Homework_2

Lindley Slipetz

7/11/2021

For this homework, I will be using the Childhood adversity and traumatic stress among inpatients at a psychiatric hospital in the Baltimore area from 1993-1995. The data include diagnoses, psychological symptoms, physical and sexual abuse, post-traumatic stress disorder, self-destructive behavior, and demographic data. I will be predicting psychoticism from gender, SES, age, occurrence of mood disorder, paranoid ideation, and level of substance abuse.

Let's load the data and packages!

```
library(caret)
#install.packages("glmnet")
library(glmnet)
library(pROC)
library(tidyverse)
#install.packages("e1071")
library(e1071)
full_data <- read.table(file = 'G:\\My Drive\\ICPSR\\ML\\HW_2\\36168-0001-Data.tsv', sep = '\t', header
```

Okay, let's subset our data to just the variables we're interested in.

```
subset_data <- full_data %>%
  select(PSYCDX, SEX, SES, MOODDX, SCL_PAR, SISDB_SUB, AGE)
```

Now we're going to check if there's any missing data.

```
df <- as.data.frame(
  cbind(
    lapply(
      lapply(subset_data, is.na), sum)
    )
  )

rownames(subset(df, df$V1 != 0))
```

```
## [1] "SCL_PAR"   "SISDB_SUB"
```

Okay, SCL_PAR, and SISDB_SUB have missing values. Let's see how much of a problem this is.

```
sum(is.na(subset_data$SCL_PAR))
```

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

```
sum(is.na(subset_data$SISDB_SUB))
```

```
## [1] 10
```

That's not that much missing data (at least to me). I think we'd be safe to just omit the data with NA.

```
complete_data <- na.omit(subset_data)
```

Dummy encoding.

```
complete_data$PSYCDX <- factor(complete_data$PSYCDX, labels=c("non_psy", "psy"))
createDummies <- dummyVars(~., complete_data[,-1], fullRank = TRUE)
new.predictors <- predict(createDummies, complete_data[,-1])
complete_data <- data.frame(PSYCDX = complete_data$PSYCDX, new.predictors)
```

Time to standardize the data.

```
preProcValues <- preProcess(complete_data, method=c("center","scale"))
complete_data <- predict(preProcValues, complete_data)
```

Splitting the data.

```
set.seed(1985)
trainIndex <- createDataPartition(complete_data$PSYCDX, p=0.7, list=FALSE)
train <- complete_data[trainIndex,]
test <- complete_data[-trainIndex,]
```

Set control parameters.

```
fitCtrl <- trainControl(method = "repeatedcv",
                        number = 3,
                        repeats = 2,
                        search = "random")
```

Set testing grid.

```
glmnetGrid <- expand.grid(alpha=seq(0,1,by=0.1), lambda=seq(0,1,by=0.05))
```

Train model.

```
glmnet.res <- train(PSYCDX ~ .,
    data=train,
    method="glmnet",
    trControl=fitCtrl,
    tuneGrid=glmnetGrid,
    metric="Accuracy")

## Warning in lognet(xd, is.sparse, ix, jx, y, weights, offset, alpha, nobs, : one
## multinomial or binomial class has fewer than 8 observations; dangerous ground

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```

```
glmnet.res
```

```
## glmnet
##
## 146 samples
##   6 predictor
##   2 classes: 'non_psy', 'psy'
##
## No pre-processing
## Resampling: Cross-Validated (3 fold, repeated 2 times)
## Summary of sample sizes: 98, 97, 97, 98, 96, 98, ...
## Resampling results across tuning parameters:
##
##   alpha  lambda  Accuracy   Kappa
##   0.0    0.00    0.9247336  -0.01063950
##   0.0    0.05    0.9316071   0.00000000
##   0.0    0.10    0.9316071   0.00000000
##   0.0    0.15    0.9316071   0.00000000
##   0.0    0.20    0.9316071   0.00000000
##   0.0    0.25    0.9316071   0.00000000
##   0.0    0.30    0.9316071   0.00000000
##   0.0    0.35    0.9316071   0.00000000
##   0.0    0.40    0.9316071   0.00000000
##   0.0    0.45    0.9316071   0.00000000
##   0.0    0.50    0.9316071   0.00000000
##   0.0    0.55    0.9316071   0.00000000
##   0.0    0.60    0.9316071   0.00000000
##   0.0    0.65    0.9316071   0.00000000
##   0.0    0.70    0.9316071   0.00000000
##   0.0    0.75    0.9316071   0.00000000
##   0.0    0.80    0.9316071   0.00000000
##   0.0    0.85    0.9316071   0.00000000
##   0.0    0.90    0.9316071   0.00000000
##   0.0    0.95    0.9316071   0.00000000
##   0.0    1.00    0.9316071   0.00000000
##   0.1    0.00    0.8972392   0.00670904
```

```
##   0.1    0.05    0.9316071   0.00000000
##   0.1    0.10    0.9316071   0.00000000
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##   0.1    0.90    0.9316071   0.00000000
##   0.1    0.95    0.9316071   0.00000000
##   0.1    1.00    0.9316071   0.00000000
##   0.2    0.00    0.8972392   0.00670904
##   0.2    0.05    0.9316071   0.00000000
##   0.2    0.10    0.9316071   0.00000000
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##   0.5    1.00    0.9316071   0.00000000
##   0.6    0.00    0.8972392   0.00670904
##   0.6    0.05    0.9316071   0.00000000
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##   0.7    1.00    0.9316071   0.00000000
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##   0.8    0.35    0.9316071   0.00000000
##   0.8    0.40    0.9316071   0.00000000
##   0.8    0.45    0.9316071   0.00000000
##   0.8    0.50    0.9316071   0.00000000
##   0.8    0.55    0.9316071   0.00000000
##   0.8    0.60    0.9316071   0.00000000
##   0.8    0.65    0.9316071   0.00000000
##   0.8    0.70    0.9316071   0.00000000
##   0.8    0.75    0.9316071   0.00000000
```
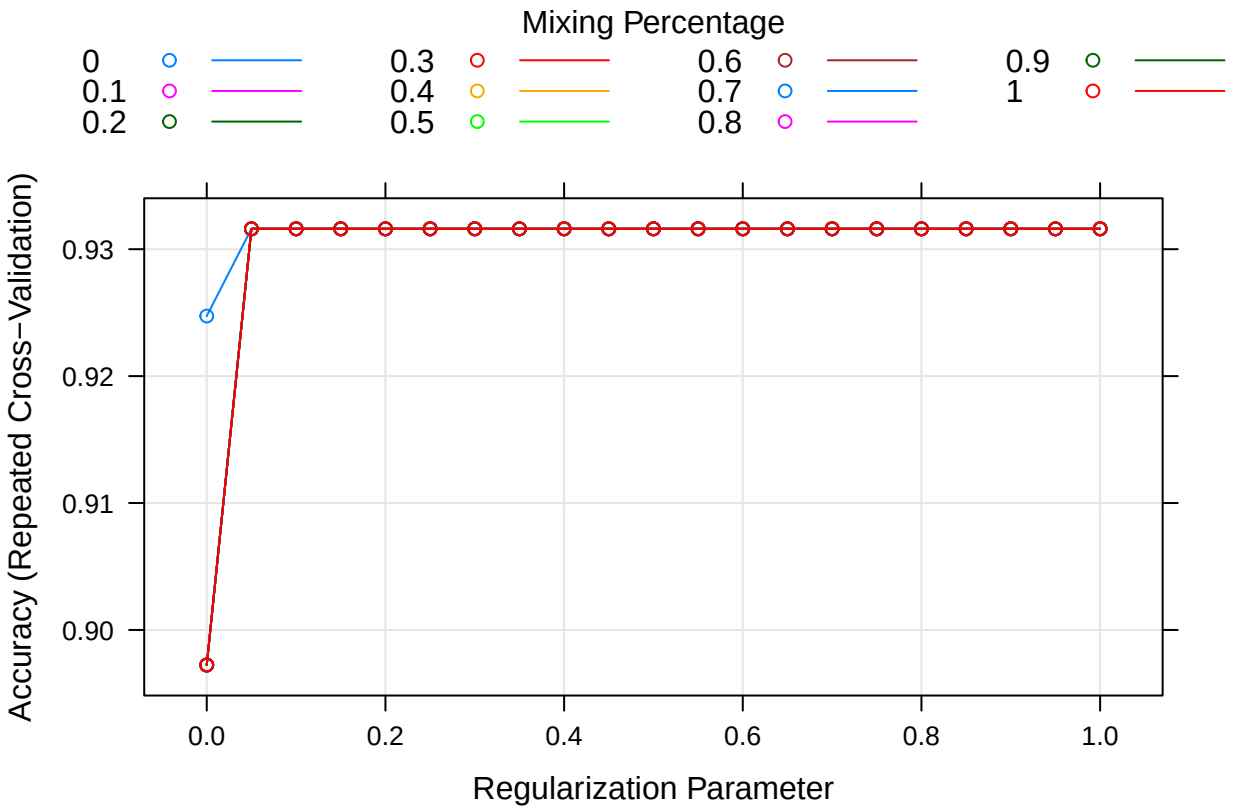

```
##   0.8    0.80    0.9316071   0.00000000
##   0.8    0.85    0.9316071   0.00000000
##   0.8    0.90    0.9316071   0.00000000
##   0.8    0.95    0.9316071   0.00000000
##   0.8    1.00    0.9316071   0.00000000
##   0.9    0.00    0.8972392   0.00670904
##   0.9    0.05    0.9316071   0.00000000
##   0.9    0.10    0.9316071   0.00000000
##   0.9    0.15    0.9316071   0.00000000
##   0.9    0.20    0.9316071   0.00000000
##   0.9    0.25    0.9316071   0.00000000
##   0.9    0.30    0.9316071   0.00000000
##   0.9    0.35    0.9316071   0.00000000
##   0.9    0.40    0.9316071   0.00000000
##   0.9    0.45    0.9316071   0.00000000
##   0.9    0.50    0.9316071   0.00000000
##   0.9    0.55    0.9316071   0.00000000
##   0.9    0.60    0.9316071   0.00000000
##   0.9    0.65    0.9316071   0.00000000
##   0.9    0.70    0.9316071   0.00000000
##   0.9    0.75    0.9316071   0.00000000
##   0.9    0.80    0.9316071   0.00000000
##   0.9    0.85    0.9316071   0.00000000
##   0.9    0.90    0.9316071   0.00000000
##   0.9    0.95    0.9316071   0.00000000
##   0.9    1.00    0.9316071   0.00000000
##   1.0    0.00    0.8972392   0.00670904
##   1.0    0.05    0.9316071   0.00000000
##   1.0    0.10    0.9316071   0.00000000
##   1.0    0.15    0.9316071   0.00000000
##   1.0    0.20    0.9316071   0.00000000
##   1.0    0.25    0.9316071   0.00000000
##   1.0    0.30    0.9316071   0.00000000
##   1.0    0.35    0.9316071   0.00000000
##   1.0    0.40    0.9316071   0.00000000
##   1.0    0.45    0.9316071   0.00000000
##   1.0    0.50    0.9316071   0.00000000
##   1.0    0.55    0.9316071   0.00000000
##   1.0    0.60    0.9316071   0.00000000
##   1.0    0.65    0.9316071   0.00000000
##   1.0    0.70    0.9316071   0.00000000
##   1.0    0.75    0.9316071   0.00000000
##   1.0    0.80    0.9316071   0.00000000
##   1.0    0.85    0.9316071   0.00000000
##   1.0    0.90    0.9316071   0.00000000
##   1.0    0.95    0.9316071   0.00000000
##   1.0    1.00    0.9316071   0.00000000
##
## Accuracy was used to select the optimal model using the largest value.
## The final values used for the model were alpha = 0 and lambda = 1.
```

```
plot(glmnet.res)
```



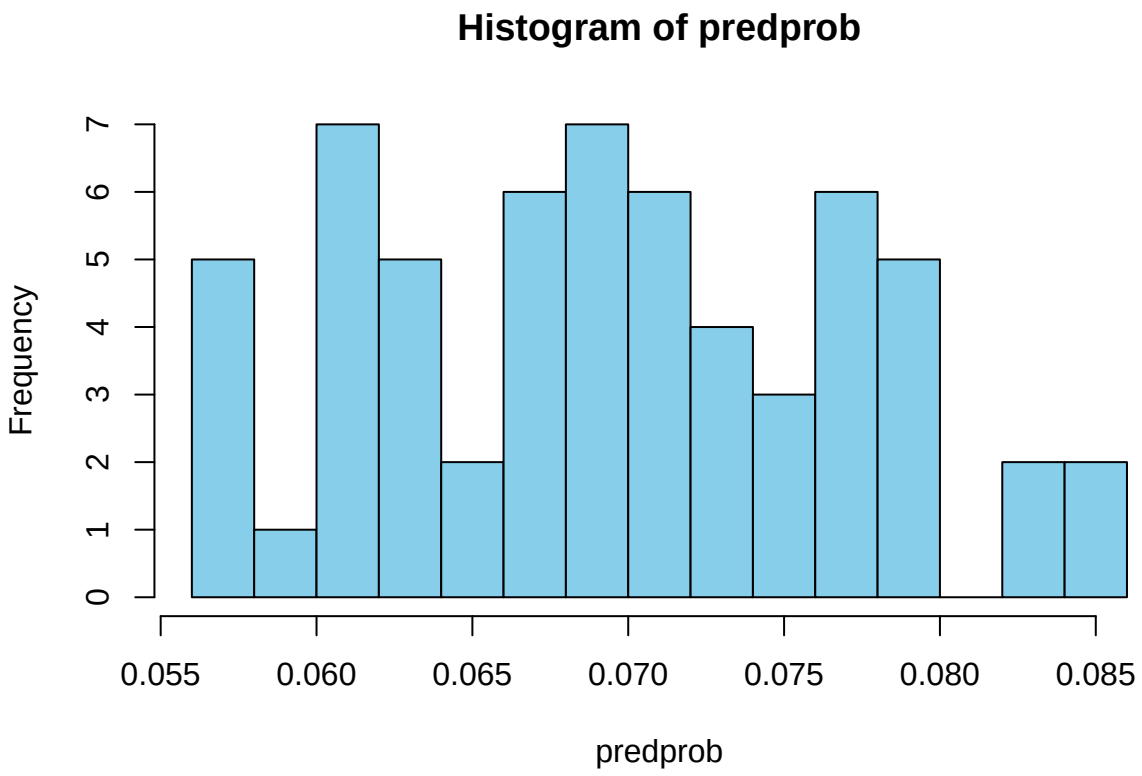
The optimal values are $\alpha = 0$ and $\lambda = 1$. Since α is 0, this elastic net is ridge regression not lasso regression.

Model performance.

```
predclass <- predict(glmnet.res, test)
table(predclass, test$PSYCDX[complete.cases(test)])
```

```
##
## predclass non_psy psy
##   non_psy      58   3
##   psy           0   0
```

```
predprob <- predict(glmnet.res, test, type="prob")[,"psy"]
hist(predprob, col="skyblue", breaks=20)
```




```
roc(test$PSYCDX[complete.cases(test)] ~ predprob)
```

```
## Setting levels: control = non_psy, case = psy
```

```
## Setting direction: controls < cases
```

```
##
## Call:
## roc.formula(formula = test$PSYCDX[complete.cases(test)] ~ predprob)
##
## Data: predprob in 58 controls (test$PSYCDX[complete.cases(test)] non_psy) < 3 cases (test$PSYCDX[comp
## Area under the curve: 1
```

I got an area under the curve of 1... that really makes me feel like something went wrong because I highly doubt I have a perfect model. Let's keep moving forward.

Here we find the beta coefficients.

```
fit.elasticnet <- glmnet(as.matrix(train[,-1]), as.numeric(train[,1]), family="binomial", alpha=0, lambd
fit.elasticnet$beta
```

```
## 6 x 1 sparse Matrix of class "dgCMatrix"
##                      s0
## SEX         0.060431601
## SES         0.028883468
## MOODDX     -0.030461034
## SCL_PAR     0.009019624
## SISDB_SUB   0.043673927
## AGE        -0.042595333
```

Since my results suggested a ridge regression, none of my coefficients are actually shrunk to zero and that's expected. So, all of my predictors are included in the model.