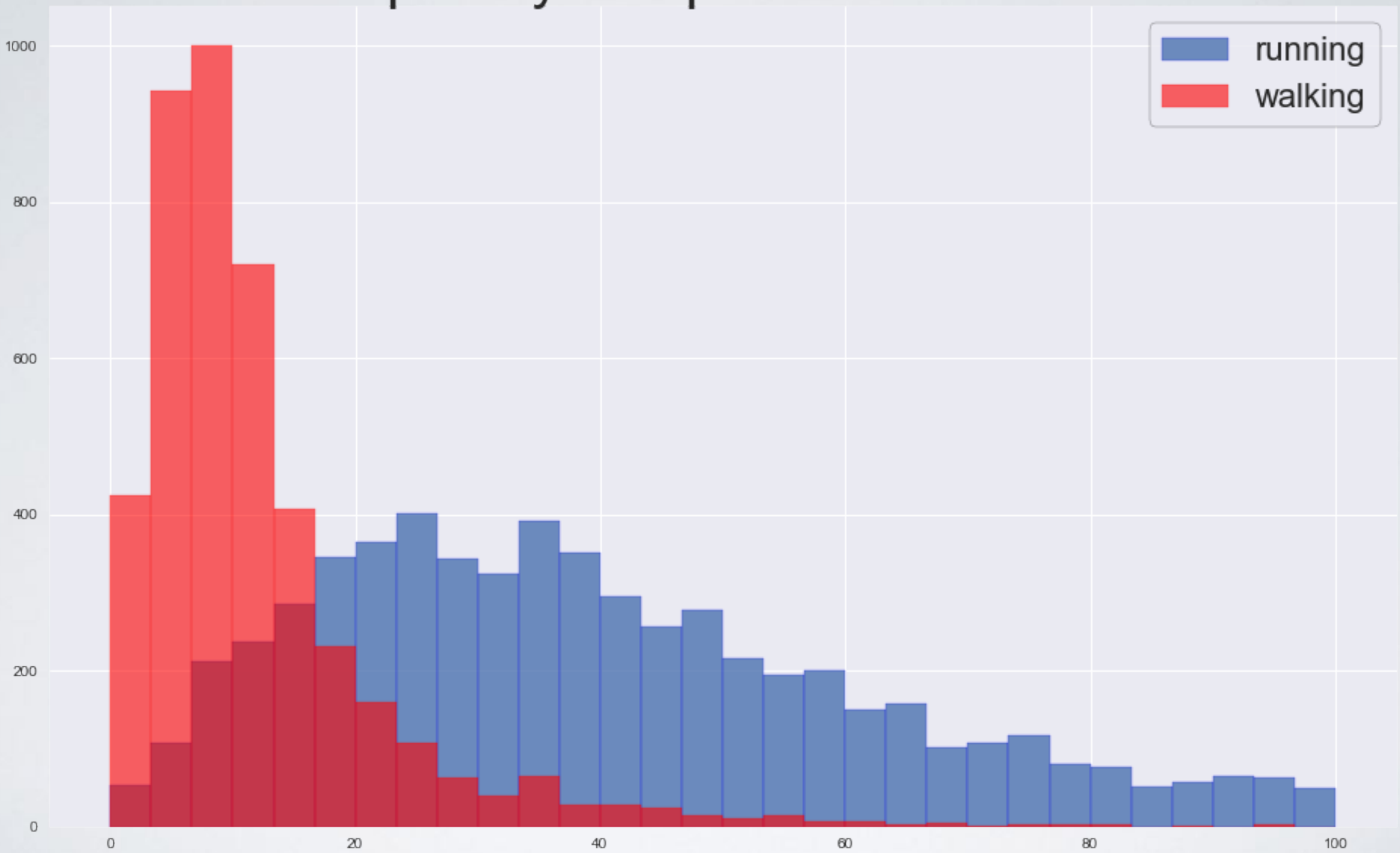


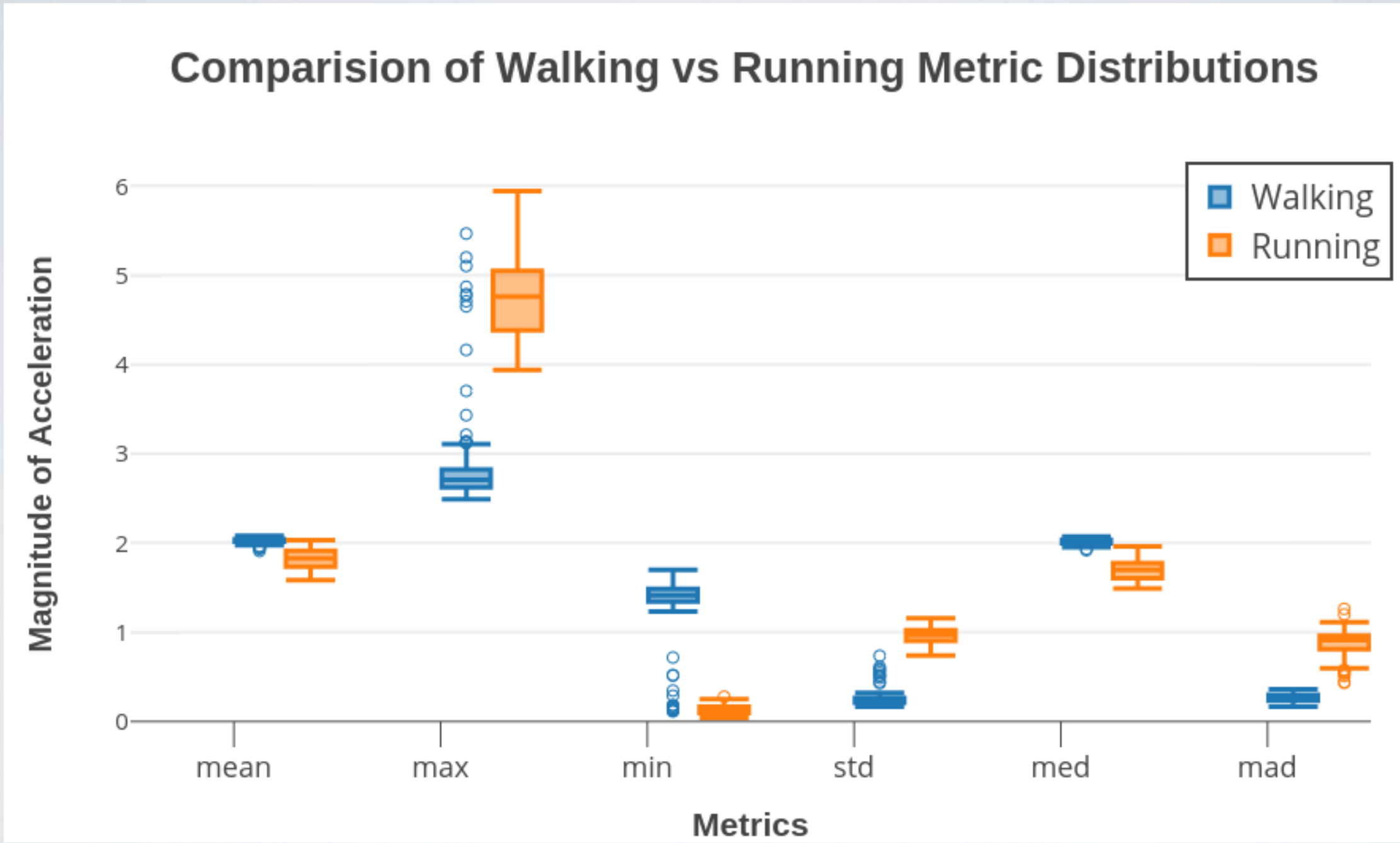
THANK YOU.

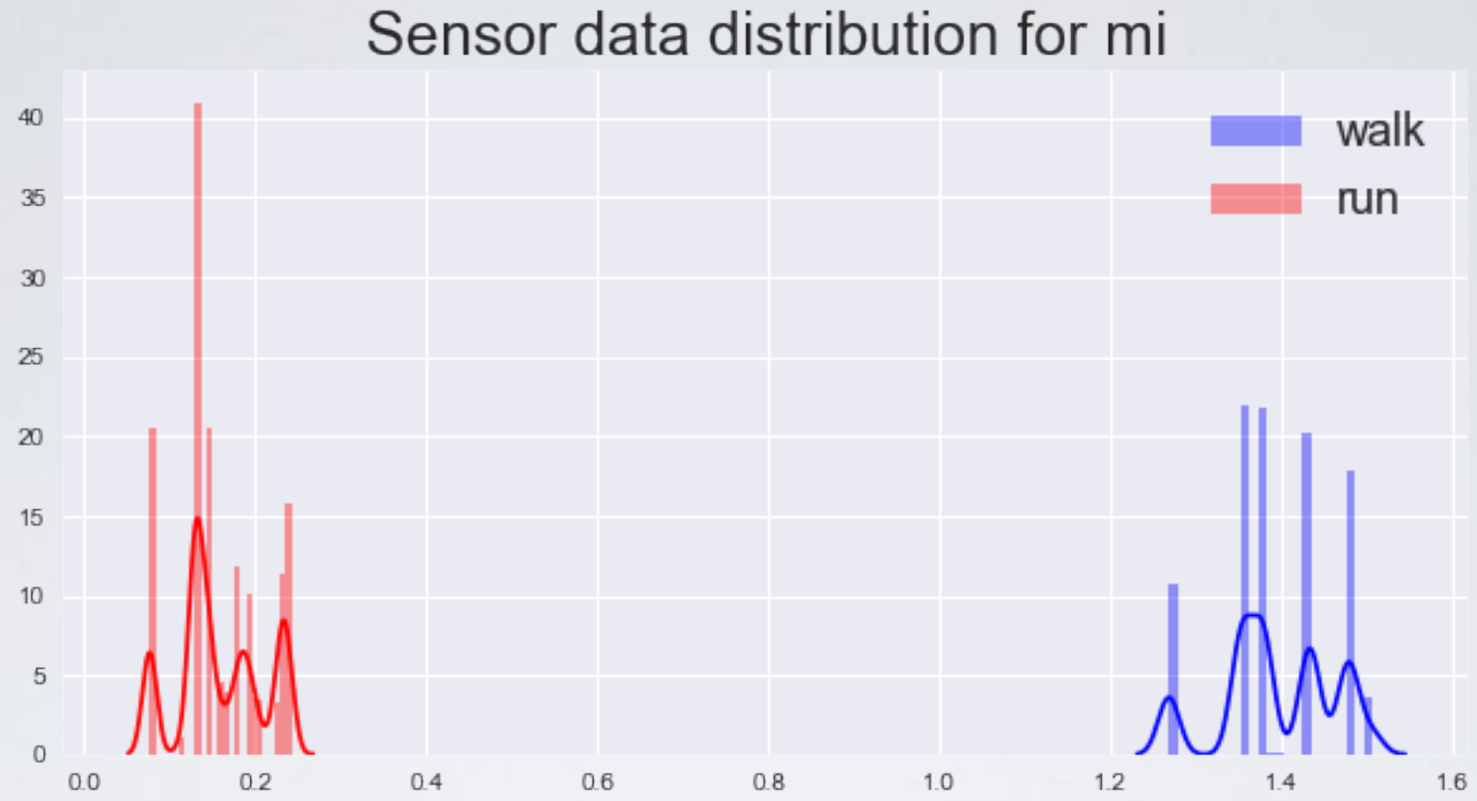
QUESTIONS?

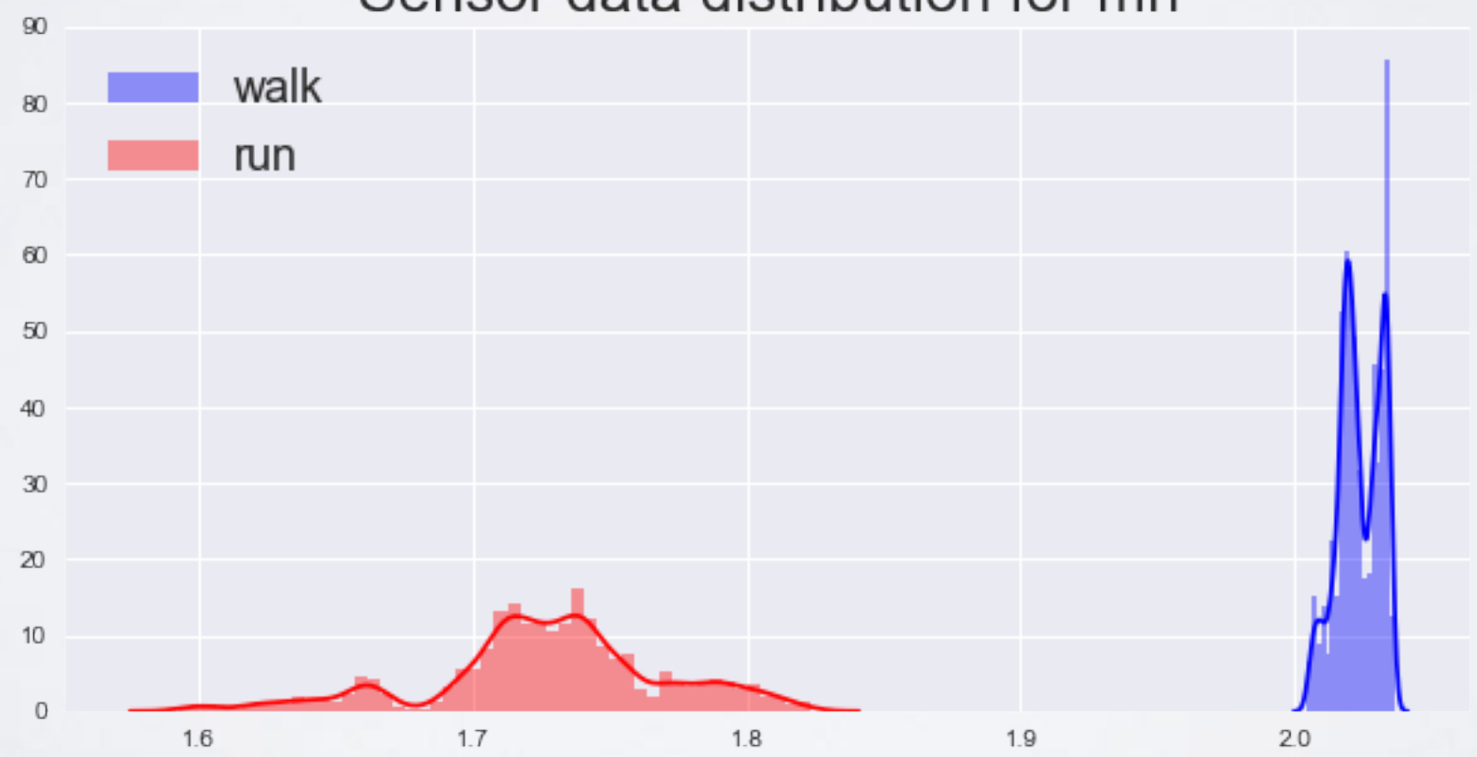
EXTRA SLIDES

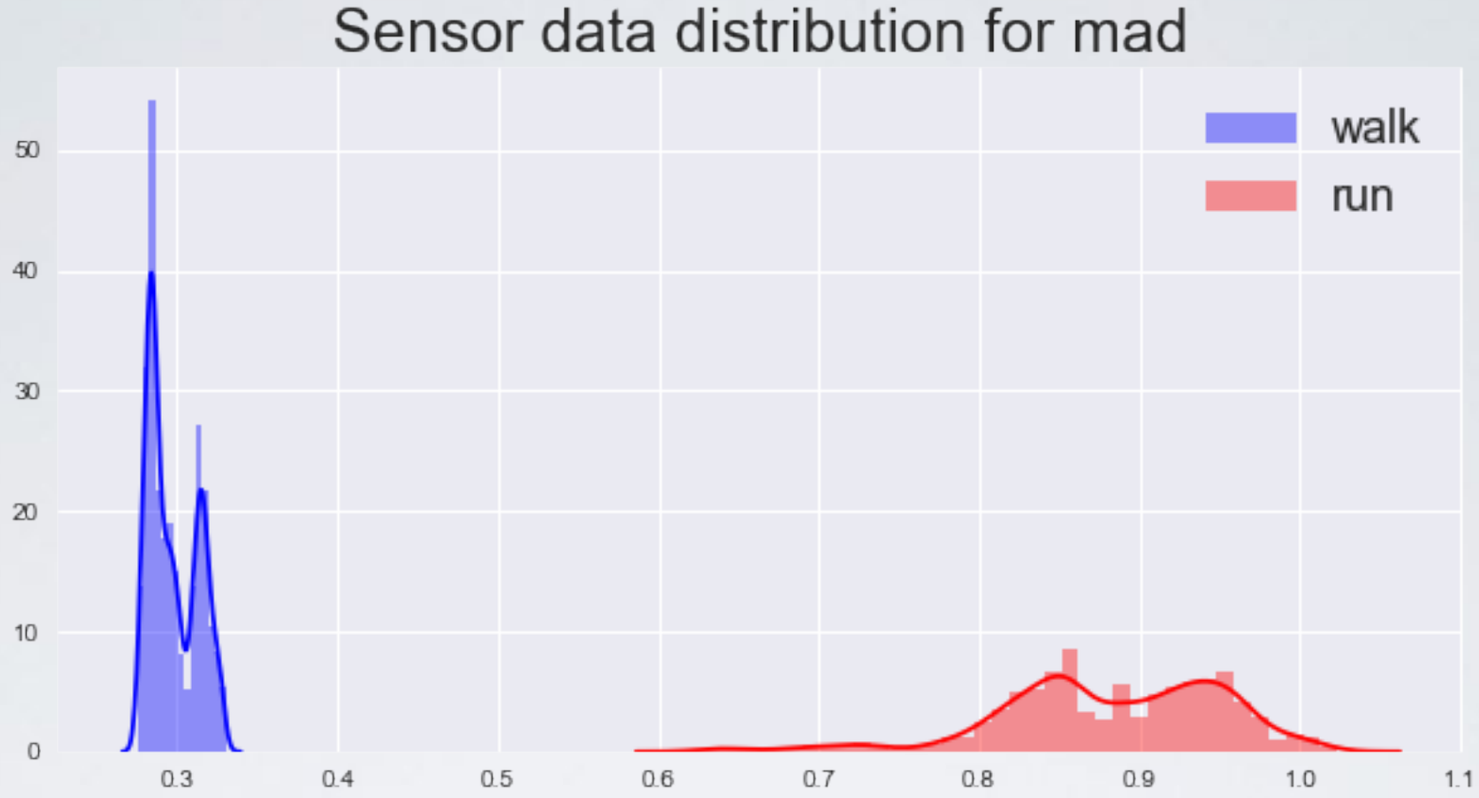
Frequency Response Distribution

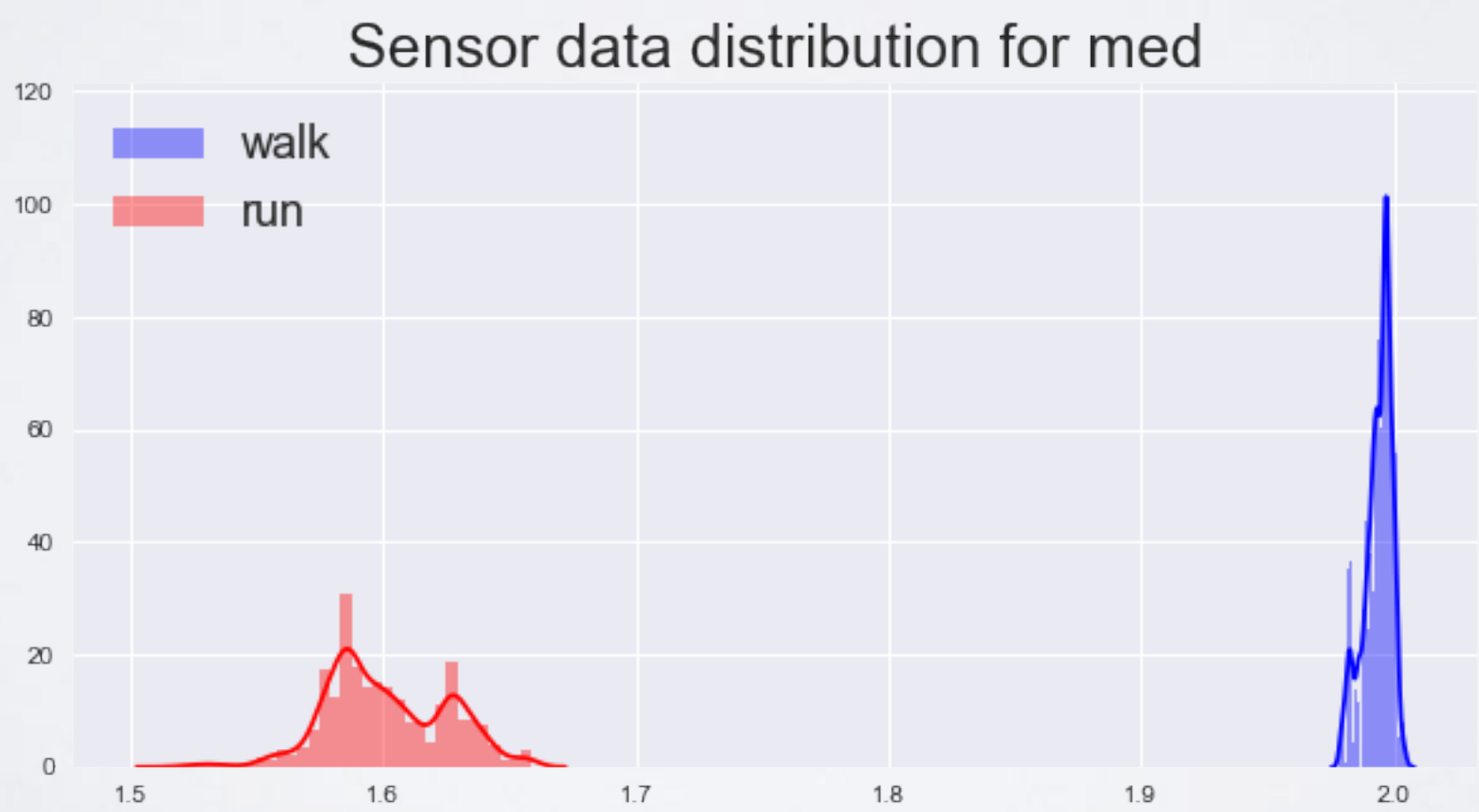


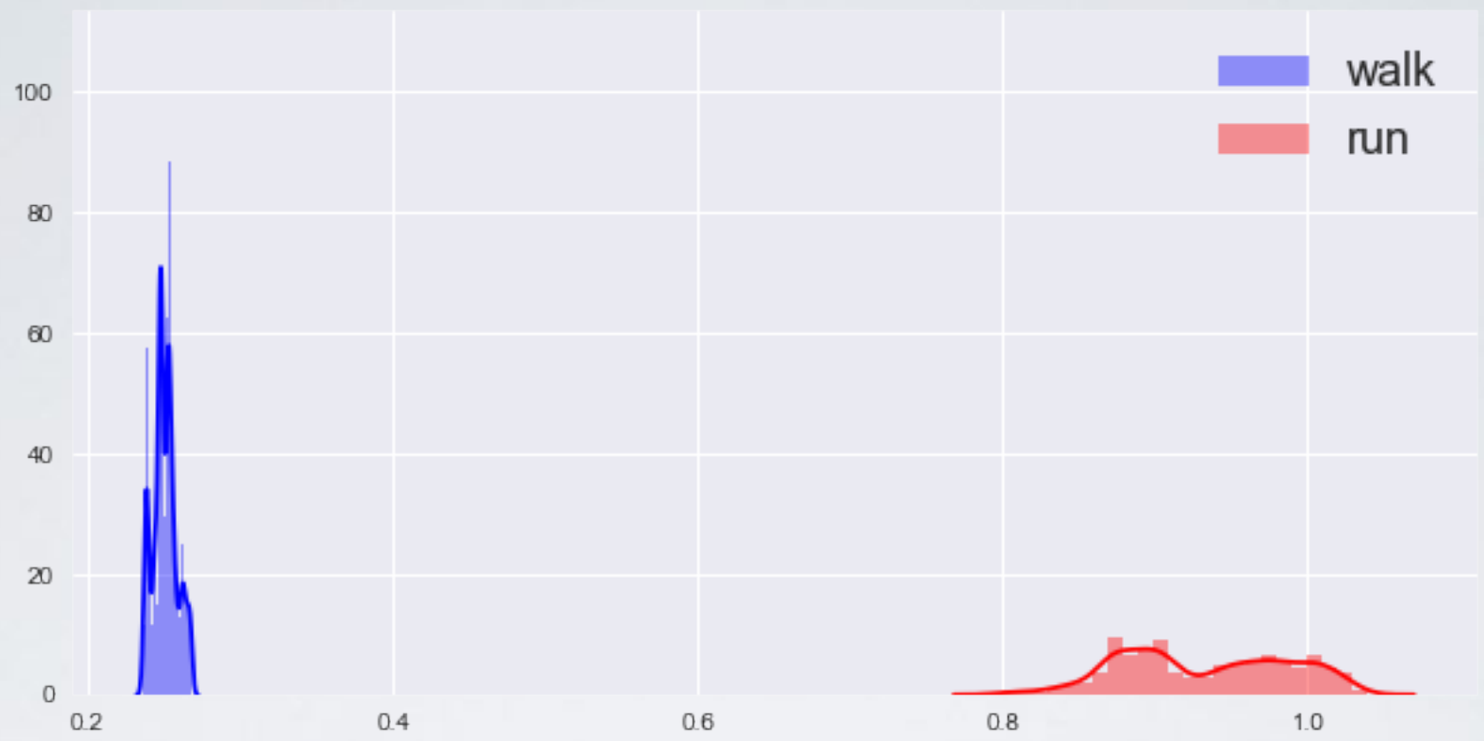

Comparision of Walking vs Running Metric Distributions
Magnitude of Acceleration
6
5
4
3
2
1
0
mean
max
min
std
med
mad
Metrics
Walking
Running

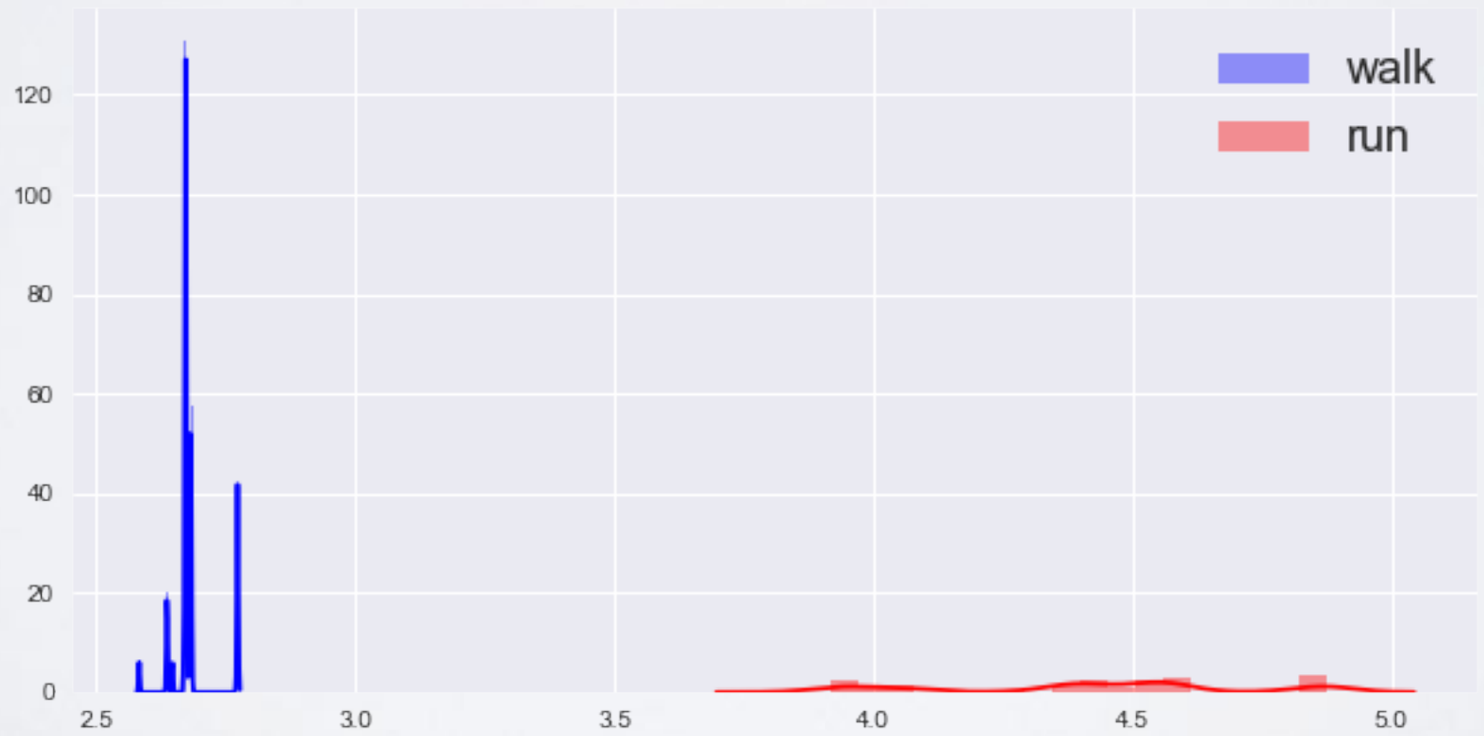

Sensor data distribution for mi
walk
run
0
5
10
15
20
25
30
35
40
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6


Sensor data distribution for mn
walk
run
0
10
20
30
40
50
60
70
80
90
1.6
1.7
1.8
1.9
2.0


Sensor data distribution for mad
walk
run
50
40
30
20
10
0
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1


Sensor data distribution for med
walk
run
120
100
80
60
40
20
0
1.5
1.6
1.7
1.8
1.9
2.0


Sensor data distribution for std
walk
run
100
80
60
40
20
0
0.2
0.4
0.6
0.8
1.0


Sensor data distribution for ma
walk
run
120
100
80
60
40
20
0
2.5
3.0
3.5
4.0
4.5
5.0

https://plot.ly/~badderc/11.embed