PENALIZED GENERALIZED LINEAR MODEL(LASSO, RIDGE, ELASTIC NET)

Supervised Learning:

Regularized Regression

- Want to build a parsimonious but interpretable model
- Shrink the number of predictors and/or size by imposing penalties on the estimated coefficients (L1, L2)
  - LASSO: $\min_{\beta_0,\beta}\left\{\frac{1}{N}\sum_{i=1}^{N}(y_i-\beta_0-x_i^T\beta)^2\right\}$ subject to $\sum_{j=1}^{p}|\beta_j|\le t.$
    - picks one correlated variable, others discarded. Sparse.
  - Ridge: $\text{minimize}\sum_{i=1}^{n}(y_i-\boldsymbol{\beta}^{\mathsf{T}}\mathbf{z}_i)^2 \text{ s.t. } \sum_{j=1}^{p}\beta_j^2\le t$
    - correlated variables coefficients are pushed to the same value
  - Elastic Net: $\arg\min_{\beta}\|\mathbf{y}-\mathbf{X}\beta\|^2+\lambda_2\|\beta\|^2+\lambda_1\|\beta\|_1$
    - sparse solution, correlated variables grouped, enter/ leave the model together

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