**Assignment\_7.4**

library(dplyr); library(corrplot);library(car); library(MASS); library(ggplot2)

library(reshape2); library(forecast)

# a- read the dataset and identify the right features

# import train data set

Variant\_1 <- read.csv("C:/Users/Aadhya Singh/Downloads/Dataset/fbtrain/Features\_Variant\_1.csv", header=FALSE)

Variant\_2 <- read.csv("C:/Users/Aadhya Singh/Downloads/Dataset/fbtrain/Features\_Variant\_2.csv", header=FALSE)

Variant\_3 <- read.csv("C:/Users/Aadhya Singh/Downloads/Dataset/fbtrain/Features\_Variant\_3.csv", header=FALSE)

Variant\_4 <- read.csv("C:/Users/Aadhya Singh/Downloads/Dataset/fbtrain/Features\_Variant\_4.csv", header=FALSE)

Variant\_5 <- read.csv("C:/Users/Aadhya Singh/Downloads/Dataset/fbtrain/Features\_Variant\_5.csv", header=FALSE)

fbtrain <- rbind(Variant\_1, Variant\_2, Variant\_3, Variant\_4, Variant\_5)

dim(fbtrain)

# import test data set

setwd("E:/C:/Users/Aadhya Singh/Downloads/Dataset/fbtest")

test1 <- read.csv("Test\_Case\_1.csv", header = F); test2 <- read.csv("Test\_Case\_2.csv", header = F)

test3 <- read.csv("Test\_Case\_3.csv", header = F); test4 <- read.csv("Test\_Case\_4.csv", header = F)

test5 <- read.csv("Test\_Case\_5.csv", header = F); test6 <- read.csv("Test\_Case\_6.csv", header = F)

test7 <- read.csv("Test\_Case\_7.csv", header = F); test8 <- read.csv("Test\_Case\_8.csv", header = F)

test9 <- read.csv("Test\_Case\_9.csv", header = F); test10 <- read.csv("Test\_Case\_10.csv", header = F)

fbtest <- rbind(test1, test2, test3, test4, test5, test6, test7, test8, test9, test10)

dim(fbtest)

# Assign variable names to the train and test data set

colnames(fbtrain) <- c("plikes","checkin","talking","category","d5","d6","d7","d8","d9","d10","d11","d12",

"d13","d14","d15","d16","d17","d18","d19","d20","d21","d22","d23","d24","d25","d26",

"d27","d28","d29","cc1","cc2","cc3","cc4","cc5","basetime","postlength","postshre",

"postpromo","Hhrs","sun","mon","tue","wed","thu","fri","sat","basesun","basemon",

"basetue","basewed","basethu","basefri","basesat","target")

colnames(fbtest) <- c("plikes","checkin","talking","category","d5","d6","d7","d8","d9","d10","d11","d12",

"d13","d14","d15","d16","d17","d18","d19","d20","d21","d22","d23","d24","d25","d26",

"d27","d28","d29","cc1","cc2","cc3","cc4","cc5","basetime","postlength","postshre",

"postpromo","Hhrs","sun","mon","tue","wed","thu","fri","sat","basesun","basemon",

"basetue","basewed","basethu","basefri","basesat","target")

dim(fbtrain); dim(fbtest)

View(fbtrain); View(fbtest)

str(fbtrain); str(fbtest)

train <- fbtrain; test <- fbtest

head(train); head(test)

# making the data tidy by constructing single collumn for post publish day

train$pubday<- ifelse(train$sun ==1, 1, ifelse(train$mon ==1, 2, ifelse(train$tue ==1, 3,

ifelse(train$wed ==1, 4, ifelse(train$thu ==1, 5, ifelse(train$fri ==1, 6,

ifelse(train$sat ==1, 7, NA)))))))

# making the data tidy by constructing single collumn for base day

train$baseday<- ifelse(train$basesun ==1, 1, ifelse(train$basemon ==1, 2, ifelse(train$basetue ==1, 3,

ifelse(train$basewed ==1, 4, ifelse(train$basethu ==1, 5,

ifelse(train$basefri ==1, 6, ifelse(train$basesat ==1, 7, NA)))))))

# now the data set is ready

#--------------------------------------------------------------------

# b- clean dataset, impute missing values and perform exploratory data analysis

distinct(train) # removing overlapping observations if any

dim(train)

sapply(train, function(x) sum(is.na(x))) # no missing values

correlation <- cor(train[,c("target", "plikes","checkin","talking","category","d5","d6","d7","d8",

"d9","d10","d11","d12","d13","d14","d15","d16","d17","d18",

"d19","d20","d21","d22","d23","d24","d25","d26","d27","d28",

"d29","cc1","cc2","cc3","cc4","cc5","basetime","postlength",

"postshre","pubday","baseday")])

corr <- as.data.frame(reshape::melt(correlation))

corr <- corr%>%filter(X1 == "target" & value != 1 & value > 0.32 & value > -0.32)

corr # good corelations with target variable

corrplot.mixed(cor(train[,c(30:34)]))

# Total comments are strongly correlated to correlated with cc4(comments in first 24 hrs of publish time) and

# cc3(comments in last 48 to last 24 hours relative to base date/time)

df <- train

melt\_df <- melt(df)

# Distribution of all the Variables - Histogram

ggplot(melt\_df, aes(x=value, fill = variable))+

geom\_histogram(bins=10, color = "Blue")+

facet\_wrap(~variable, scales = 'free\_x')

df <- log(train[1:39])

par(mfrow=c(1,1))

# c. Visualize the dataset and make inferences from that

barplot(table(train$target, train$pubday), col = heat.colors(7),

xlab = "Weekday", ylab = "Number of comments",

main = "Number of comments Vs. Weekday")

# post published on Wednesday has maximum comments

# number of comments vs Post Likes

scatterplot(train$plikes, train$target , col = "Blue",

xlab = "Page Likes", ylab = "Number of comments",

main = "Number of comments Vs. Pagelikes",

xlim = c(0,10000000), ylim = c(0,400))

abline(lm(plikes~target, data = train), col = "red")

# as the page likes increases the comments are not increasing

# Number of comments Vs Post length

scatterplot(train$postlength, train$target , col = "Red",

xlab = "Post Length", ylab = "Number of comments",

main = "Number of comments Vs. Psot Length",

ylim = c(0,400), xlim = c(0,5000))

abline(lm(postlength~target, data = train), col= "blue")

# as the page lenth is increasing the number of comments decreases

hist(train$target, breaks = 1000, xlim = c(0,10) )

# data is very positively skewed. Very less comments after base time

# d. Perform any 3 hypothesis tests using columns of your choice, make conclusions

# Ho: Mean difference bet comments across the publish day is not significant

day <- aov(target~pubday, data = train)

summary(day)

# Comments are dependent on day of publish

# Ho: Mean difference in comments across the target and cc4 is not significant

cc4 <- t.test(train$target, train$cc4, paired = FALSE, alternative = "two.sided", mu=0)

cc4

# Difference between the number of comments after H hrs and

# comments in first 24 hrs of publish is significant

# Ho: Difference between Mean comments within cc2 and cc4 is not significant

cc2 <- t.test(x=train$cc2, y=train$cc4, paired = FALSE, alternative = "two.sided", mu=0)

cc2

# Difference between the number of comments in last 24 hrs of base time and

# comments in first 24 hrs of publish is significant

# e. Create a linear regression model to predict the number of comments in the next 24 hours

# (relative to basetime)

TARGET <- lm(target~., data = train)

# step <- stepAIC(TARGET, direction = "both")

final\_model <- lm(target ~ checkin + talking + d5 + d6 + d7 + d8 + d9 + d10 + d11 +

d12 + d13 + d16 + d17 + d19 + d20 + d21 + d22 + d23 + d24 +

cc1 + cc2 + cc3 + cc4 + basetime + postshre + Hhrs + wed +

thu + fri + basemon + basewed, data = train)

summary(final\_model)

# f. Fine tune the model and represent important features

final\_model <- lm(target ~ talking + d5 + d7 + d8 + d10 + d11 +

d12 + d13 + d16 + d17 + d19 + d20 + d22 + d23 +

cc1 + cc2 + cc3 + cc4 + basetime + postshre + Hhrs, data = train)

summary(final\_model)

prediction <- predict(final\_model, test)

predicted <- data.frame(cbind(actuals = test$target, prediction = prediction))

predicted$prediction <- ifelse(prediction<0, 0, round(prediction,0))

cor(predicted)

View(predicted)

# g. Interpret the summary of the linear model

# Residual error is distributed between -346.83 to 1271.33

# P-value of the model is less than alpha (0.05), hence we can accept the model

# 32.46% variability is represented by the model

#--------------------------------------------------------------------------------

# h. - report the test accuracy vs. the training accuracy

# test accuracy

round(accuracy(predicted$prediction,predicted$actuals),3)

prediction <- predict(final\_model, test)

predicted <- data.frame(cbind(actuals = test$target, prediction = prediction))

predicted$prediction <- ifelse(prediction<0, 0, round(prediction,0))

min\_max\_accuracy <- mean(apply(predicted, 1, min) / apply(predicted, 1, max))

min\_max\_accuracy

# training accuracy

round(accuracy(predicted$prediction,predicted$actuals),3)

prediction <- predict(final\_model, train)

predicted <- data.frame(cbind(actuals = train$target, prediction = prediction))

predicted$prediction <- ifelse(prediction<0, 0, round(prediction, 0))

min\_max\_accuracy <- mean(apply(predicted, 1, min) / apply(predicted, 1, max))

min\_max\_accuracy

# i. - interpret the final model coefficients

summary(final\_model)

coef(final\_model) # coefficients of the model

#comments in H Hrs has slope with Independent variables as below:

# talking d5 d7 d8 d10 d11

# -1.858115e-05 -4.759496e-01 8.609203e-01 1.675394e-01 -1.239555e-01 -2.236221e-03

# d12 d13 d16 d17 d19 d20 d22

# 1.612318e-01 1.276223e-01 1.114969e-02 1.085186e-01 -1.165972e-01 4.201675e-01 -8.837498e-01

# d23 cc1 cc2 cc3 cc4 basetime postshre

# -2.159461e-01 4.338324e-02 2.196493e-01 -2.272725e-02 -6.728051e-02 -1.933110e-01 2.921963e-03

# Hhrs

# 3.880629e-01

# j. - plot the model result and compare it with assumptions of the model

par(mfrow=c(2,2))

plot(final\_model)

# Model does not pass the test of normality

# the data is heteroscadatic

# Observations 3528,30608,16432 may have the leverage or potential for influencing the model

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