

03/16/2023

$$\min_w \|y - Xw\|_2^2$$

$$\min_w \ell(w)$$

ridge regression: L_2

$$\min_w \|y - Xw\|_2^2$$

$$+ \lambda \|w\|_2^2$$

regularization
term

lasso regression: L_1

$$\min_w \|y - Xw\|_2^2$$

$$+ \lambda \|w\|_1$$

regularization
term

$$(X^T X + \lambda I) \omega = X^T y$$

$$\omega = X^T \left(\frac{y - X\omega}{\lambda} \right)$$

$$\Rightarrow v \text{ s.t. } \omega = X^T v$$

$$X^T X \overbrace{(X^T v)}^{\omega} + \lambda \overbrace{(X^T v)}^{\omega} = X^T y$$

$$X^T (X X^T v + \lambda v) = X^T y$$

$$\rightarrow X X^T v + \lambda v = y$$

$$\rightarrow (X X^T + \lambda) v = y$$

$$\rightarrow v = (X X^T + \lambda)^{-1} y$$

$$\hookrightarrow \omega = X^T \underbrace{(X X^T + \lambda)^{-1}}_K y$$

$$\begin{bmatrix} \text{---} \\ \text{---} \\ \text{---} \end{bmatrix} \begin{matrix} f_1^T \\ f_2^T \\ f_3^T \end{matrix} \begin{bmatrix} \text{---} \\ \text{---} \\ \text{---} \end{bmatrix} \begin{bmatrix} \text{---} \\ f_1 \\ \text{---} \end{bmatrix} \begin{bmatrix} \text{---} \\ f_2 \\ \text{---} \end{bmatrix} \dots$$

$$f(x) = [x_1^2, x_2^2, x_1, x_2\sqrt{2}, x_1\sqrt{2}, x_2\sqrt{2}, 1]^T$$

$$\downarrow$$

$$(x^T x' + 1)^2$$