

Lab 3 – RLS

Regularized Least Squares

$$\min_{w \in \mathbb{R}^D} \frac{1}{n} \sum_{i=1}^n (y_i - w^\top x_i)^2 + \lambda w^\top w, \quad \lambda \geq 0.$$

$$f(x) = x^\top w, \quad \forall x \in \mathbb{R}^D.$$

$$(X_n^\top X_n + \lambda n I)w = X_n^\top Y_n.$$

Regularized Least Squares

$$(X_n^\top X_n + \lambda n I) w = X_n^\top Y_n$$

A

b

$$Aw = b$$

RLS training

def regularizedLSTrain(Xtr, Ytr, reg_par)

$$(X_n^\top X_n + \lambda n I) w = X_n^\top Y_n.$$

Return ...?

The regularization parameter controls the invertibility of the matrix

RLS test

def regularizedLSTest(w, Xtest)

$$f(x) = \boxed{x^\top w} \quad \forall x \in \mathbb{R}^D$$

Return ...?

Ypred

Your objectives today

- Implement and use RLS for regression
- Practicing its use on synthetic data (checking for instance matrix invertibility as the regularization parameter changes, or comparing with the results obtained with NO regularization)
- Apply K-Fold Cross Validation for selecting the best value for the regularization parameter

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