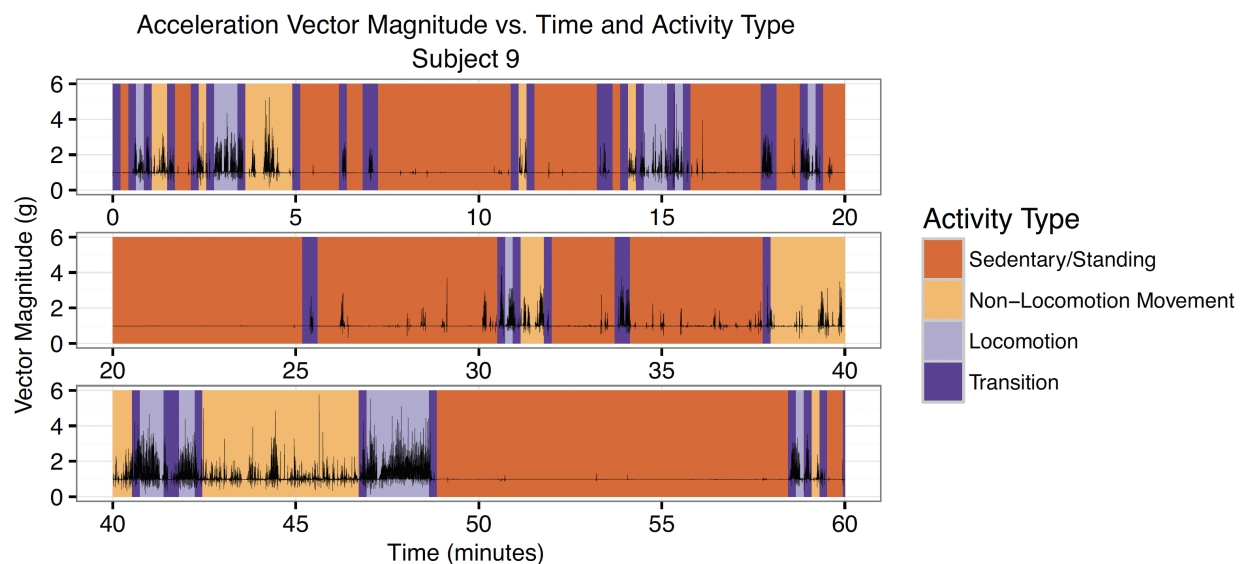# Stat 340: Intro. to Classification and Logistic Regression

Motivating Examples

Data Set 1: Classifying Physical Activity from Acclerometer Data

(Think fitbits)

Acceleration Vector Magnitude vs. Time and Activity Type
Subject 9

In each 10-second window of time, extract a variety of summaries of the accelerometer signal during that window.

$$Y_i = j \text{ if subject was engaged in activity type } j \text{ at time window indexed by } i$$
$$X_{i1} = \text{mean acceleration in X axis at time window } i$$
$$X_{i2} = \text{mean acceleration in Y axis at time window } i$$
$$\vdots$$
$$X_{i77} = \text{variance of acceleration in Z axis during time window } i$$

$J = 4$ classes in this example

Accelerometer Signal Feature Pair Plots

Accelerometer on the Wrist, Free Living Data from Sasaki et al. [2016]
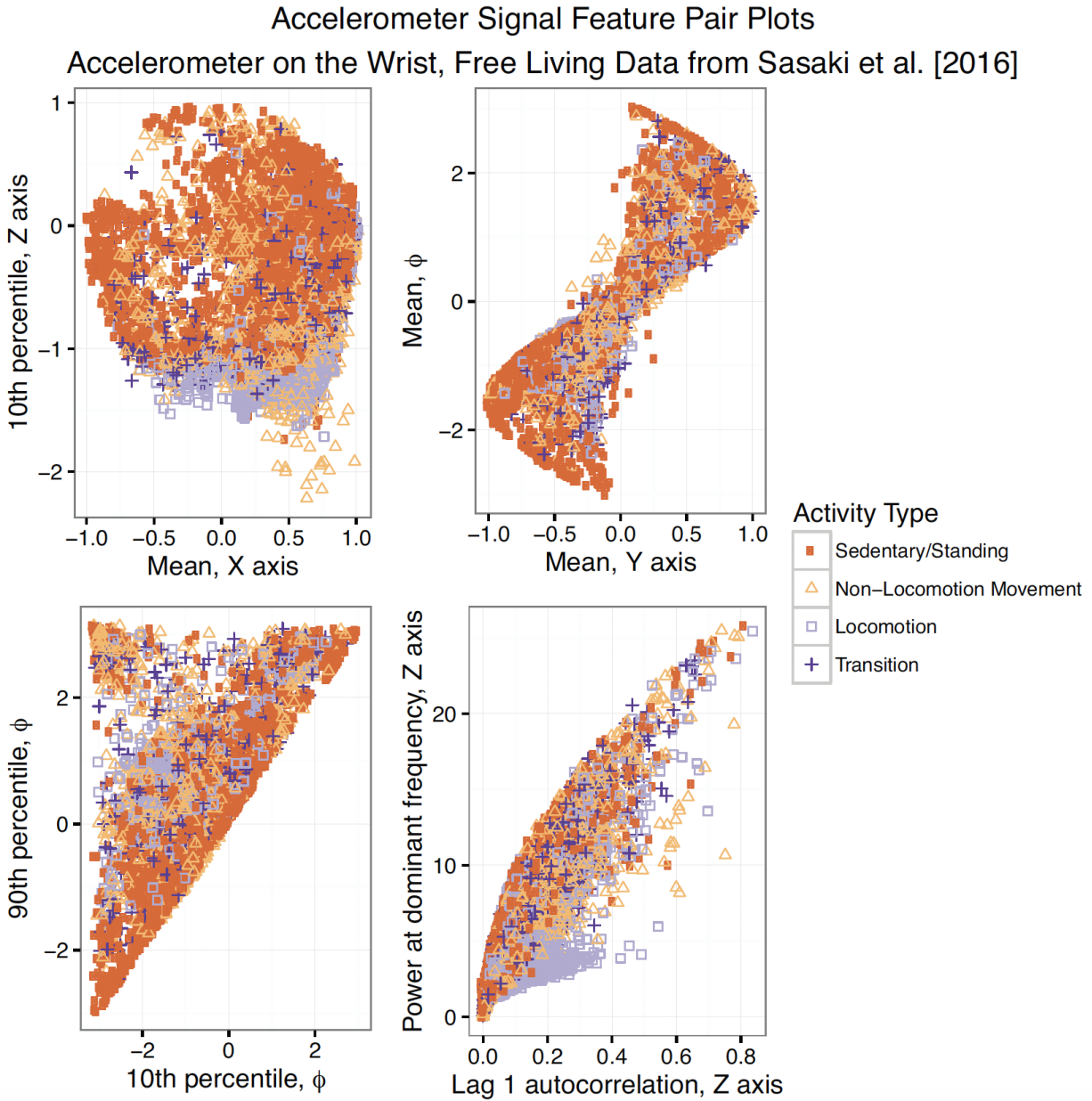
Goal: specify a statistical model to classify physical activity type (predict Y) from accelerometer data?

Data Set 2: Challenger Space Shuttle O-Rings

On January 28, 1986, the American space shuttle Challenger exploded 73 seconds into flight; all seven crew members on board died. It was later determined that the cause of the explosion was a failure in a joint in one of the booster rockets that launched the shuttle. The failure was due to damage to an O-ring that was used to seal the joint.

Can we predict probability of damage to an O-ring given the temperature on the morning of the launch?

$$Y_i = \begin{cases} 1 & \text{if there was evidence of damage to on O-ring on launch number } i \\ 0 & \text{otherwise} \end{cases}$$

$$X_i = \text{ temperature at launch for launch number } i$$
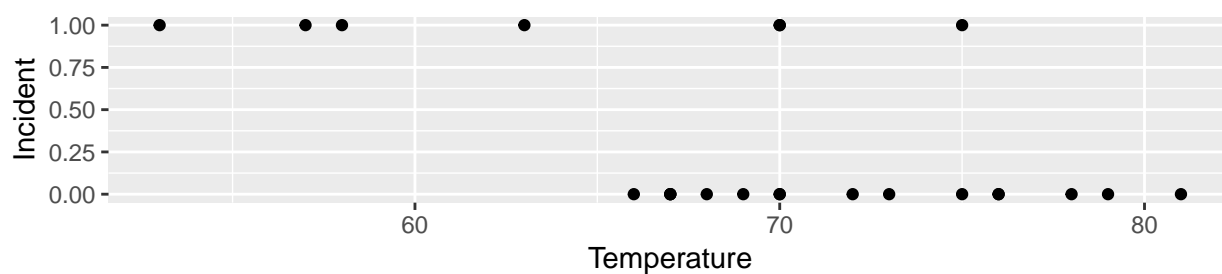
With $J = 2$ classes, it's common to code them as 0 and 1 instead of 1 and 2.