Linear Regression

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ANM23M022
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Minimize the distance b/w $(y, \bar{y})$

$$J(w) \quad J(y, \bar{y}) = \sum_{i=1}^{m} \frac{1}{2m} (\bar{y}^{(i)} - y^{(i)})^2$$

$$= \sum_{i=1}^{m} \frac{1}{2m} (h_w(x^{(i)}) - y^{(i)})^2$$

$$= \sum_{i=1}^{m} \frac{1}{2m} (w_0 + w_1 x^{(i)} - y^{(i)})^2$$

$J(w) \rightarrow$ cost function

Aim: minimize $J(w)$

Cost function

$$J(w) = \sum_{i=1}^{m} \frac{1}{2m} (w_0 + w_1 x^{(i)} - y^{(i)})^2$$

$$\frac{\partial J(w)}{\partial w_0} = \sum_{i=1}^{m} \frac{1}{2m} 2(w_0 + w_1 x_i - y^i)$$

$$\sum_{i=1}^{m} (w_0 + w_1 x^i - y^i)$$

$$\frac{\partial J(w)}{\partial w_1} = \sum_{i=1}^{m} \frac{1}{2m} 2(w_0 + w_1 x^i - y^i) x^i$$

$$= \sum_{i=1}^{m} \frac{1}{m} (w_0 + w_1 x^i - y^i) x^i$$

Generalised form.

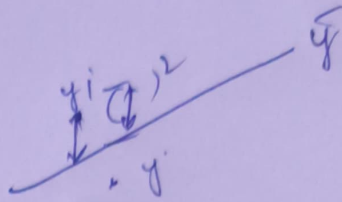
$$J(w) = \sum_{i=1}^{m} \frac{1}{2m} (w_0 x_0 + w_1 x_1 - y^i)^n$$

$x_0 = 1$

$$\frac{\partial J(w)}{\partial w_0}; \quad \frac{\partial J(w)}{\partial w_1},$$

→ Starting pt $w^* = (w_0^*, w_1^*)$

→ J, $-\nabla J$, at $w_k^* = w^*$



→ Update w's

$$w^*_{k+1} = w_k^* - \alpha_k \nabla J$$

↳ find using line search

or

use fixed learning rate

Aim: minimize w's so that $J(w)$

Cost fn has to be in convex fn | one minima.

↓

Verify

→ any w can converge.