Lasso Regression

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What is lasso regression

- Lasso regression uses shrinkage
- data values are shrunk towards a central point
- Ridge and lasso regularization work by adding a penalty term to the log likelihood function.
- A tuning parameter, λ controls the strength of the L1 penalty.

$$\sum_{i=1}^{n} \left(y_i - \beta_0 - \sum_{j=1}^{p} \beta_j x_{ij}\right)^2 + \lambda \sum_{j=1}^{p} |\beta_j| = RSS + \lambda \sum_{j=1}^{p} |\beta_j|.$$

Lasso Regression

- lasso (least absolute shrinkage and selection operator) is a regression analysis method that performs both variable selection and regularization in order to enhance the prediction accuracy and interpretability of the statistical model it produces.
- Originally introduced in geophysics literature in 1986
- Independently rediscovered and popularized in 1996 by Robert Tibshirani, who coined the term and provided further insights into the observed performance.

Lasso was originally formulated for least squares models and this simple case reveals a substantial amount about the behavior of the estimator, including its relationship to ridge regression and best subset selection and the connections between lasso coefficient estimates and so-called soft thresholding. It also reveals that (like standard linear regression) the coefficient estimates need not be unique if covariates are collinear.

Though originally defined for least squares, lasso regularization is easily extended to a wide variety of statistical models including

The L1 norm explained

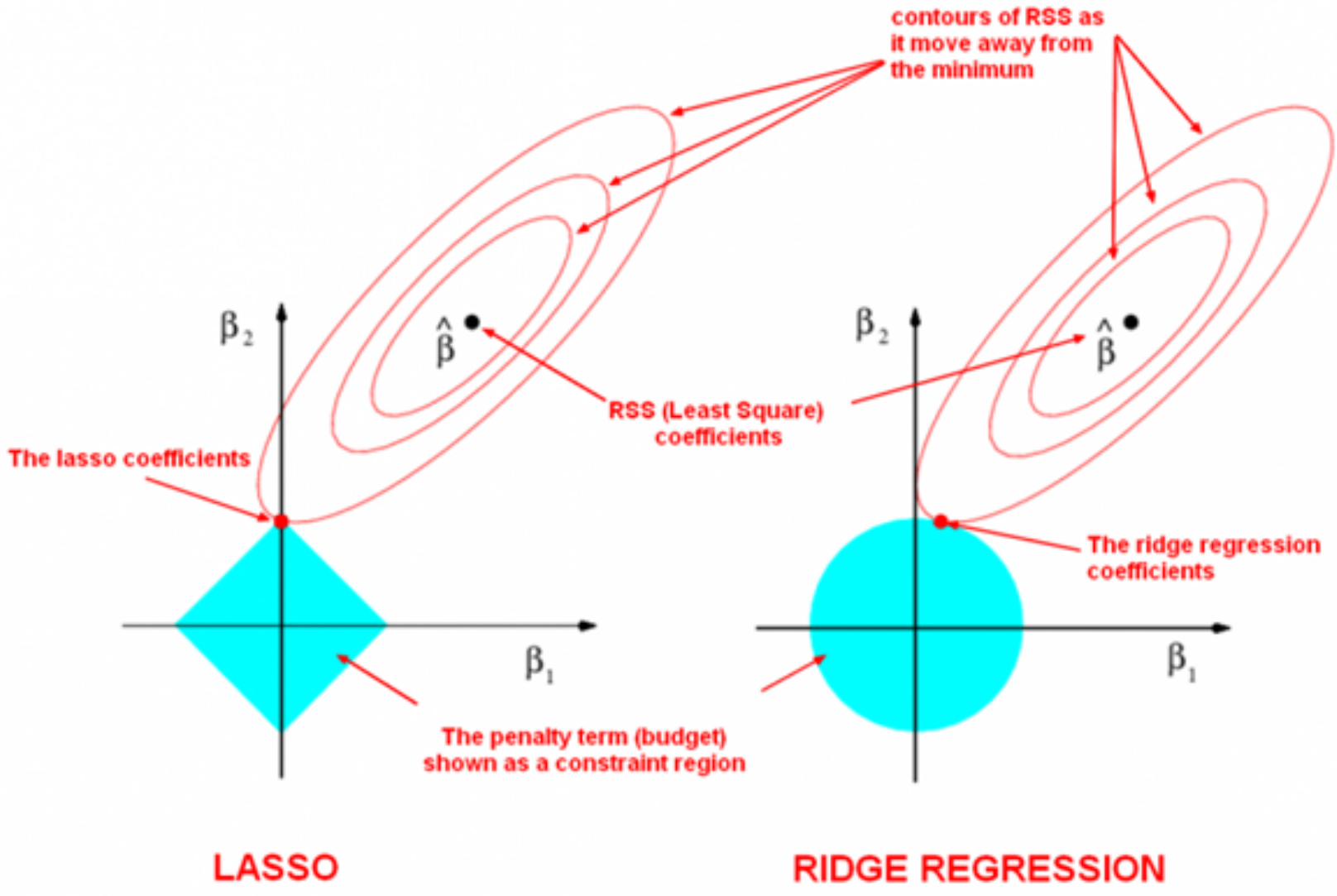

Figure 1:

Lasso regression with package glmnet

```
install.packages("glmnet")
```

```
library(glmnet)
```

```
## Loading required package: Matrix
```

```
## Loading required package: foreach
```

```
## Loaded glmnet 2.0-16
```

```
x=matrix(rnorm(100*20),100,20)
g2=sample(1:2,100,replace=TRUE)
fit2=glmnet(x,g2,family="binomial")
```

```
caret::varImp(fit2,lambda=0.0007567)
```

```
##           Overall
## V1  3.075694e-01
```

- LASSO is a feature selection method.
- LASSO regression has inbuilt penalization functions to reduce overfitting.

Links

A comprehensive beginners guide for Linear, Ridge and Lasso Regression

- Course for statistical learning - Youtube - Videos
- pcLasso: a new method for sparse regression
- Youtube - lasso regression - clearly explained
- Glmnet Vignette