Exploratory Data Analysis

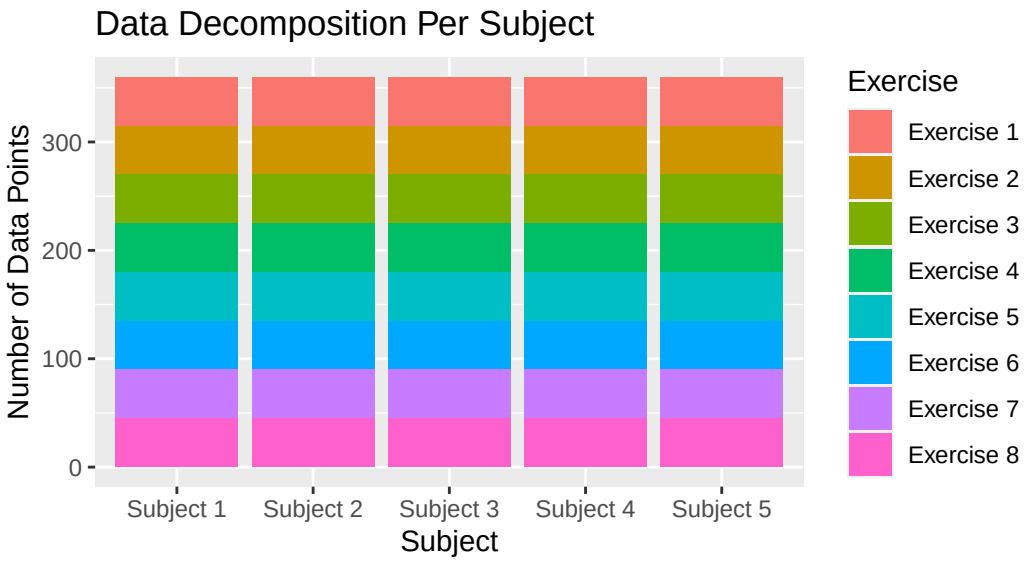
Data Structure

We have data from 5 subjects. In the study each subject performs 8 different exercises while wearing 5 motion sensors on different parts of their body. Each sensor takes 9 measurements while the subject is performing the exercise. In all directions (x, y, and z) the sensor calculates the acceleration ($\frac{\text{meters}}{\text{second}^2}$), angular rate ($\frac{\text{radians}}{\text{second}}$), and magnetic field (relative).

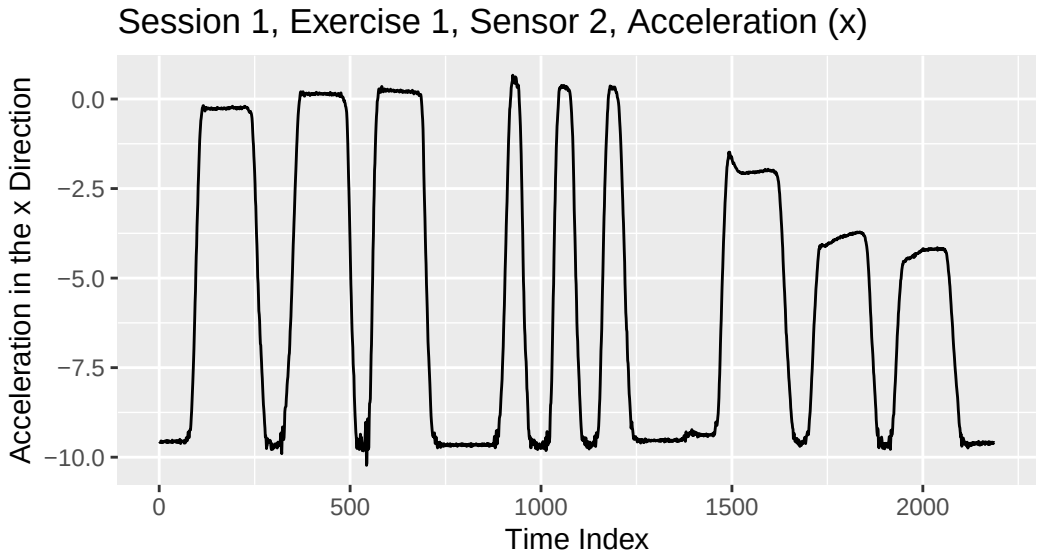
$$5 \text{ subjects } \times 8 \text{ exercises } \times 5 \text{ motion sensors } \times 9 \text{ measurements } = 1800 \text{ total data points}$$

$$8 \text{ exercises } \times 5 \text{ motion sensors } \times 9 \text{ measurements } = 360 \text{ data points per subject}$$

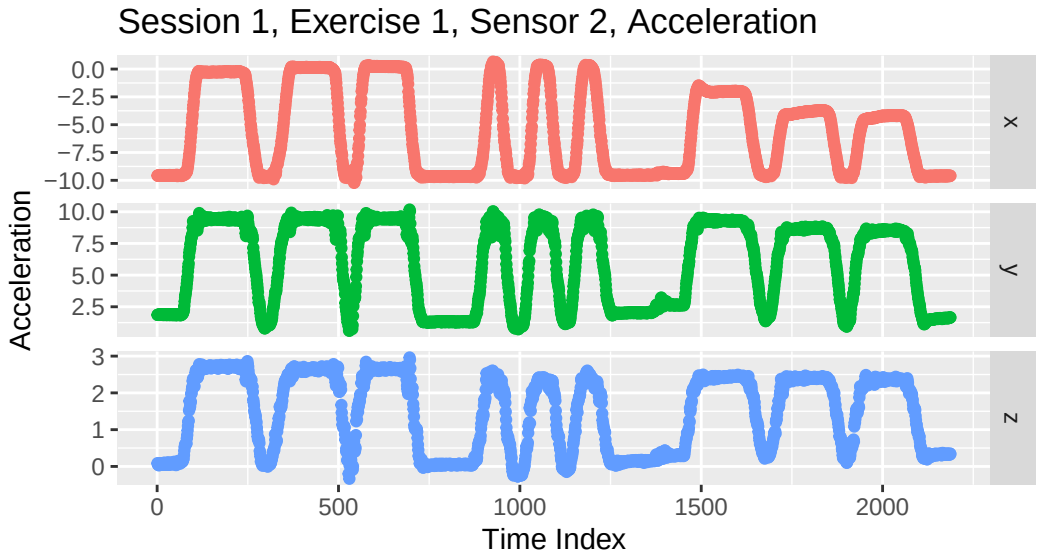
$$5 \text{ motion sensors } \times \text{ 9 measurements } = 45 \text{ data points per exercise}$$

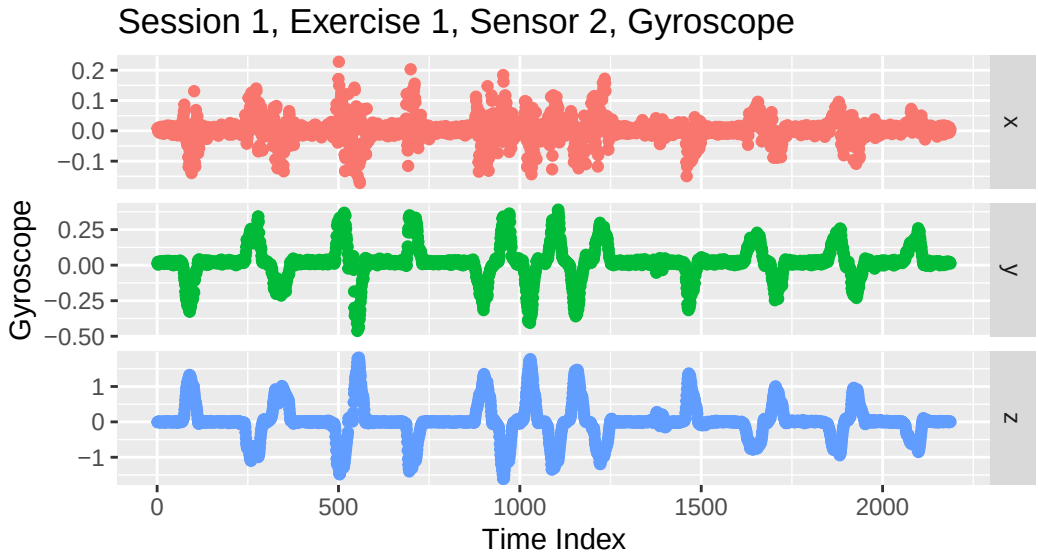


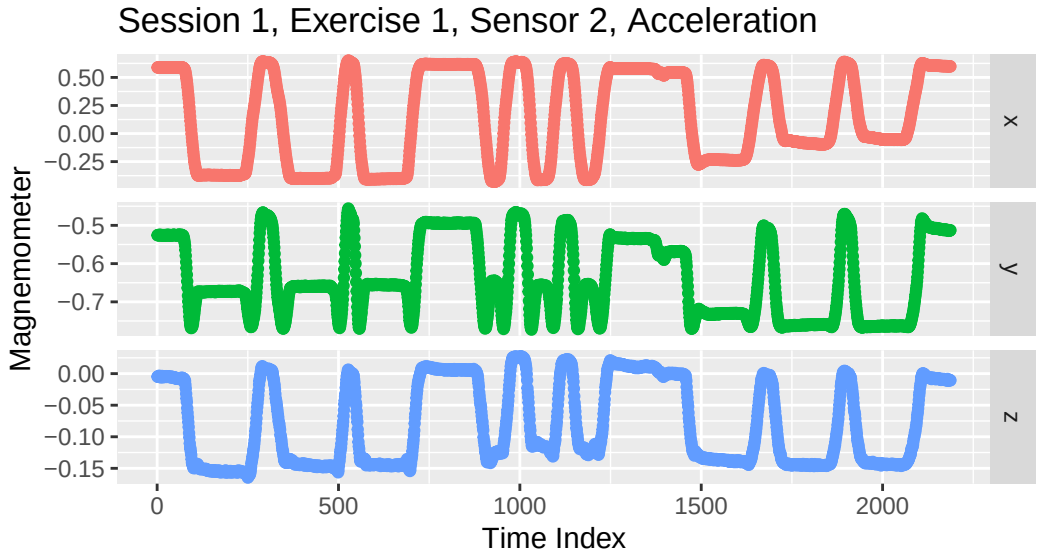
In our case, each data point is a time series of observations. The following is a single data point that represents acceleration in the x direction ($\frac{\text{meters}}{\text{second}^2}$).



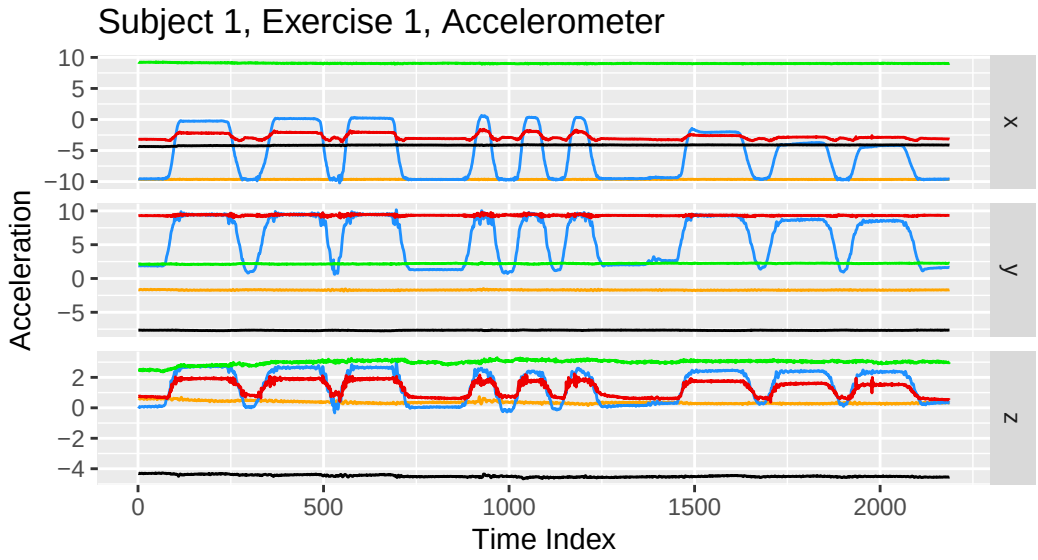
We can visualize a all of the measurements a sensor gives us:

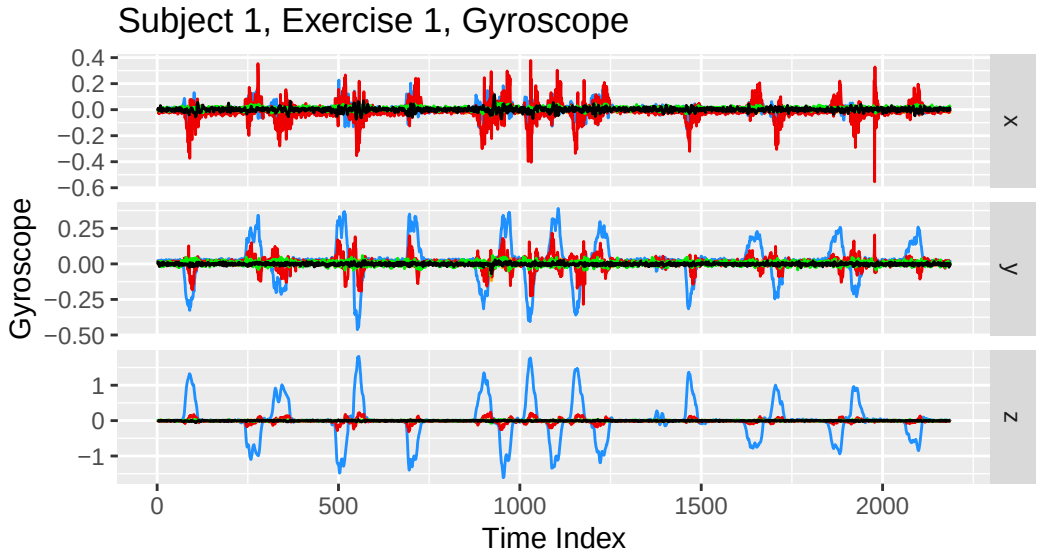


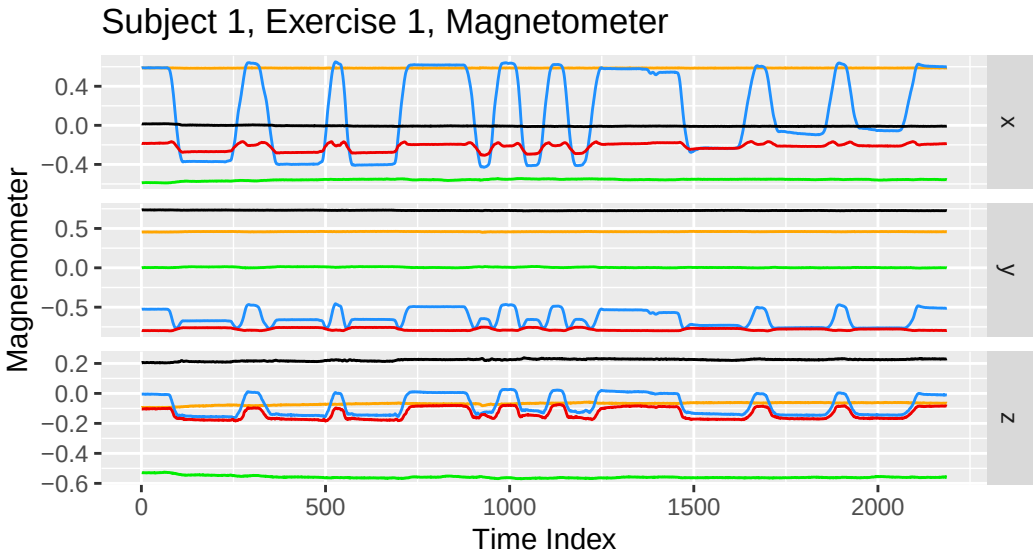




We can also visualize all of the data from a specific session and exercise:


Subject 1, Exercise 1, Accelerometer
Acceleration
10
5
0
−5
−10
x
y
z
2
−2
−4
0
500
1000
1500
2000
Time Index


Subject 1, Exercise 1, Gyroscope
Gyroscope
0.4
0.2
0.0
−0.2
−0.4
−0.6
x
0.25
0.00
−0.25
−0.50
y
1
0
−1
z
0
500
1000
1500
2000
Time Index


Subject 1, Exercise 1, Magnetometer
Magnemometer
0.4
0.0
−0.4
0.5
0.0
−0.5
0.2
0.0
−0.2
−0.4
−0.6
x
y
z
0
500
1000
1500
2000
Time Index