Plotting linear Regression

goal: fit a line through the points

Problem: the data does not exactly go through the data

$$y = wx + b$$

learn w and b from training data so that x_i and y_i:

$$E(w,b) = \sum_{i=1}^{n=15} (y_i - wx_i - b)^2$$

Sum of Squared Error

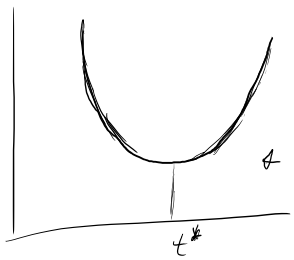
find the minimizer of the following function:

Optimization 101:

given $f(\tau)$, find value of τ where $f(\tau)$ is lowest

Enumerate over the entire set to find the lowest

$f(t)$



Convex

+ find derivative where $f'(x) == 0$

Partial derivative, with multiple values, take the derivative of one, while holding the other as a static

$$\mathcal{E}(w,b) = \sum_{i=1}^{n} (y_i - wx_i - b)^2$$

$$\sum_{i=1}^{n} y_i - w\sum_{i=1}^{n} x_i - nb = 0$$

$$b = \frac{1}{n}\left(\sum_{i=1}^{n} y_i - w\sum_{i=1}^{n} x_i\right)$$

$$\frac{y}{n} - w\frac{x}{n}$$

$$\downarrow \quad \downarrow$$

$$\overline{y} \quad w\ \overline{x}$$

x bar = average value of x

Linear Algebra

Vector calculus

Vector $x = \begin{pmatrix} x_0 \\ x_1 \\ \vdots \\ x_{n-1} \end{pmatrix}$

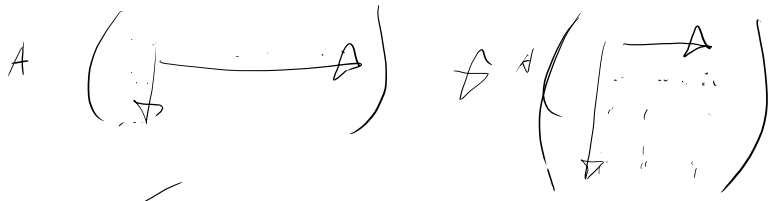
Matrix $X = \begin{pmatrix} 0,0 & 1,0 \\ 0,1 & \\ 0,2 & \end{pmatrix}$

Transpose

x^T ⇒ Column vector into a row

Matrix Transpose

A ⇒



Matrix Multiplication

Inner Product, dot product → $\begin{bmatrix} x & y & z \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix}$ → $xx \; yy \; zz$

Outer Product → $\begin{bmatrix} xx & yx & zx \\ xy & yy & zy \\ xz & yz & zz \end{bmatrix}$

Inversion of a matrix

A^{-1} = Square inverse

Over

Under