

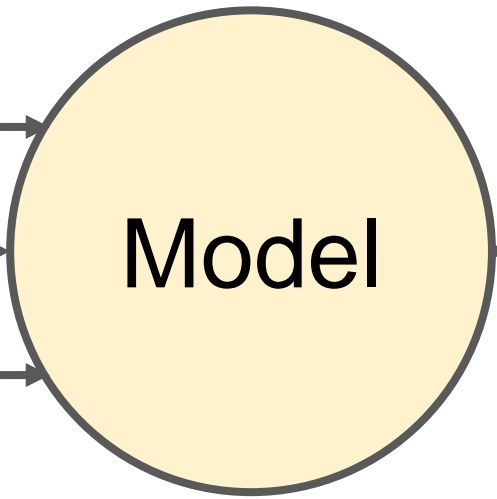
Feature: Individual measurable property or characteristic of a phenomenon being observed

Feature Example



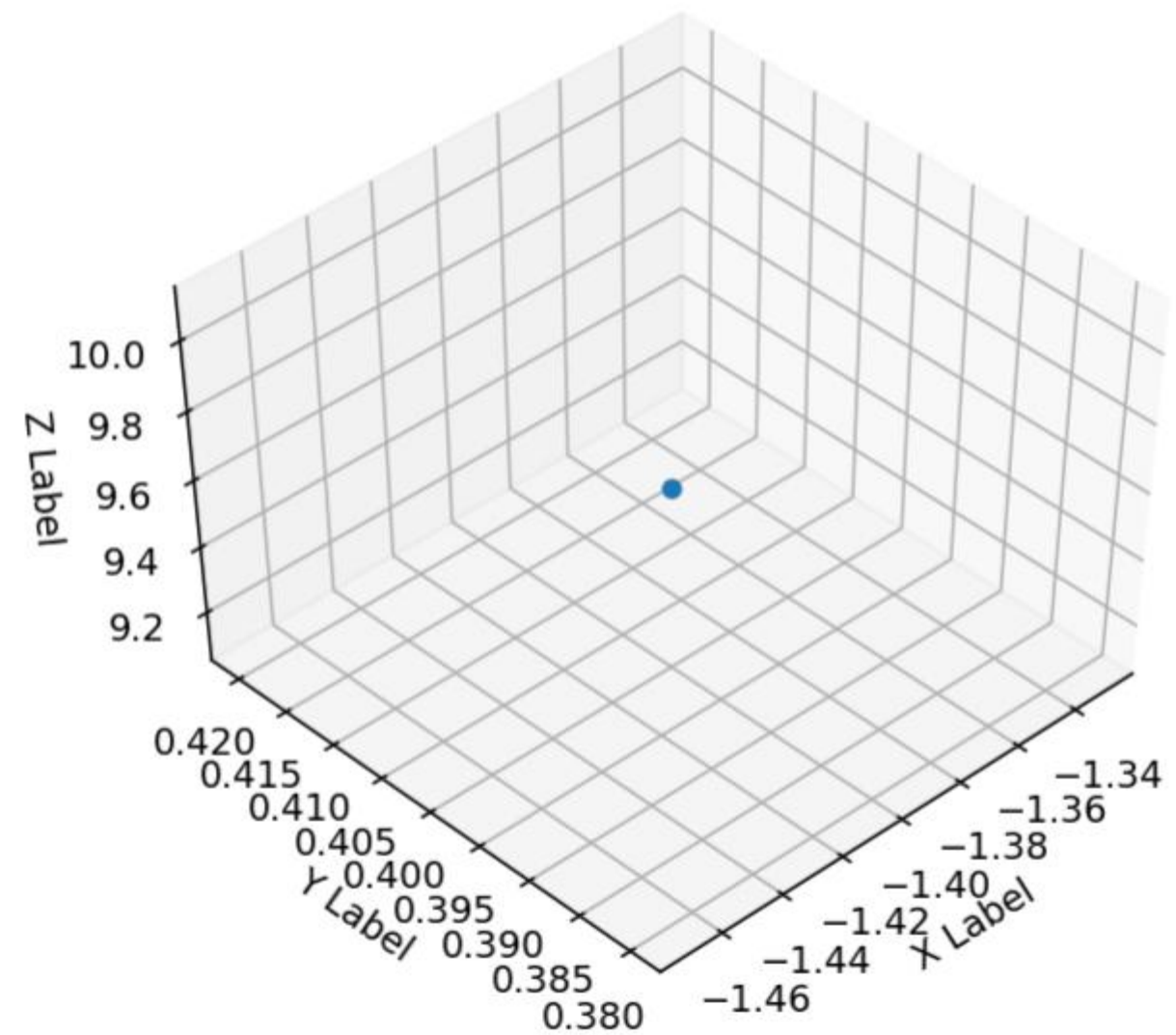
Acceleration (m/s²)

x	-1.4
y	0.4
z	9.6

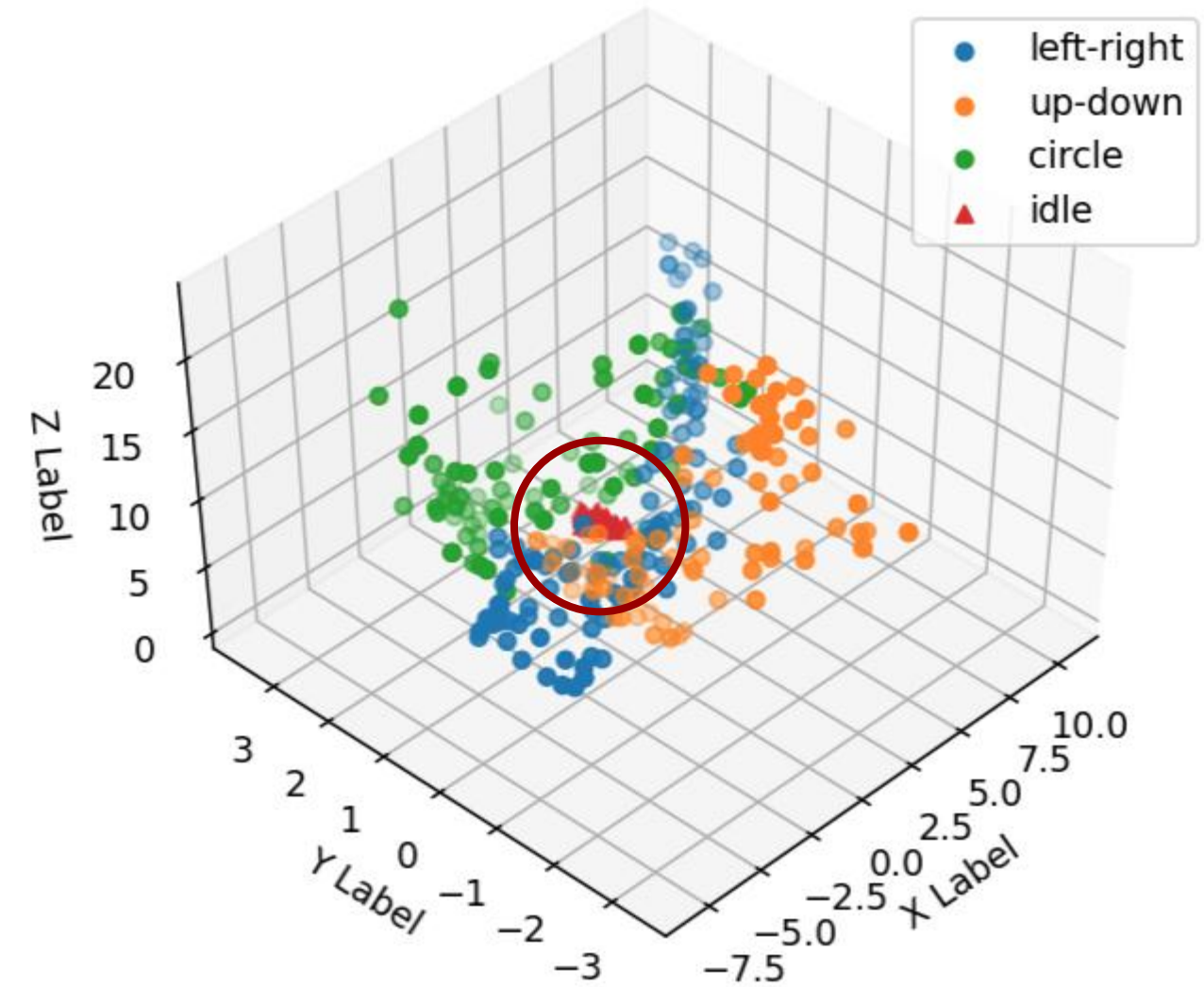


- Left-right
- Up-down
- Circle
- Idle

1 (x, y, z) accelerometer point
from “left-right” sample



Many (x, y, z) accelerometer
points from all classes



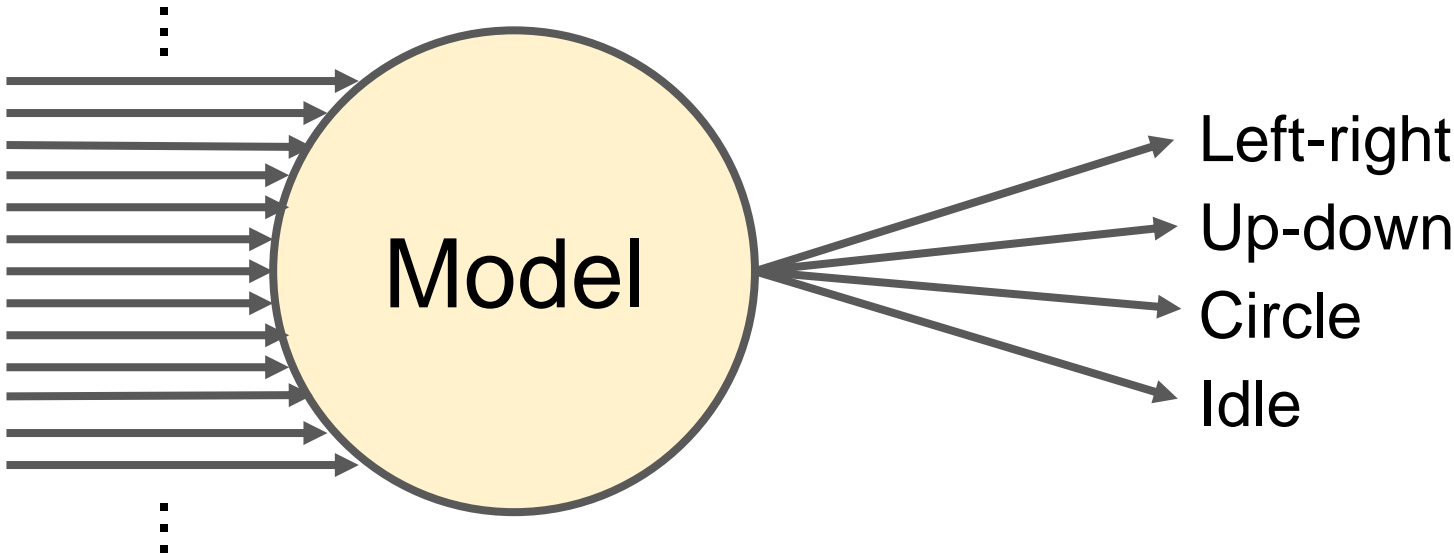
Feature Example



Acceleration (m/s²)

x	-1.4	-1.4	-2.8	-3.4	-4.0	...
y	0.4	0.4	0.1	0.2	0.3	...
z	9.6	9.6	9.9	9.7	9.8	...

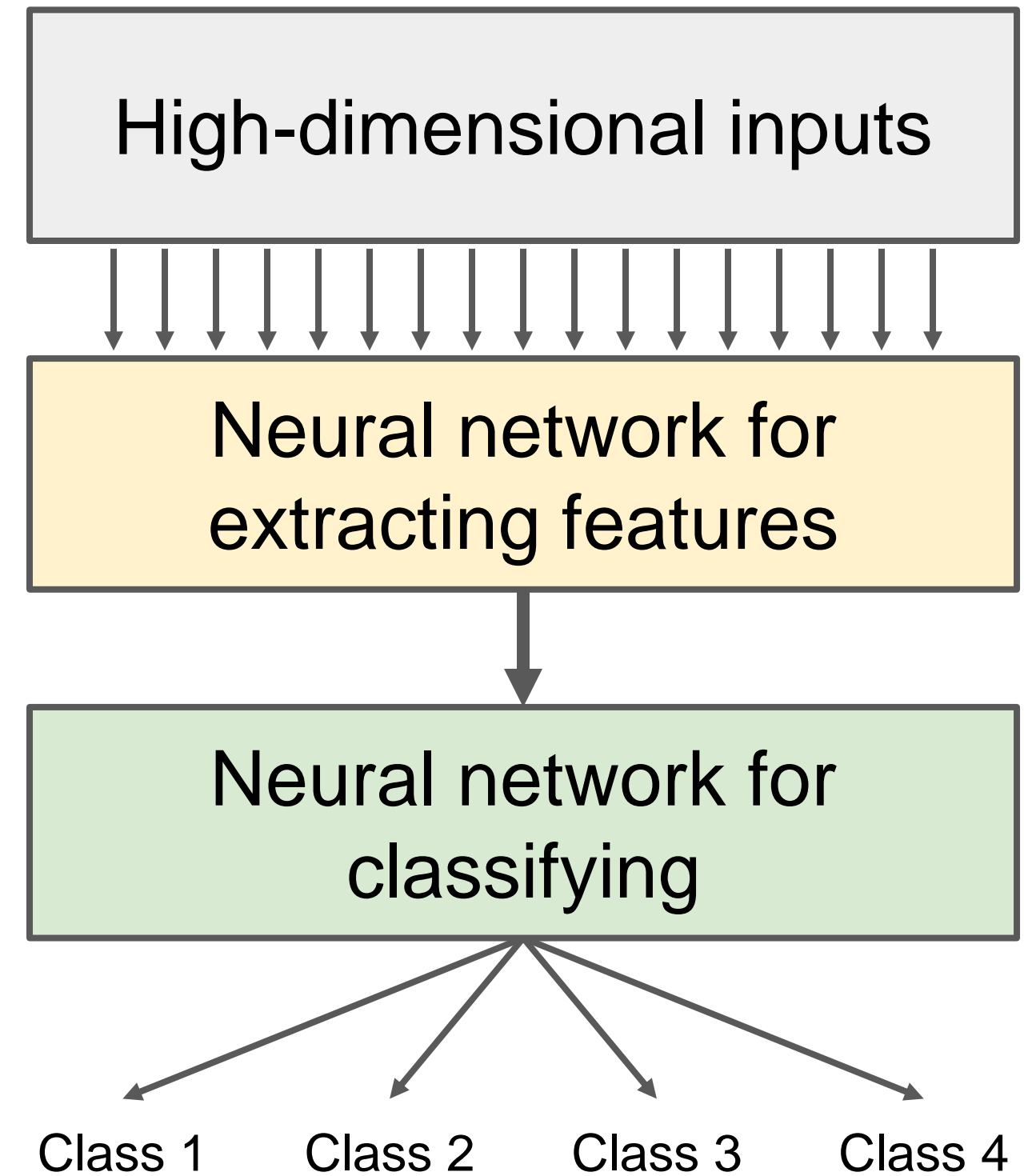
125 samples for each axis



375 total inputs to the model!

Problems with deep learning

1. Computational complexity
2. Requires lots of training data



Feature Example



Acceleration (m/s²)

x	-1.4	-1.4	-2.8	-3.4	-4.0
y	0.4	0.4	0.1	0.2	0.3
z	9.6	9.6	9.9	9.7	9.8

375 raw values

Feature extraction:

Calculate RMS for each axis

$$x_{\text{RMS}} = 5.7 \text{ m/s}^2 \text{ (RMS)}$$
$$y_{\text{RMS}} = 1.2 \text{ m/s}^2 \text{ (RMS)}$$
$$z_{\text{RMS}} = 9.9 \text{ m/s}^2 \text{ (RMS)}$$

3 model input values

Model

- Left-right

- Up-down

► Circle

Idle

X Axis

accX RMS



Y Axis

accY RMS

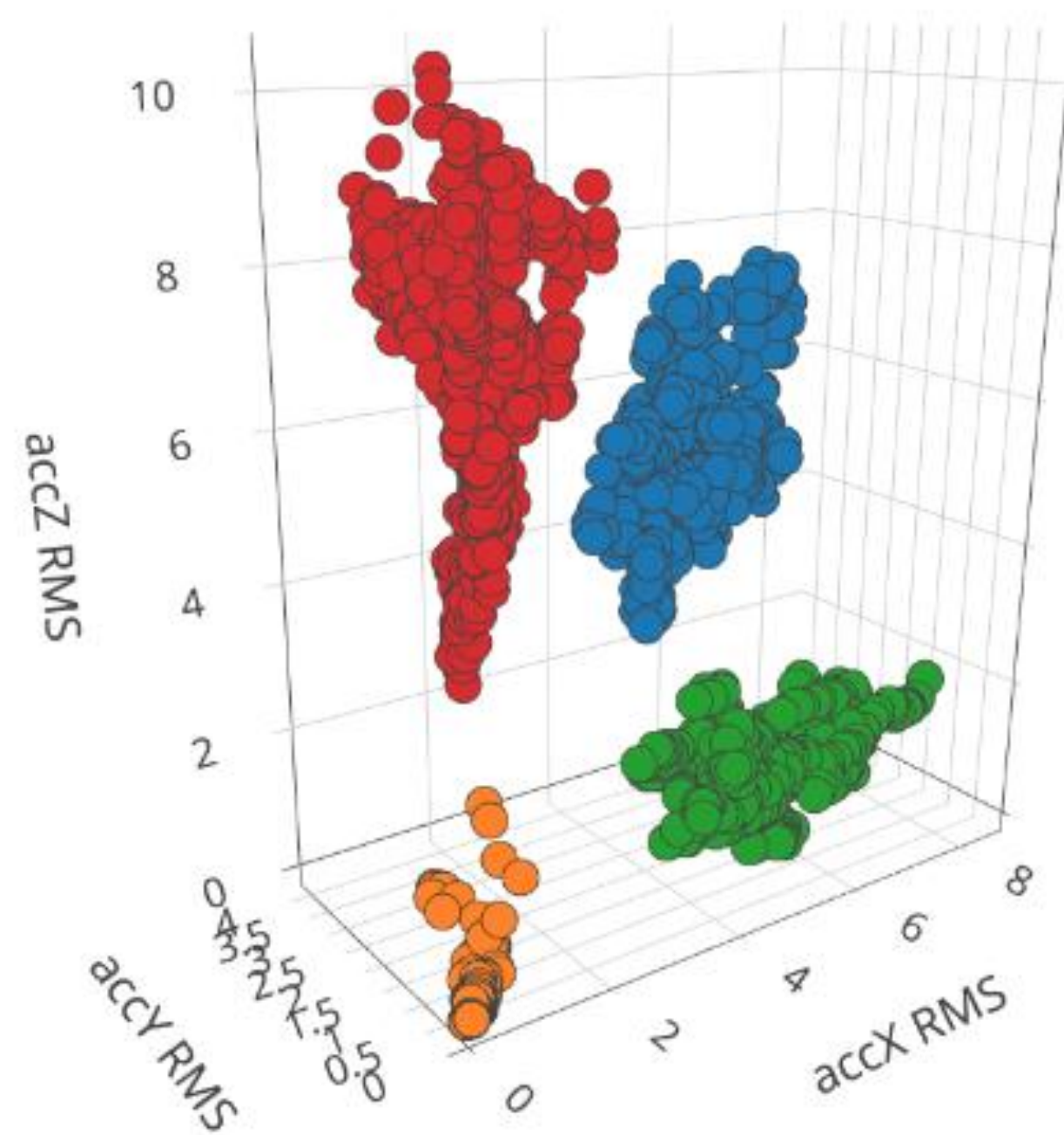


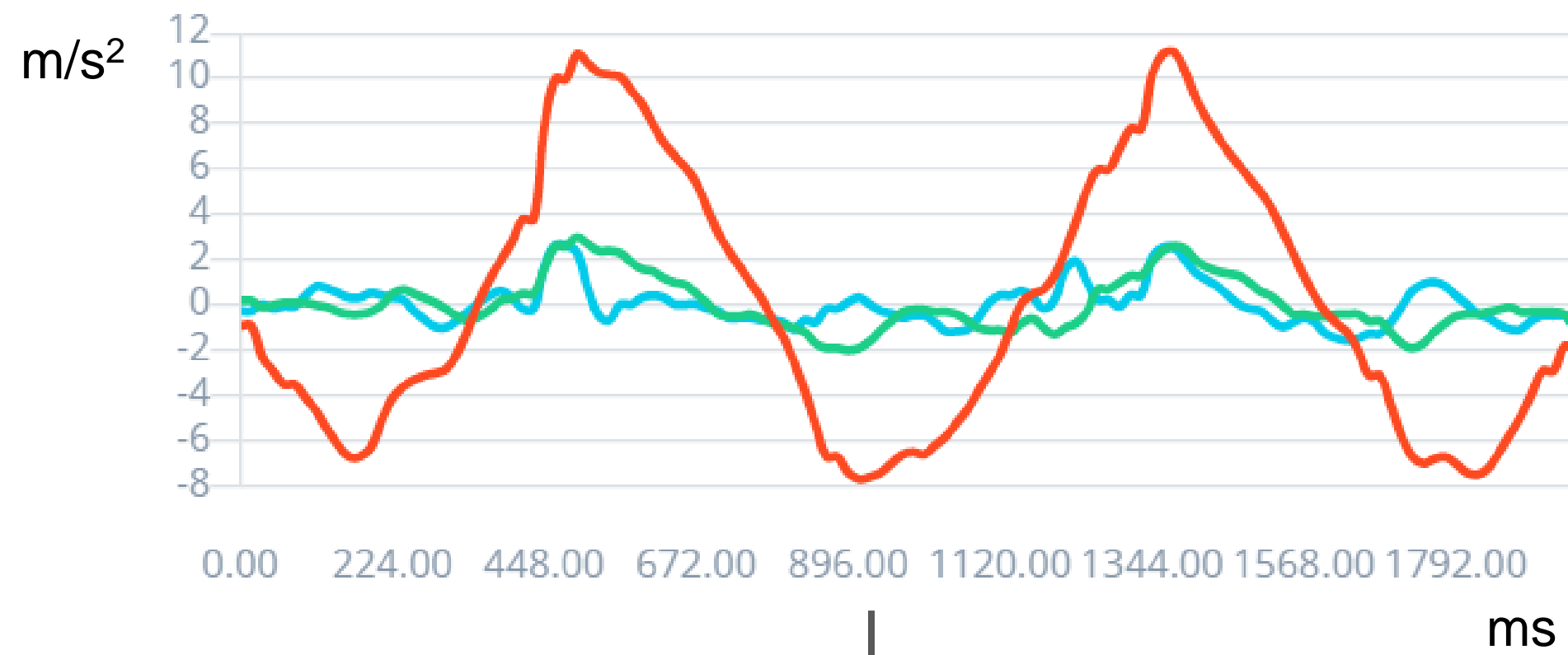
Z Axis

accZ RMS

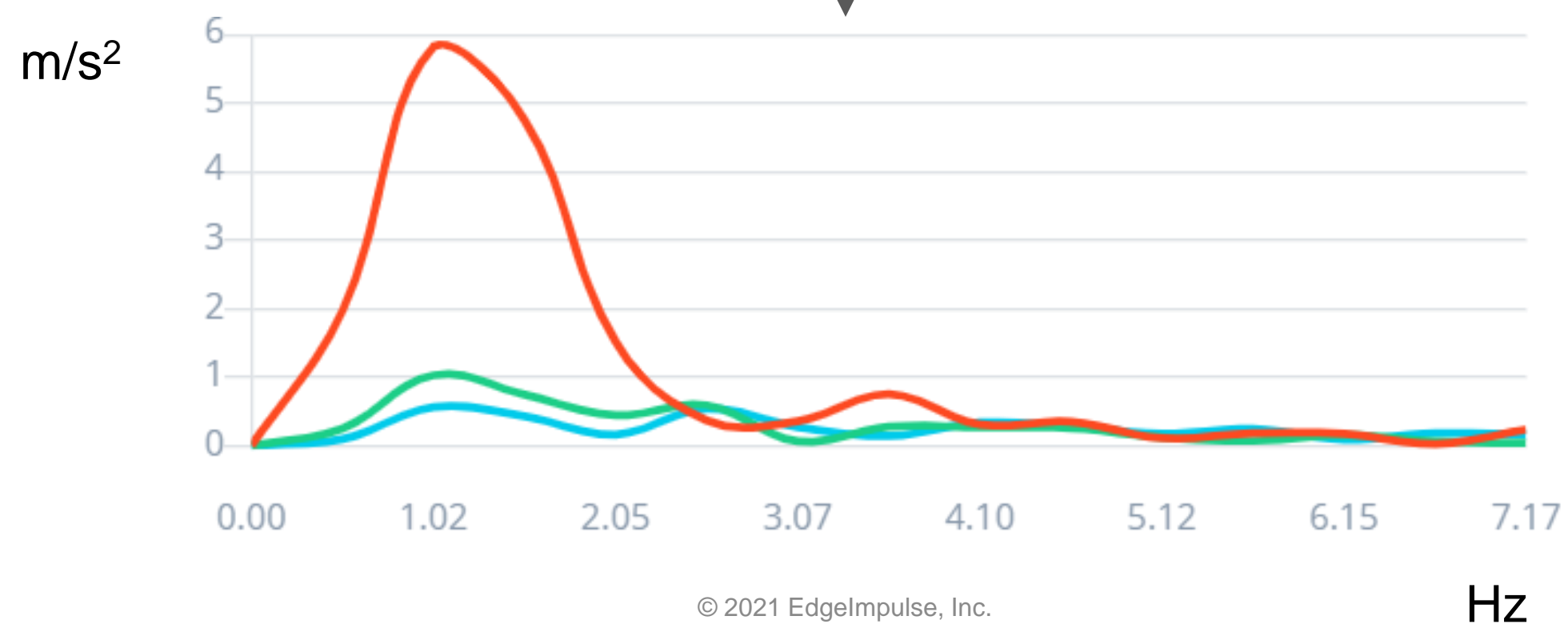


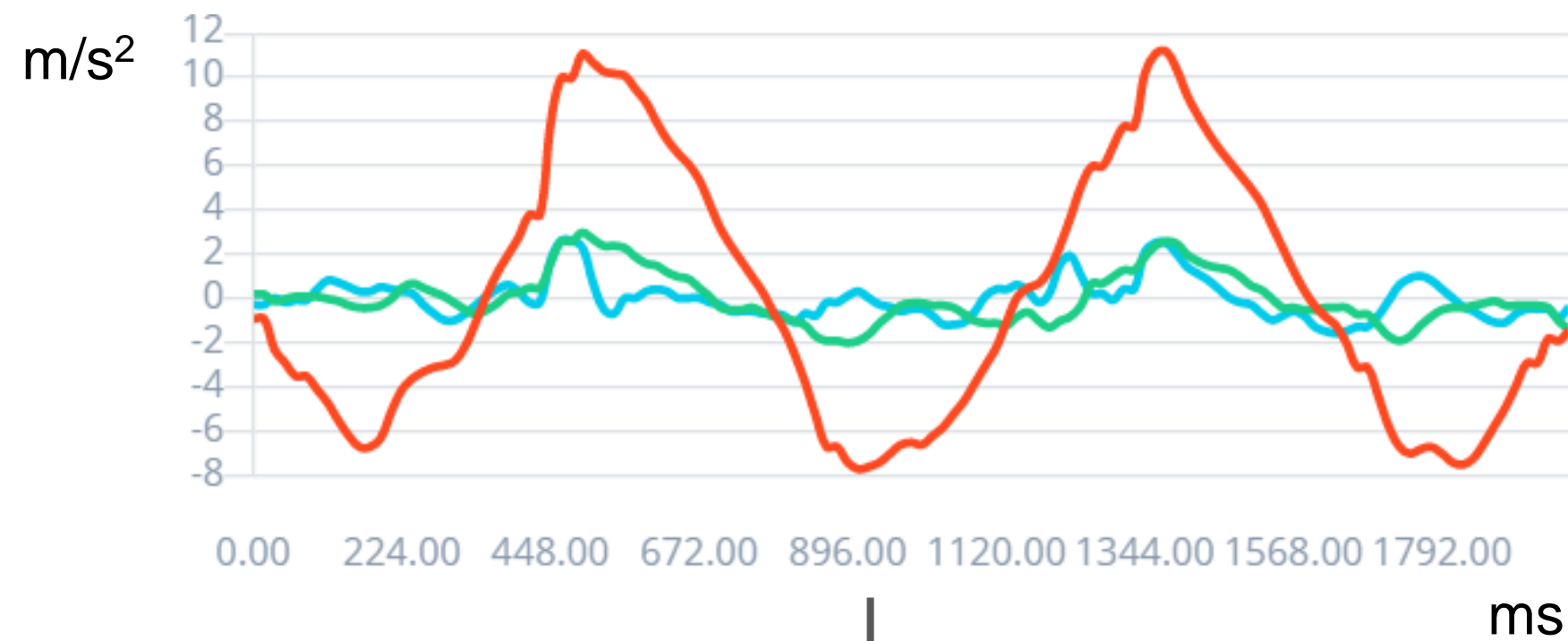
- circle
- idle
- left-right
- up-down



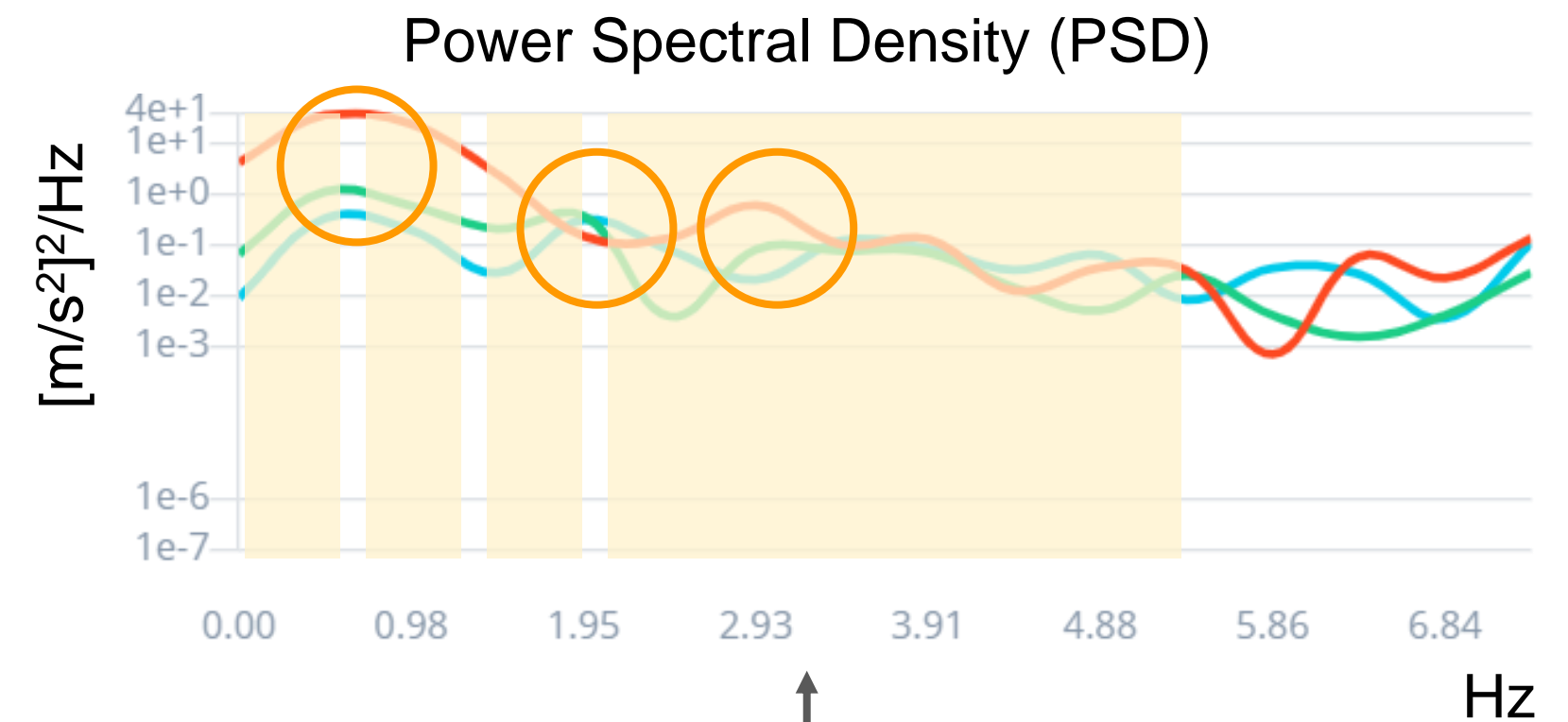
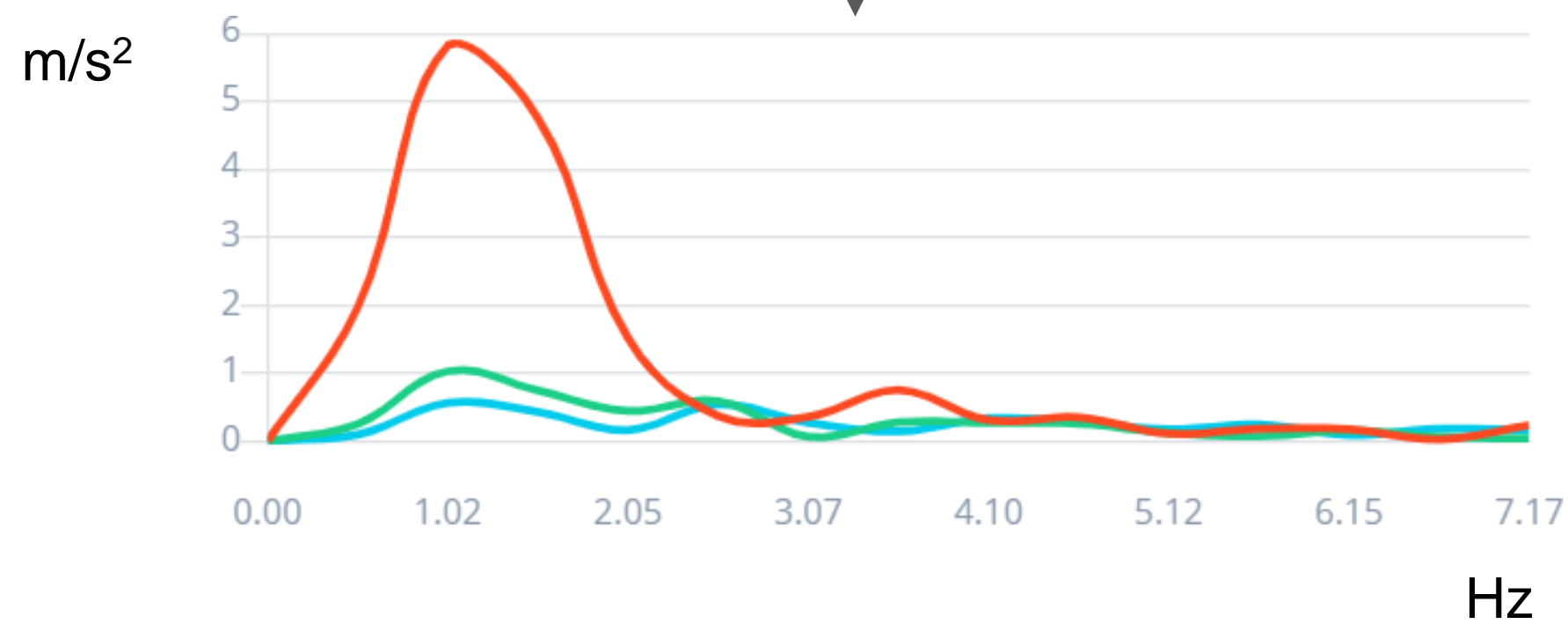


**Feature extraction:
FFT**





**Feature
extraction:
FFT**



**Feature
extraction:
PSD**

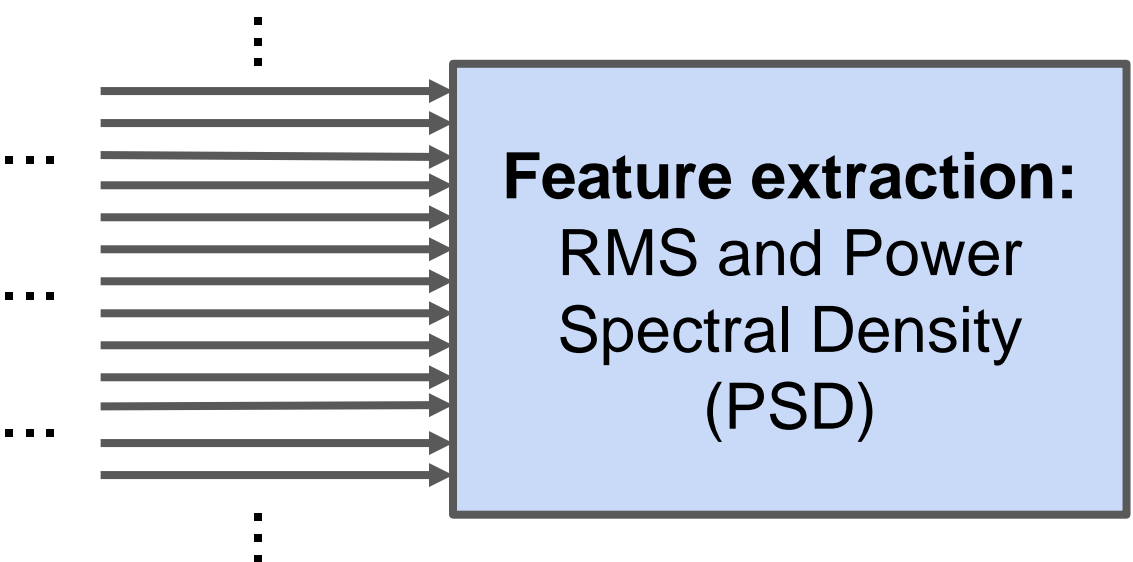
Feature Example



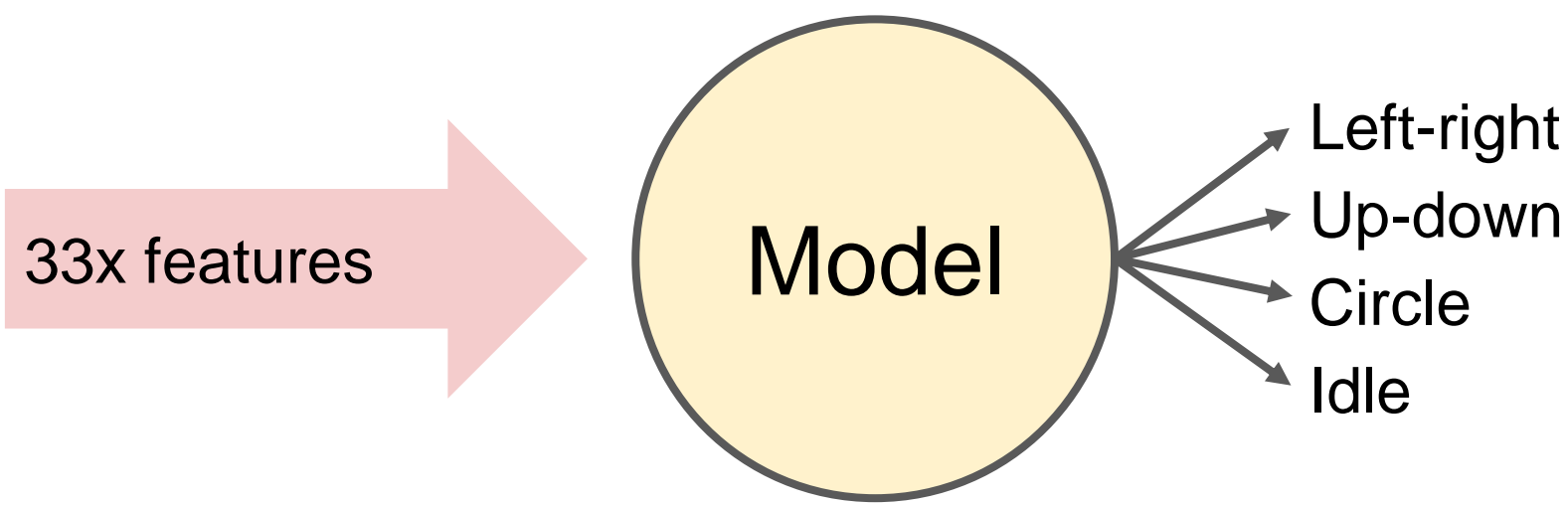
11 features per axis: RMS, 3x peak amplitudes from PSD, 3x peak frequencies from PSD, 4x spectral bins

Acceleration (m/s^2)

x	-1.4	-1.4	-2.8	-3.4	-4.0
y	0.4	0.4	0.1	0.2	0.3
z	9.6	9.6	9.9	9.7	9.8



375 raw values



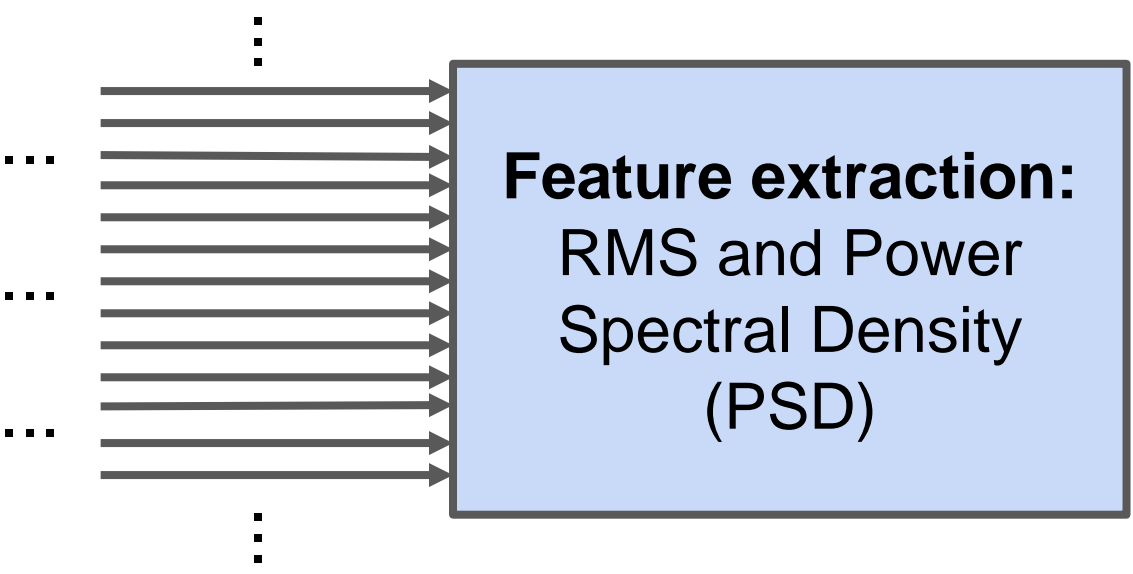
Feature Example



11 features per axis: RMS, 3x peak amplitudes from PSD, 3x peak frequencies from PSD, 4x spectral bins

Acceleration (m/s^2)

x	-6.8	-5.6	-4.6	-4.1	-3.8
y	-0.1	0.2	0.7	0.9	0.7
z	10.4	10.3	10.2	10.1	9.6



375 raw values

