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Regularization

In mathematics, statistics, finance computer science, particularly in machine learning and inverse problems, regularization is a process that changes the result answer to be "simpler". It is often used to obtain results for ill-posed problems or to prevent overfitting.

For example we want to minimize the functión $f(x)$ but we want the norm of x let be small. To achive this we define the function:

$$g(x) = f(x) + \lambda \cdot ||x||_2^2$$

And we going to minimize $g(x)$.

What happened if?

$\underline{\lambda = 0}$:

Then we only minimize $f(x)$.

$\underline{\lambda = \infty}$:

Then we only minimize $||x||_2^2$.

Ridge Regularization (L2)

$$\boxed{g(x) = f(x) + \lambda \cdot ||x||_2^2}$$

Lasso Regularization (L1)

$$\boxed{g(x) = f(x) + \lambda \cdot ||x||_1}$$

Elastic Net

$$\boxed{g(x) = f(x) + \lambda \cdot \left[(1-\alpha) \cdot ||x||_1 + \frac{\alpha}{2} \cdot ||x||_2^2\right]}$$