

Individual Assignment 1

2024-10-18

QB1. Build a Lasso regression model to predict Sales based on all other attributes (“Price”, “Advertising”, “Population”, “Age”, “Income” and “Education”). What is the best value of lambda for such a lasso model

```
#Load necessary libraries  
library(ISLR)
```

```
## Warning: package 'ISLR' was built under R version 4.2.3
```

```
library(dplyr)
```

```
##  
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':  
##  
##   filter, lag
```

```
## The following objects are masked from 'package:base':  
##  
##   intersect, setdiff, setequal, union
```

```
library(glmnet)
```

```
## Warning: package 'glmnet' was built under R version 4.2.3
```

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

```
## Loaded glmnet 4.1-8
```

```
library(caret)
```

```
## Loading required package: ggplot2
```

```
## Loading required package: lattice
```

```

#Filter the relevant attributes
Carseats_Filtered <- Carseats %>% select(Sales, Price, Advertising, Population, Age, Income, Education)

#Preprocess the data(scale and center the features)
preProcess_data <- preProcess(Carseats_Filtered[, -1], method = c("center", "scale"))
Carseats_Scaled <- predict(preProcess_data, Carseats_Filtered[, -1])

# Convert predictors to matrix
X <- as.matrix(Carseats_Scaled)

# Response variable (Sales)
y <- Carseats_Filtered$Sales

# Lasso regression with cross-validation
lasso_model <- cv.glmnet(X, y, alpha = 1)

# Best lambda value
best_lambda <- lasso_model$lambda.min
print(best_lambda)

```

```
## [1] 0.004305309
```

QB2. What is the coefficient for the price (normalized) attribute in the best model (i.e. model with the optimal lambda)?

```

# Get the coefficients of the model with the optimal lambda
lasso_coefficients <- coef(lasso_model, s = best_lambda)

# Convert the coefficients to a readable format
coefficients_df <- as.data.frame(as.matrix(lasso_coefficients))

# Print the coefficient for Price (normalized)
price_coefficient <- coefficients_df["Price", ]
print(price_coefficient)

```

```
## [1] -1.353834
```

QB3. How many attributes remain in the model if lambda is set to 0.01? How that number changes if lambda is increased to 0.1? Do you expect more variables to stay in the model (i.e., have non-zero coefficients) as we increase lambda?

```

# Get the coefficients for lambda = 0.01
lasso_coefficients_0.01 <- coef(lasso_model, s = 0.01)

# Count the number of non-zero coefficients
non_zero_coeffs_0.01 <- sum(lasso_coefficients_0.01 != 0)
print(non_zero_coeffs_0.01)

```

```
## [1] 7
```

```
# Get the coefficients for lambda = 0.1
lasso_coefficients_0.1 <- coef(lasso_model, s = 0.1)

# Count the number of non-zero coefficients
non_zero_coeffs_0.1 <- sum(lasso_coefficients_0.1 != 0)
print(non_zero_coeffs_0.1)
```

```
## [1] 5
```

QB4. Build an elastic-net model with alpha set to 0.6. What is the best value of lambda for such a model?

```
# Elastic-Net model with alpha = 0.6 and cross-validation
elastic_net_model <- cv.glmnet(X, y, alpha = 0.6)

# Best lambda for the Elastic-Net model
best_lambda_elastic_net <- elastic_net_model$lambda.min
print(best_lambda_elastic_net)
```

```
## [1] 0.02404947
```