

ds2_hw3

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2023-03-21

```
library(caret)
```

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

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

```
library(knitr)  
library(glmnet)
```

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

```
## Loaded glmnet 4.1-4
```

```
library(mlbench)  
library(splines)  
library(mgcv)
```

```
## Loading required package: nlme
```

```
## This is mgcv 1.8-40. For overview type 'help("mgcv-package")'.
```

```
library(pROC)
```

```
## Type 'citation("pROC")' for a citation.
```

```
##
```

```
## Attaching package: 'pROC'
```

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

```
##
```

```
##      cov, smooth, var
```

```
library(earth)
```

```
## Loading required package: Formula
```

```
## Loading required package: plotmo
```

```

## Loading required package: plotrix

## Loading required package: TeachingDemos

library(tidyverse)

## -- Attaching packages ----- tidyverse 1.3.2 --

## v tibble 3.1.8      v dplyr 1.0.10
## v tidyr 1.3.0       v stringr 1.5.0
## v readr 2.1.2      v forcats 0.5.2
## v purrr 1.0.1
## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::collapse() masks nlme::collapse()
## x tidyr::expand()   masks Matrix::expand()
## x dplyr::filter()   masks stats::filter()
## x dplyr::lag()      masks stats::lag()
## x purrr::lift()     masks caret::lift()
## x tidyr::pack()     masks Matrix::pack()
## x tidyr::unpack()   masks Matrix::unpack()

library(ggplot2)
library(pdp)

##
## Attaching package: 'pdp'
##
## The following object is masked from 'package:purrr':
##
##     partial

library(vip)

##
## Attaching package: 'vip'
##
## The following object is masked from 'package:utils':
##
##     vi

library(klaR)

## Loading required package: MASS
##
## Attaching package: 'MASS'
##
## The following object is masked from 'package:dplyr':
##
##     select

```

```
##
## Attaching package: 'klaR'
##
## The following object is masked from 'package:TeachingDemos':
##
##      triplot

library(AppliedPredictiveModeling)

auto=read_csv("./auto.csv") %>%
  janitor::clean_names() %>%
  na.omit() %>%
  mutate(mpg_cat = as.factor(mpg_cat),
         year = as.factor(year),
         origin = as.factor(origin),
         mpg_cat = fct_relevel(mpg_cat, c("low", "high")))

## Rows: 392 Columns: 8
## -- Column specification -----
## Delimiter: ","
## chr (1): mpg_cat
## dbl (7): cylinders, displacement, horsepower, weight, acceleration, year, or...
##
## i Use 'spec()' to retrieve the full column specification for this data.
## i Specify the column types or set 'show_col_types = FALSE' to quiet this message.

set.seed(2023)
train_index=createDataPartition(y=auto$mpg_cat, p=0.7, list = FALSE)
train=auto[train_index,]
test=auto[-train_index,]
#training data
x1=model.matrix(mpg_cat~.,train)[,-1]
y1=train$mpg_cat
#testing data
x2=model.matrix(mpg_cat~.,test)[,-1]
y2=auto$mpg_cat[-train_index]

#1.
glm_fit=glm(mpg_cat ~ .,
            data = auto,
            subset = train_index,
            family = binomial(link = "logit"))
summary(glm_fit)

##
## Call:
## glm(formula = mpg_cat ~ ., family = binomial(link = "logit"),
##      data = auto, subset = train_index)
##
## Deviance Residuals:
##      Min       1Q   Median       3Q      Max
## -2.0585  -0.0673   0.0028   0.1359   3.4148
```

```
##
## Coefficients:
##           Estimate Std. Error z value Pr(>|z|)
## (Intercept)  22.287033    6.589777   3.382 0.000719 ***
## cylinders    -0.873335    0.724940  -1.205 0.228319
## displacement  0.007416    0.021833   0.340 0.734095
## horsepower   -0.027269    0.039025  -0.699 0.484702
## weight       -0.005532    0.002191  -2.524 0.011594 *
## acceleration -0.192443    0.249056  -0.773 0.439706
## year71        0.318705    2.397011   0.133 0.894226
## year72       -1.206294    1.362235  -0.886 0.375873
## year73       -1.735417    1.452223  -1.195 0.232084
## year74        1.975910    1.809505   1.092 0.274850
## year75        1.167625    1.497279   0.780 0.435490
## year76        2.213028    1.621090   1.365 0.172207
## year77        1.388917    1.823066   0.762 0.446145
## year78        1.544688    1.505540   1.026 0.304890
## year79        4.607034    1.941760   2.373 0.017663 *
## year80        5.194261    2.073119   2.506 0.012227 *
## year81        4.785045    1.801277   2.656 0.007896 **
## year82        3.532248    1.690508   2.089 0.036666 *
## origin2       1.201654    1.163232   1.033 0.301590
## origin3       0.341372    1.139917   0.299 0.764581
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##    Null deviance: 382.62  on 275  degrees of freedom
## Residual deviance:  78.48  on 256  degrees of freedom
## AIC: 118.48
##
## Number of Fisher Scoring iterations: 8
```

```
pred_prob=predict(glm_fit, newdata = auto[-train_index,],
                  type = "response")
pred=rep("low", length(pred_prob))
pred[pred_prob>0.5]="high"
cm=confusionMatrix(data = as.factor(pred),
                  reference = auto$mpg_cat[-train_index],
                  positive = "high")
```

```
## Warning in confusionMatrix.default(data = as.factor(pred), reference =
## auto$mpg_cat[-train_index], : Levels are not in the same order for reference and
## data. Refactoring data to match.
```

```
kable(cm$table,"simple")
```

	low	high
low	52	5
high	6	53

```
cm$byClass["Balanced Accuracy"]
```

```
## Balanced Accuracy  
##          0.9051724
```

```
#2.  
set.seed(2023)  
ctrl=trainControl(method = "repeatedcv",  
                  repeats = 5,  
                  summaryFunction = twoClassSummary,  
                  classProbs = TRUE)  
mars.fit=train(x = auto[train_index,1:7],  
              y = auto$mpg_cat[train_index],  
              method = "earth",  
              tuneGrid = expand.grid(degree = 1:3,  
                                    nprune = 2:20),  
              metric = "ROC",  
              trControl = ctrl)
```

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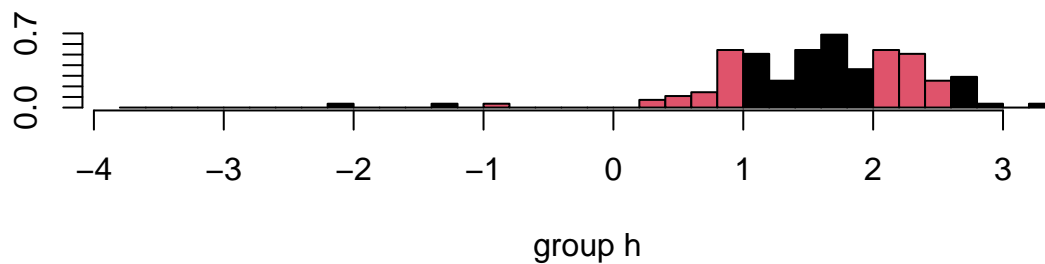
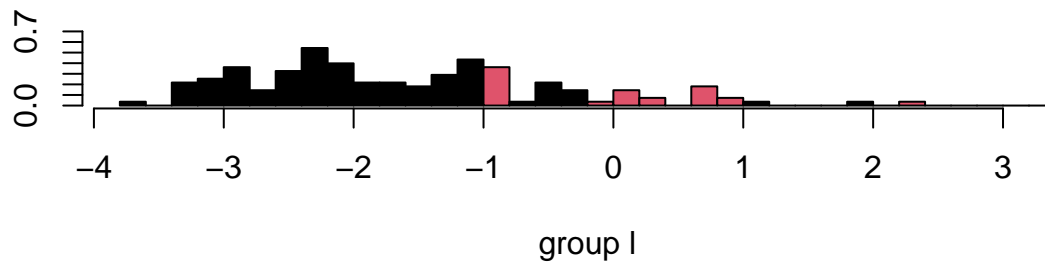
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```
#3.
set.seed(2023)
lda_fit=lda(mpg_cat~., data=auto, subset=train_index)
plot(lda_fit,col=as.numeric(auto$mpg_cat),abbrev=TRUE)
```



```
lda_fit$scaling
```

```
##                LD1
## cylinders    -0.6330461045
## displacement -0.0006067008
## horsepower    0.0101564649
## weight       -0.0009549525
## acceleration -0.0635785096
## year71        0.4736405821
## year72        0.0179567748
## year73       -0.0758425539
## year74        0.9473677997
## year75        0.2649570035
## year76        0.6429583548
## year77        0.7169187913
## year78        0.2963530158
## year79        1.2533575787
## year80        1.5369245404
## year81        1.6226917506
## year82        1.5570246564
```

```
## origin2      0.4476293185
## origin3      0.2628033617
```

```
#use caret
set.seed(2023)
lda_fit2=train(mpg_cat~., data=train,method="lda",metric="ROC",trControl=ctrl)
lda_fit2$results
```

```
##   parameter      ROC      Sens      Spec      ROCSD      SensSD      SpecSD
## 1      none 0.9628885 0.8689011 0.973956 0.04535456 0.09050892 0.04060157
```

```
#4.
set.seed(2023)
logit_fit_caret=train(x = auto[train_index,1:7],
                      y = auto$mpg_cat[train_index],
                      method="glm",
                      metric="ROC",
                      trControl=ctrl)
```

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