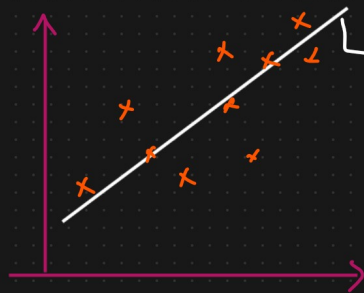


Ridge Regression, Lasso Regression, Elastic net Regression

Linear Regression



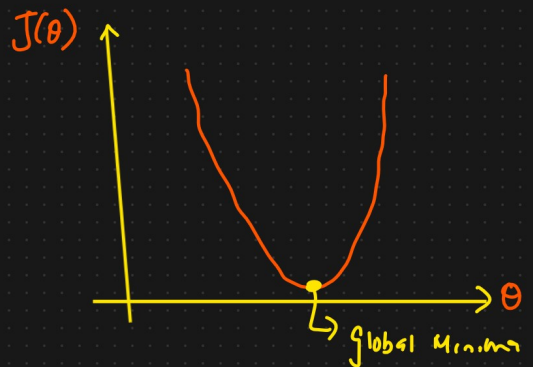
$$h_0(x) = \theta_0 + \theta_1 x$$

$$h_0(x) = \theta_0 + \theta_1 x_1 + \theta_2 x_2 + \theta_3 x_3 \dots + \theta_n x_n$$

$$\text{Cost fn} = \frac{1}{m} \sum_{i=1}^m (h_0(x^{(i)}) - y^{(i)})^2$$

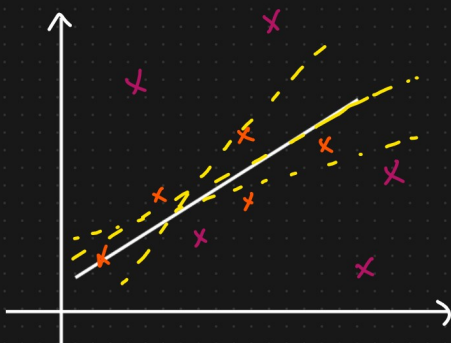


Mean Squared Error



ℓ_2 Norm

① Ridge Regression (ℓ_2 Regularization) → Reduce Overfitting



Overfitting

Training Data → Accuracy ↑↑ = 95%

TEST DATA → Accuracy ↓↓↓ = 60%

$$\text{Cost fn} = \frac{1}{m} \sum_{i=1}^m (h_0(x^{(i)}) - y^{(i)})^2$$

$$+ \lambda \sum_{i=1}^n (\text{slope})^2$$

↑
hyperparameter

Value +

$$h_0(x) = \theta_0 + \theta_1 x$$

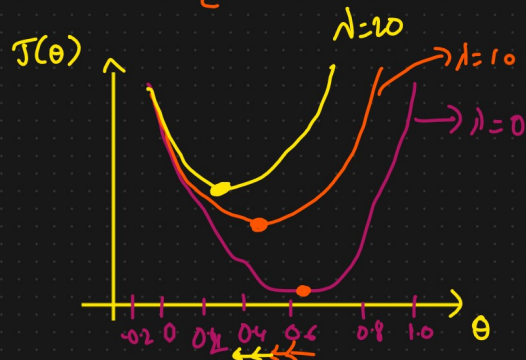
$$h_0(x) = \theta_0 + \theta_1 x_1 + \theta_2 x_2 + \dots + \theta_n x_n$$

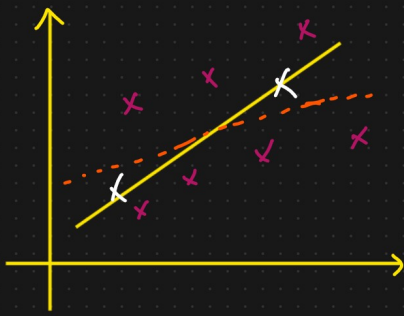
$$\rightarrow [\theta_1^2 + \theta_2^2 + \theta_3^2 + \theta_4^2 + \dots + \theta_n^2]$$

$$h_0(x) = \theta_0 + \theta_1 x_1 + \theta_2 x_2 + \theta_3 x_3 \quad \boxed{\lambda \uparrow \quad \theta \downarrow}$$

$$= \theta_0 + 0.95x_1 + 0.82x_2 + 1.5x_3$$

$$= \theta_0 + 0.85x_1 + 0.70x_2 + \boxed{0.1x_3} \quad 0.2\lambda$$





$$\text{Cost fn} = 0 + \lambda (\text{slope})^2$$

$$= +ve \downarrow \downarrow \downarrow$$

Outlier

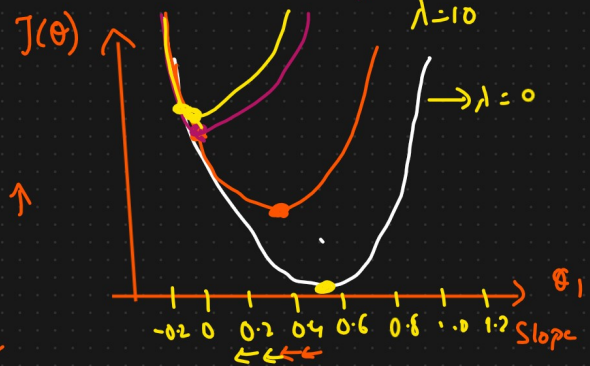
② Lasso Regression $\left[\begin{array}{l} L_1 \text{ Norm} \\ L_1 \text{ Regularization} \end{array} \right] \Rightarrow \text{Reduce the features} \downarrow \text{feature selection.}$

$$\text{Cost fn} : \frac{1}{m} \sum_{i=1}^m (h_{\theta}(x^{(i)}) - y^{(i)})^2 + \lambda \sum_{i=1}^m |\text{slope}|$$

$$h_{\theta}(x) = \theta_0 + \theta_1 x_1 + \theta_2 x_2 + \theta_3 x_3$$

$$= \boxed{\theta_0 + 0.54x_1 + 0.23x_2} + \boxed{0.10x_3}$$

\downarrow
 \downarrow
 0 feature removed



③ ElasticNet $\left[L_1 \text{ and } L_2 \text{ Norm} \right]$

$$\text{Cost fn} = \frac{1}{m} \sum_{i=1}^m (h_{\theta}(x^{(i)}) - y^{(i)})^2 + \boxed{\lambda_1 \sum_{i=1}^m (\text{slope})^2} + \boxed{\lambda_2 \sum_{i=1}^m |\text{slope}|}$$

\downarrow
 MAE
 \downarrow
 RMSE

Ridge.

LASSO

