Python Data Products

Course 2: Design thinking and predictive pipelines

Lecture: Recap on mathematical notation

Learning objectives

In this lecture we will…

- Revise the mathematical notation necessary to cover the basics of machine learning algorithms

Vectors and matrices

x : **vector** – usually a vector of **features**

x_i : a vector component, usually a single feature

y : a vector of **labels**

θ : a vector of **parameters**

X : **matrix** – usually a **feature matrix**

X_i : feature vector for a specific datapoint

X^T: **transpose** operator

$\|\theta\|_2^2 = \sum_i \theta_i^2$: vector **norm**

(in general $\|\theta\|_p = (\sum_i |\theta_i|^p)^{\frac{1}{p}}$)

Linearity

We will frequently talk about **linear** models

Precisely speaking, a function *f(x)* is **linear** if

$$f(x+y) = f(x) + f(y) \text{ (additivity)}$$
$$f(\alpha x) = \alpha f(x) \text{ (homogeneity)}$$

For the purposes of this class, we care about functions of the form:

$$\theta \cdot x$$

which is linear in theta

Probability and statistics

$p(y)$: **probability** of some event

$p(y|x)$: **conditional probability** of some event

$\bar{x} = \frac{1}{|x|} \sum_i x_i$: **mean** of a vector

$var(x)$: **variance** of a vector

$\sigma(x) = \frac{1}{1+e^{-x}}$: **sigmoid** function

Summary of concepts

- Covered basic notation of vectors, matrices, probability, and statistics