Human Resource Analytics

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Load the required libraries

```
library(reshape)
library(ggplot2)
library(e1071)
library(ROCR)
library(randomForest)
library(caret)
library(corrplot)
library(dplyr)
library(rattle)
library(rpart)
```

Load the file and remove the duplicated rows

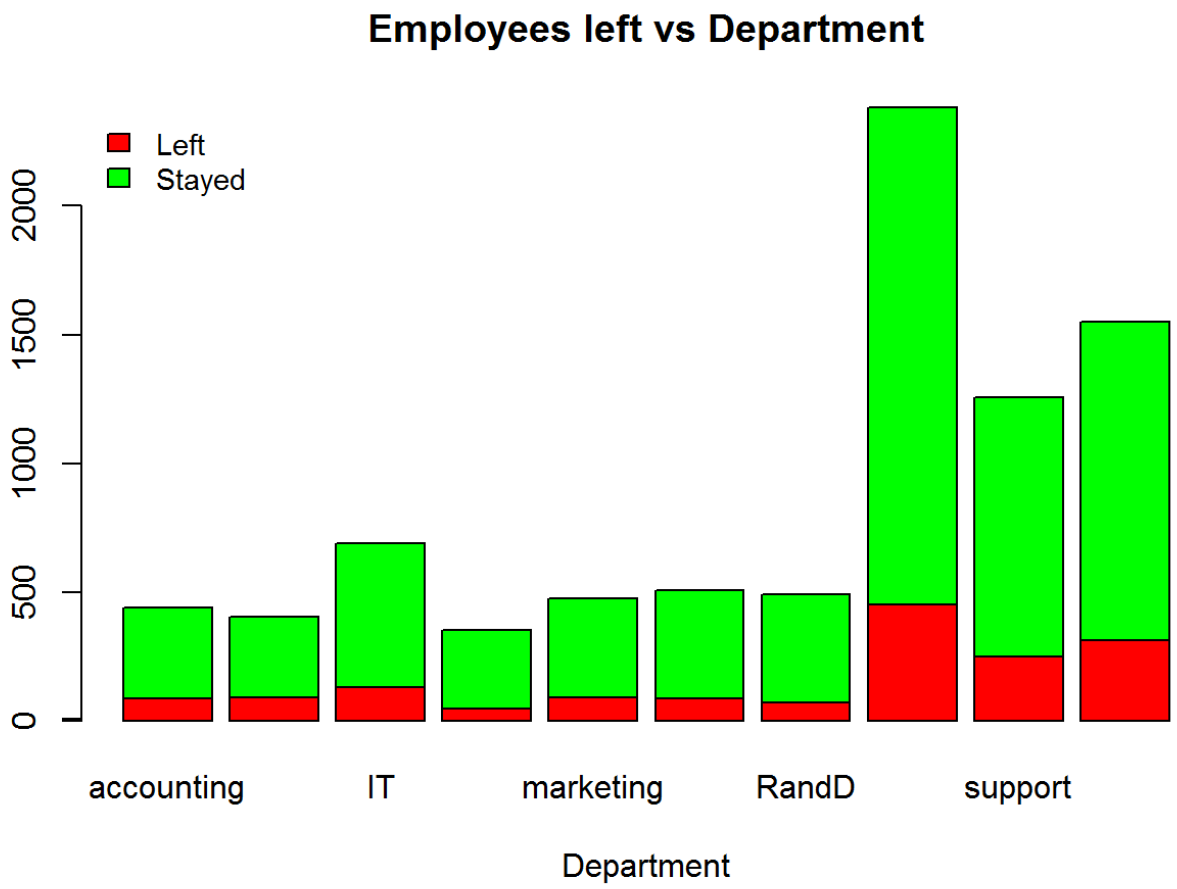
```
df <- read.csv("C:\\Users\\SGHOSH13\\Documents\\GyanData\\HR Analytics\\People Char
m case_1.csv", stringsAsFactors = F)

dups <- which(duplicated(df))

df <- df[-dups, ]

copydf <- df
```

First lets start with some exploratory data analysis.

```
df$leftStatus[df$left ==  1] = 'Left'
df$leftStatus[df$left ==  0] = 'Stayed'

#Create a barplot of Employee Quit Status by Department
analysisTable <- table(df$leftStatus, df$dept)
analysisTable
```

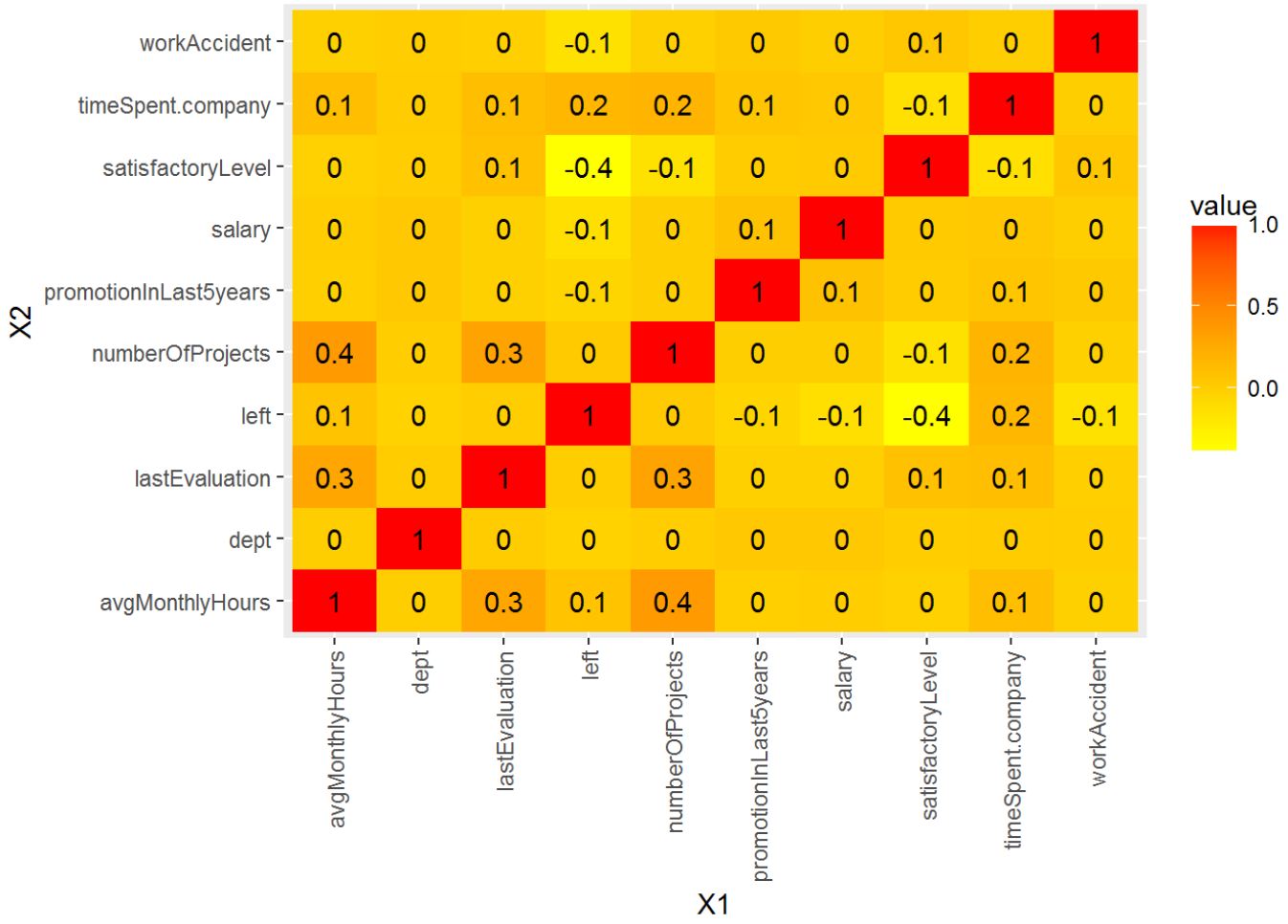
```
##
##          accounting   hr   IT management marketing product_mng RandD sales
##   Left           85   88  131         47        90          86    69   450
##   Stayed        353  317  556        303       386         422   420  1933
##
##          support technical
##   Left       250       313
##   Stayed    1005      1237
```

```
barplot(analysisTable, main="Employees left vs Department",
        xlab="Department", col=c("red","green"))

axis(2, at = 0:5, labels = 0:5)
legend("topleft", rownames(analysisTable), fill = c("red","green"), bty = 'n', cex
= 0.9)
```



Visualise the Correlation amongst variables

```
department <- unique(df$dept)
df$dept <- as.numeric(1:10)[match(df$dept, department)]
df$salary <- as.numeric(1:3)[match(df$salary, c('low', 'medium', 'high'))]

corr <- cor(df[, c(1:10)])
corr <- melt(corr)
ggplot(corr, aes(X1, X2, fill = value)) + geom_tile() +
  scale_fill_gradient(low = "yellow",  high = "red") +
  geom_text(aes(label = round(value, 1))) +
  theme(axis.text.x=element_text(angle=90,hjust=1,vjust=0.5))
```

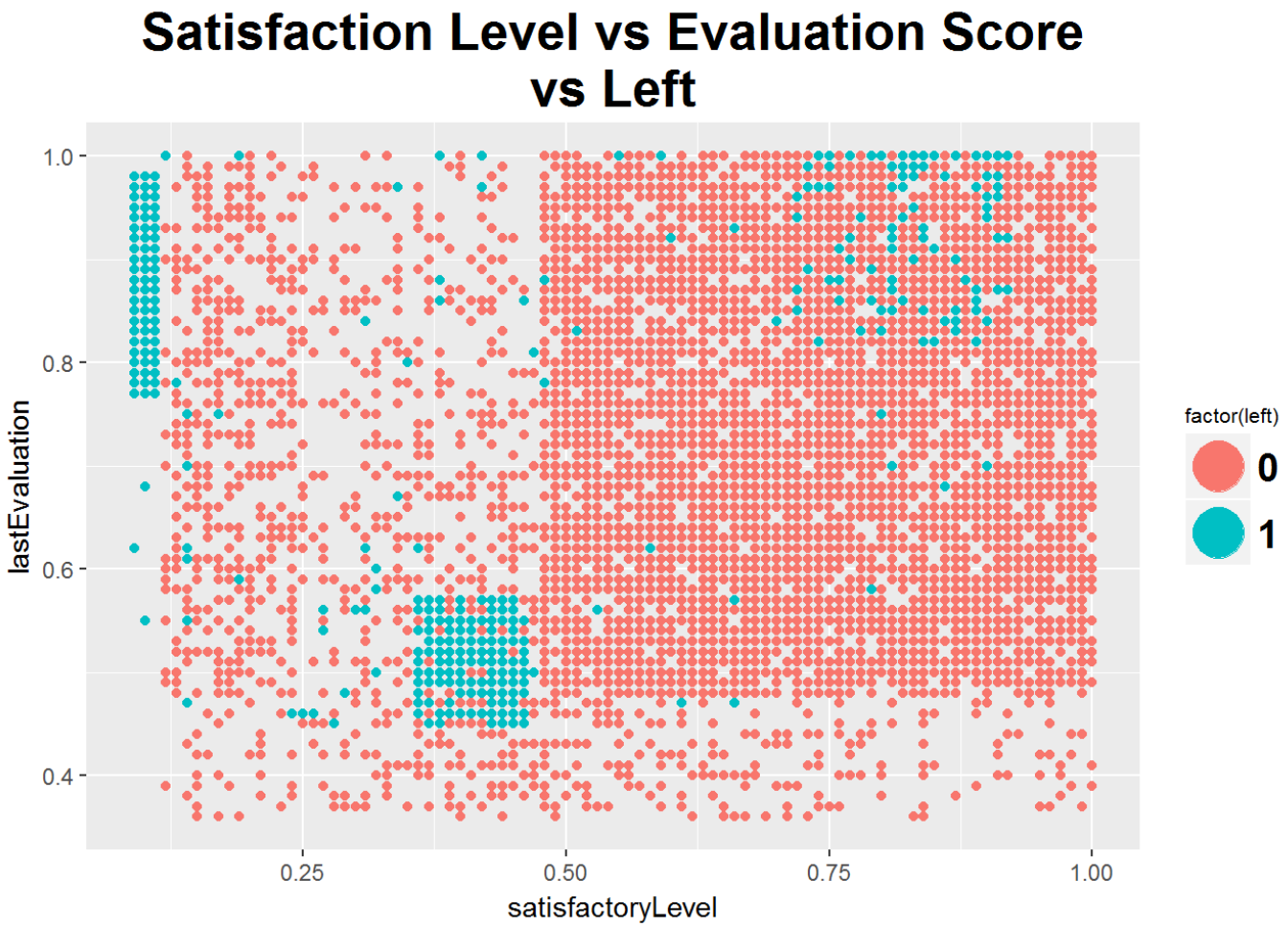


Some more analysis to analyse who are the people who have quit

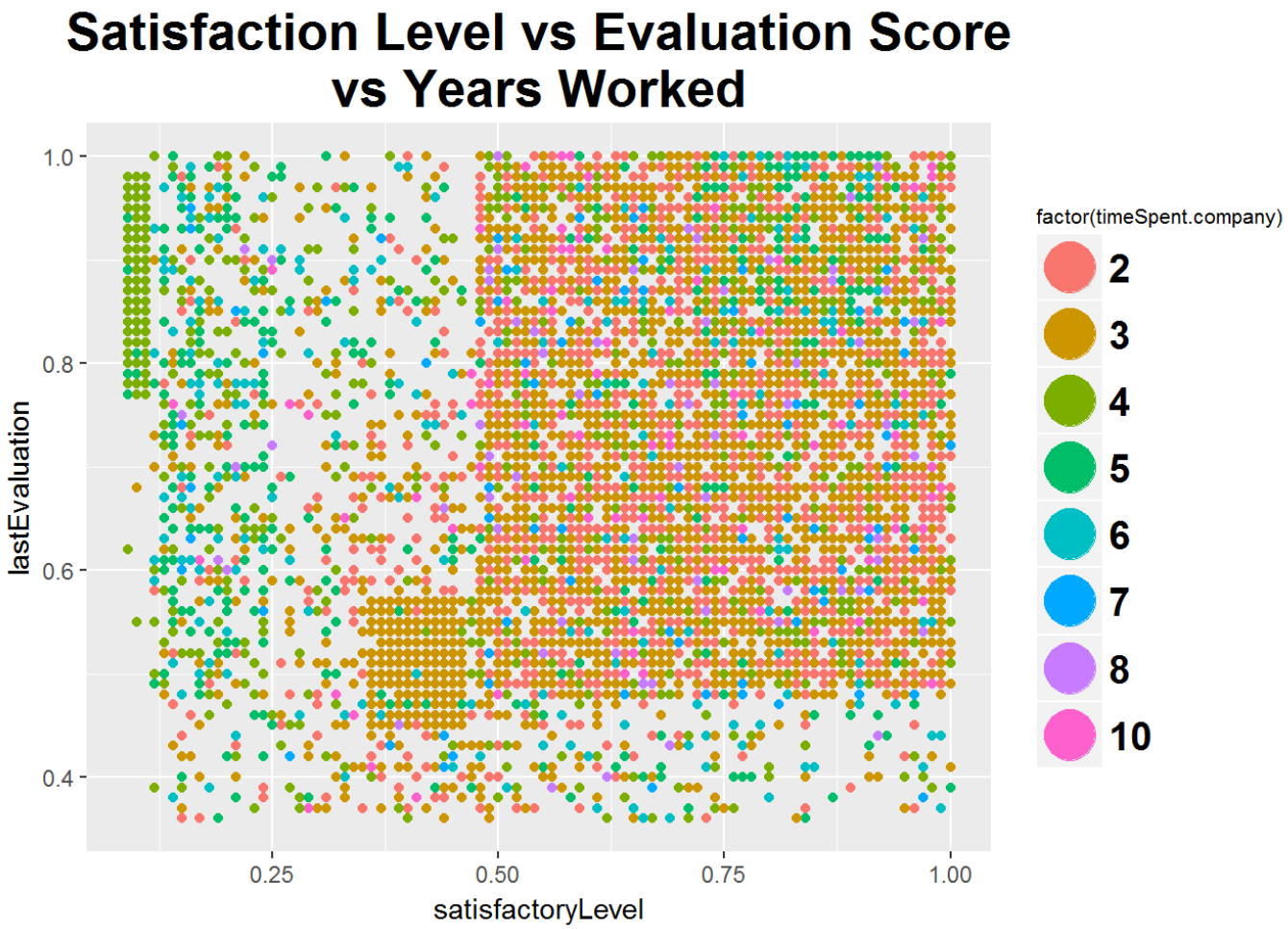
```
df <- copydf

quantile(as.numeric(df$avgMonthlyHours), probs = c(0,1/3,2/3,1))
```

```
##         0% 33.33333% 66.66667%       100% 
##         96        170        230        310 
```

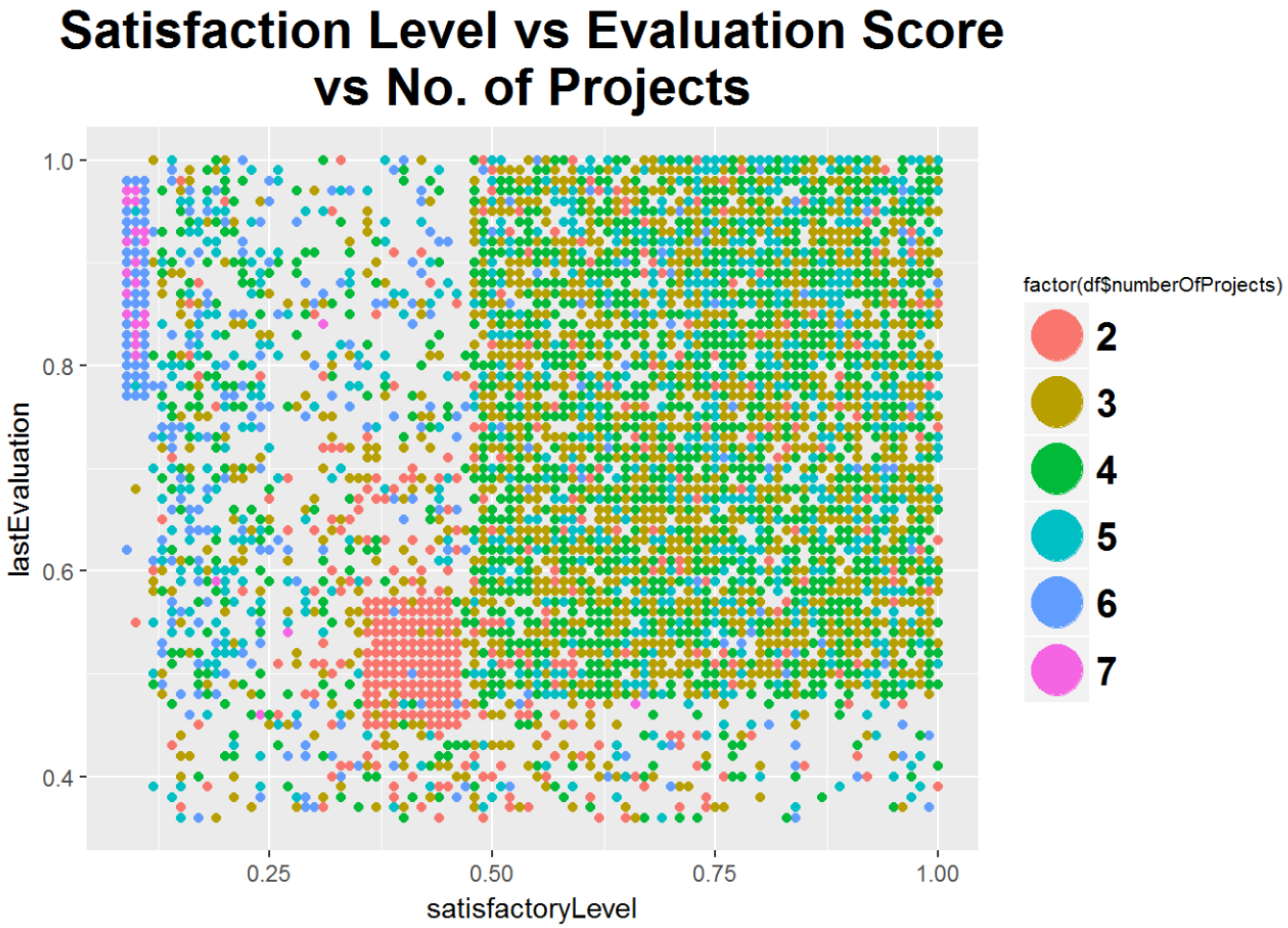
```
df$hrs <- cut(df$avgMonthlyHours, c(96, 170, 230, 310), include.lowest=TRUE)

p1 = ggplot(data = df, aes(satisfactoryLevel, lastEvaluation))
p1 + geom_point(aes(color = factor(left))) + ggtitle("Satisfaction Level vs Evaluat
ion Score\nvs Left") +
  theme(plot.title=element_text(size = 20, face = "bold", hjust = 0.5)) +
  theme(legend.title=element_text(size=8)) + theme(legend.text=element_text(size=1
0))+
  guides(colour = guide_legend(override.aes = list(size=9))) +
  theme(legend.text = element_text(size=15, face="bold"))
```



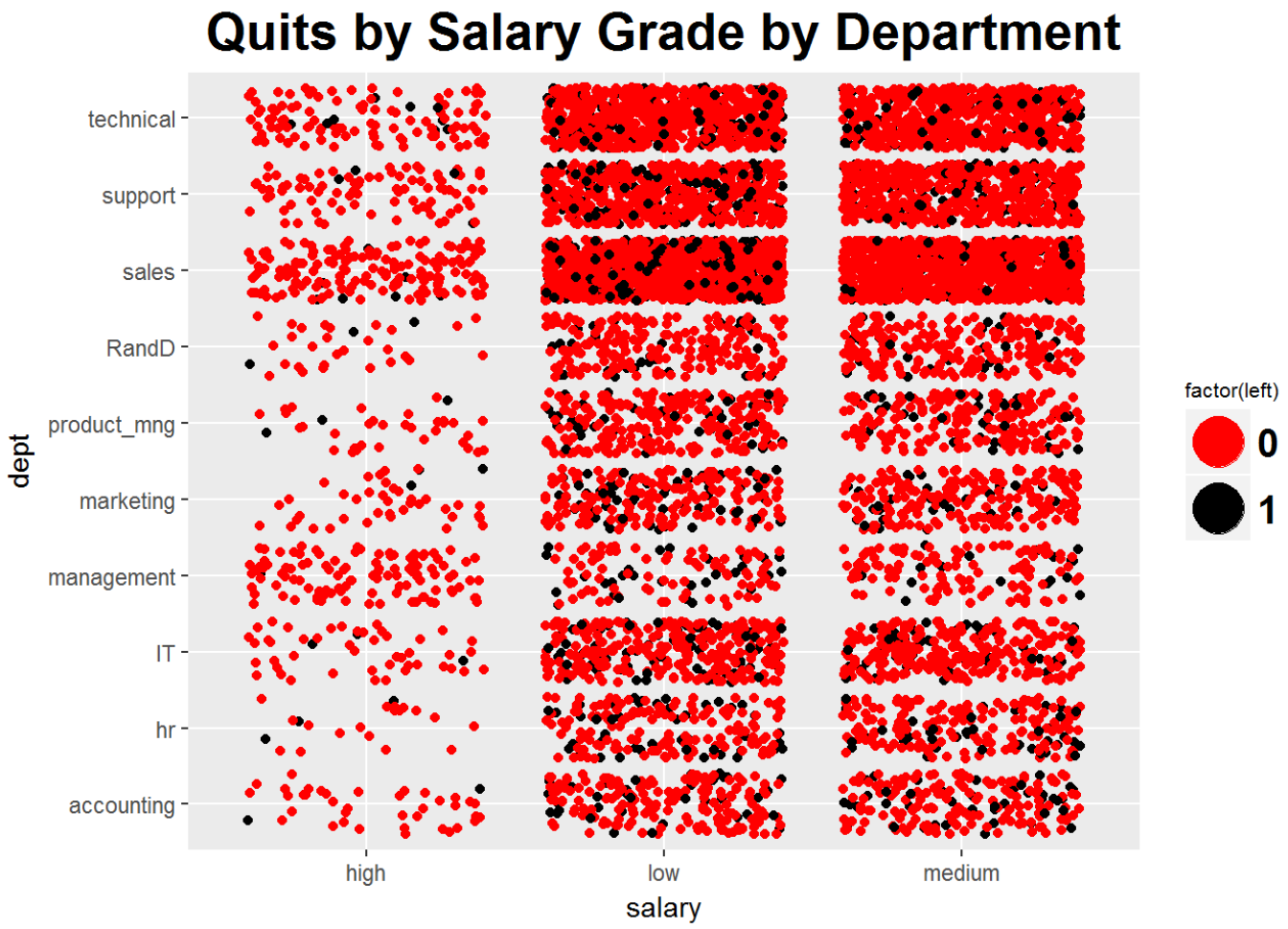

```
p2 = ggplot(data = df, aes(satisfactoryLevel, lastEvaluation))
p2 + geom_point(aes(color = factor(timeSpent.company))) + ggtitle("Satisfaction Le
vel vs Evaluation Score\nvs Years Worked") +
  theme(plot.title=element_text(size = 20, face = "bold", hjust = 0.5)) +
  theme(legend.title=element_text(size=8)) + theme(legend.text=element_text(size=1
0))+
  guides(colour = guide_legend(override.aes = list(size=9))) +
  theme(legend.text = element_text(size=15, face="bold"))
```



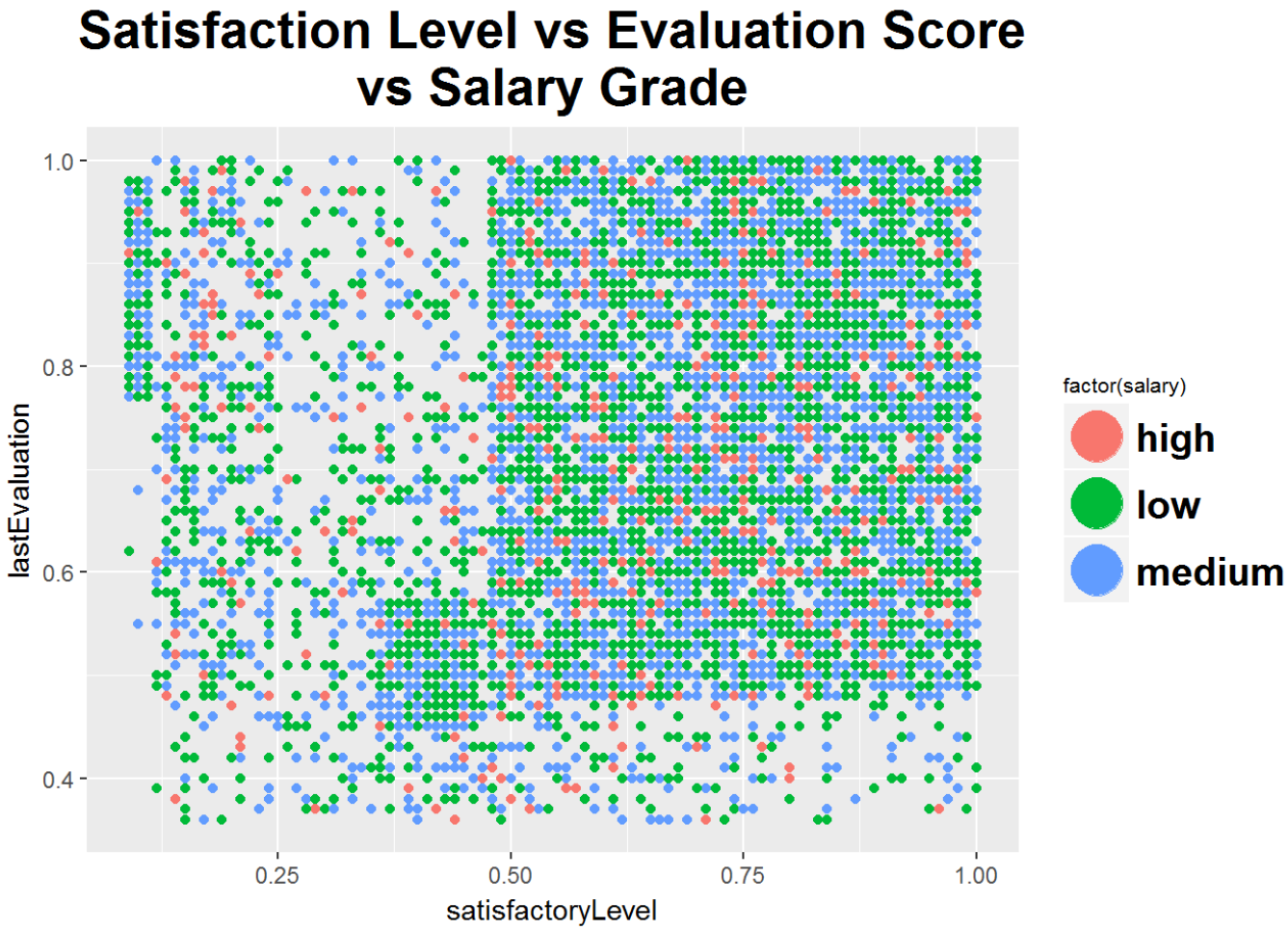

```
p4 = ggplot(data = df, aes(satisfactoryLevel, lastEvaluation))
p4 + geom_point(aes(color = factor(df$numberOfProjects))) + ggtitle("Satisfaction
Level vs Evaluation Score\nvs No. of Projects") +
    theme(plot.title=element_text(size = 20, face = "bold", hjust = 0.5)) +
    theme(legend.title=element_text(size=8)) + theme(legend.text=element_text(size
=10))+
    guides(colour = guide_legend(override.aes = list(size=9))) +
    theme(legend.text = element_text(size=15, face="bold"))
```



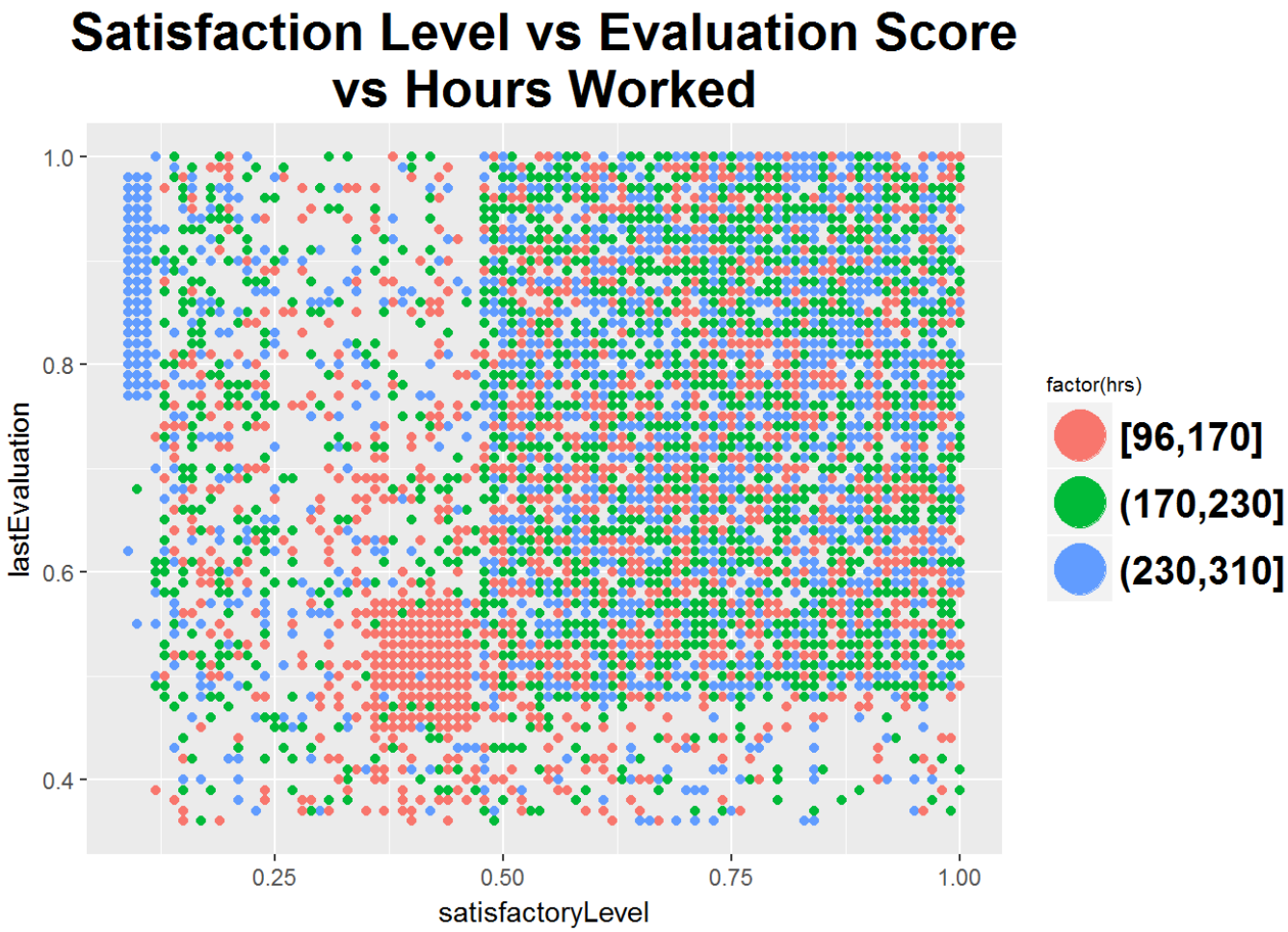

```
p3 = ggplot(data = df, aes(salary, dept))
p3 + geom_jitter(aes(color = factor(left))) + ggtitle("Quits by Salary Grade by De
partment") +
  theme(plot.title=element_text(size = 20, face = "bold", hjust = 0.5)) +
  theme(legend.title=element_text(size=8)) + theme(legend.text=element_text(size=1
0))+
  guides(colour = guide_legend(override.aes = list(size=9))) +
  theme(legend.text = element_text(size=15, face="bold")) +
  scale_color_manual(values=c("red", "black"))
```



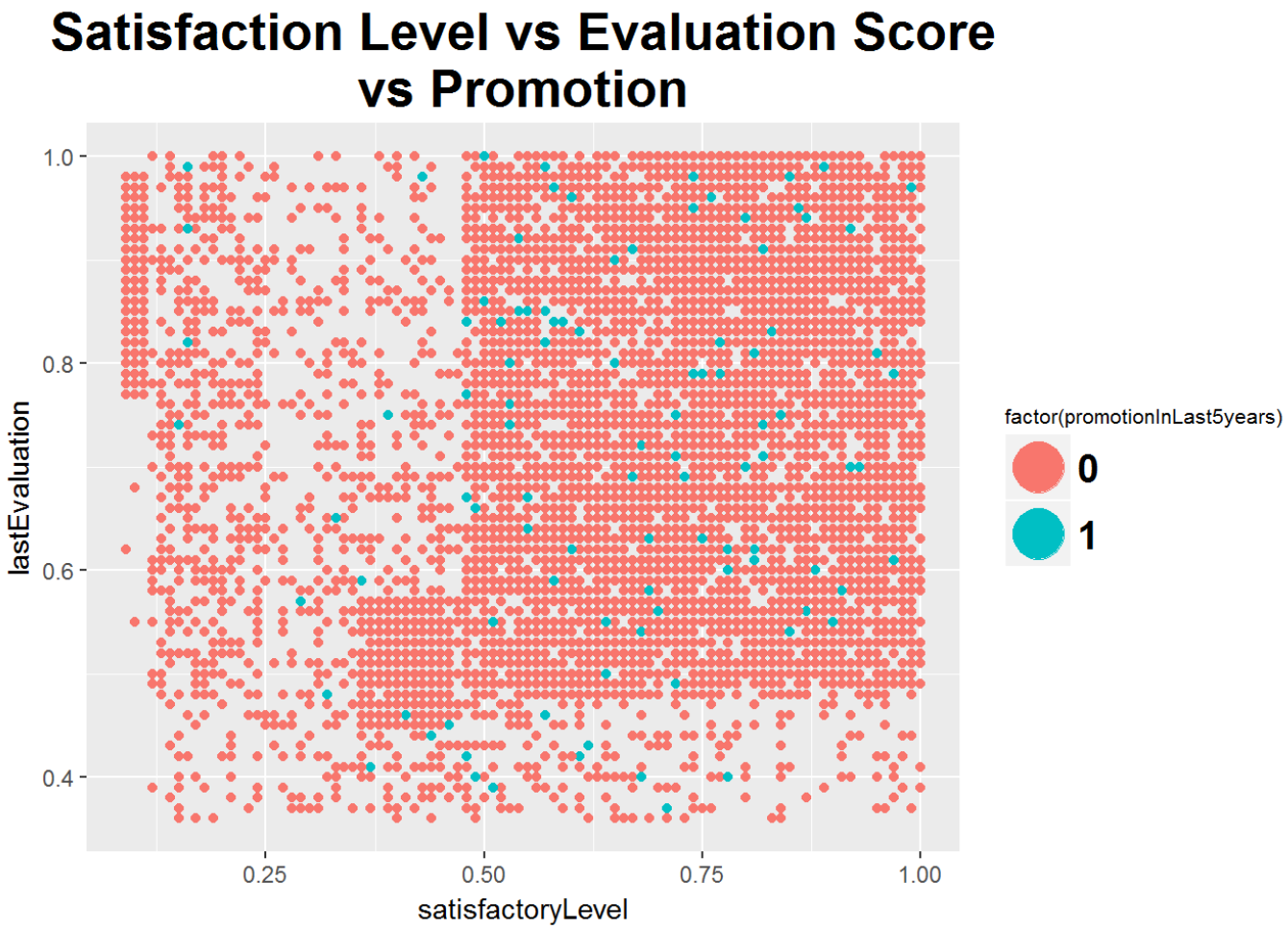

```
p4 = ggplot(data = df, aes(satisfactoryLevel, lastEvaluation))
p4 + geom_point(aes(color = factor(salary))) + ggtitle("Satisfaction Level vs Eval
uation Score\nvs Salary Grade") +
  theme(plot.title=element_text(size = 20, face = "bold", hjust = 0.5)) +
  theme(legend.title=element_text(size=8)) + theme(legend.text=element_text(size=1
0))+
  guides(colour = guide_legend(override.aes = list(size=9))) +
  theme(legend.text = element_text(size=15, face="bold"))
```




```
p5 = ggplot(data = df, aes(satisfactoryLevel, lastEvaluation))
p5 + geom_point(aes(color = factor(hrs))) + ggtitle("Satisfaction Level vs Evaluati
on Score\nvs Hours Worked") +
  theme(plot.title=element_text(size = 20, face = "bold", hjust = 0.5)) +
  theme(legend.title=element_text(size=8)) + theme(legend.text=element_text(size=1
0))+
  guides(colour = guide_legend(override.aes = list(size=9))) +
  theme(legend.text = element_text(size=15, face="bold"))
```




```
p6 = ggplot(data = df, aes(satisfactoryLevel, lastEvaluation))
p6 + geom_point(aes(color = factor(promotionInLast5years))) + ggtitle("Satisfactio
n Level vs Evaluation Score\nvs Promotion") +
  theme(plot.title=element_text(size = 20, face = "bold", hjust = 0.5)) +
  theme(legend.title=element_text(size=8)) + theme(legend.text=element_text(size=1
0))+
  guides(colour = guide_legend(override.aes = list(size=9))) +
  theme(legend.text = element_text(size=15, face="bold"))
```

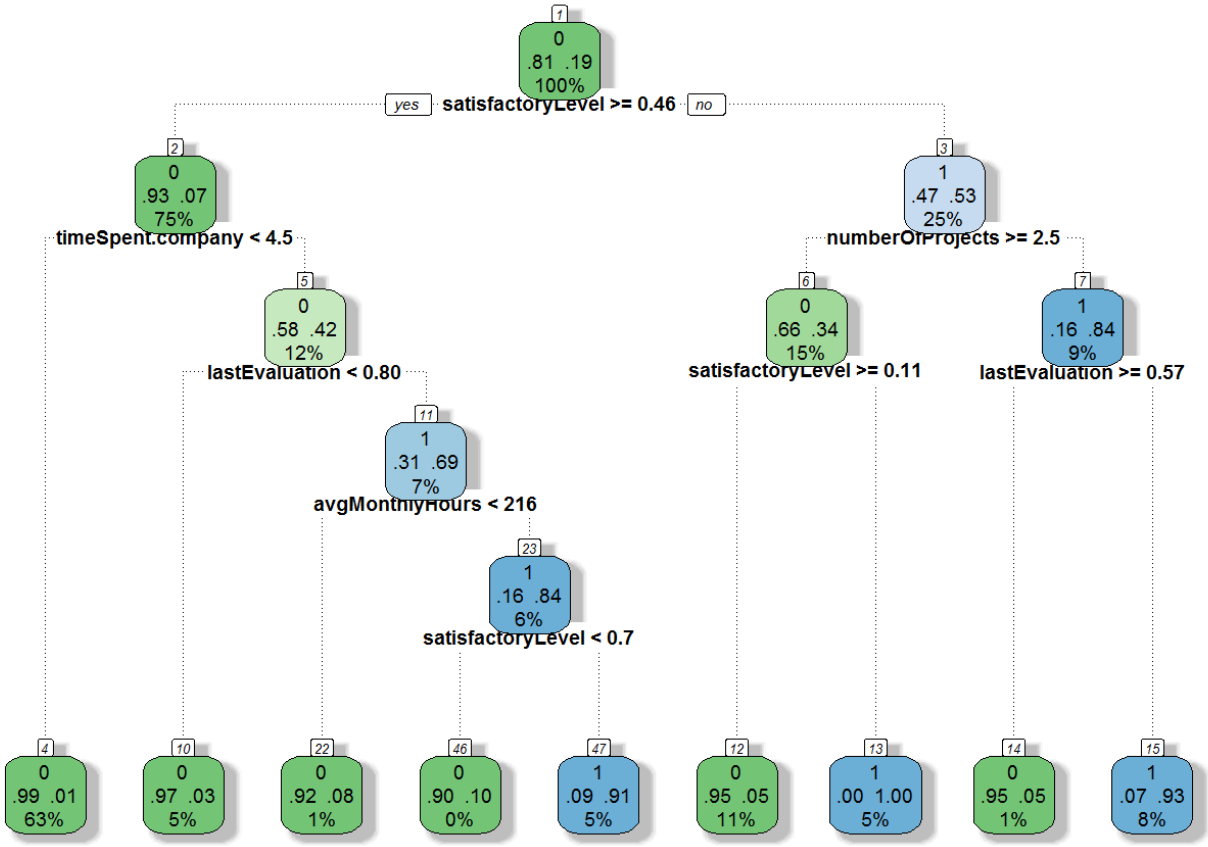


Now lets try some Classifier Techniques to predict whos going to leave First, lets load the Test Data

```
df2 <- read.csv("C:\\Users\\SGHOSH13\\Documents\\GyanData\\HR Analytics\\People Cha
rm case_2.csv", stringsAsFactors = F)
dups <- which(duplicated(df2))
df2 <- df2[-dups, ]

df <- df[,-c(9,10,11)]
train <- df
test  <- df2[,-c(9,10)]
```

Decision trees

```
model_dt <- rpart(left ~ ., data=train, method="class", minbucket=30)
fancyRpartPlot(model_dt, cex = 0.6)
```



Rattle 2017-Aug-28 14:59:48 sghosh13

```
predicted_dt <- predict(model_dt, test, type="class")
table(test$left, predicted_dt)
```

```
##    predicted_dt
##        0    1
##   0 3623   57
##   1   85  853
```

```
mean(predicted_dt==test$left)
```

```
## [1] 0.9692508
```

```
confusionMatrix(predicted_dt, df2$left)
```

```
## Confusion Matrix and Statistics
##
##           Reference
## Prediction    0    1
##          0 3623   85
##          1   57  853
##
##                Accuracy : 0.9693
##                  95% CI : (0.9639, 0.974)
##     No Information Rate : 0.7969
##     P-Value [Acc > NIR] : < 2e-16
##
##                   Kappa : 0.9039
##  Mcnemar's Test P-Value : 0.02346
##
##             Sensitivity : 0.9845
##             Specificity : 0.9094
##          Pos Pred Value : 0.9771
##          Neg Pred Value : 0.9374
##              Prevalence : 0.7969
##          Detection Rate : 0.7845
##    Detection Prevalence : 0.8029
##       Balanced Accuracy : 0.9469
##
##        'Positive' Class : 0
##
```

Random forests

```
model_rf <- randomForest(as.factor(left) ~ ., data=train, nsize=20, ntree=200)
predicted_rf <- predict(model_rf, test)
table(test$left, predicted_rf)
```

```
##    predicted_rf
##        0    1
##   0 3674    6
##   1   58  880
```

```
mean(predicted_rf==test$left)
```

```
## [1] 0.9861412
```

```
confusionMatrix(predicted_rf, df2$left)
```

```
## Confusion Matrix and Statistics
##
##           Reference
## Prediction    0    1
##          0 3674   58
##          1    6  880
##
##                Accuracy : 0.9861
##                  95% CI : (0.9823, 0.9893)
##     No Information Rate : 0.7969
##     P-Value [Acc > NIR] : < 2.2e-16
##
##                   Kappa : 0.9563
##  Mcnemar's Test P-Value : 1.83e-10
##
##             Sensitivity : 0.9984
##             Specificity : 0.9382
##          Pos Pred Value : 0.9845
##          Neg Pred Value : 0.9932
##              Prevalence : 0.7969
##          Detection Rate : 0.7956
##    Detection Prevalence : 0.8081
##       Balanced Accuracy : 0.9683
##
##        'Positive' Class : 0
##
```

Plotting ROC Curves for the Classifiers

```
# Decision tree
predict_dt_ROC <- predict(model_dt, test)
pred_dt <- prediction(predict_dt_ROC[,2], test$left)
perf_dt <- performance(pred_dt, "tpr", "fpr")

auc_dt <- performance(pred_dt,"auc")
auc_dt <- round(as.numeric(auc_dt@y.values),3)

# Random forest
predict_rf_ROC <- predict(model_rf, test, type="prob")
pred_rf <- prediction(predict_rf_ROC[,2], test$left)
perf_rf <- performance(pred_rf, "tpr", "fpr")

auc_rf <- performance(pred_rf,"auc")
auc_rf <- round(as.numeric(auc_rf@y.values),3)

print(paste('AUC of Decision Tree:',auc_dt))
```

```
## [1] "AUC of Decision Tree: 0.968"
```

```
print(paste('AUC of Random Forest:',auc_rf))
```

```
## [1] "AUC of Random Forest: 0.989"
```

```
# Plotting the 2 curves
plot(perf_dt, main = "ROC curves for all Classifiers", col='red', lwd=3)
plot(perf_rf, add=TRUE, col='blue', lwd=3)
legend('bottomright', c("Decision Tree", "Random Forest"), fill = c('red','blue'),
bty='n', cex = 0.6)
abline(0,1, col = 'black', lwd =2)
```