Notebook 4 Dimensionality Reduction

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Data Cleaning and factors

The dataset being use has to do with hotel reservations and weather a customer would cancel a reservation or not

```
library(readr)
```

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

```
library(caret)
```

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

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

```
df <- read.csv("hotel-reservations.csv", header=TRUE)
df <- df[,c(2,3,4,5,6,8,9,13,15,16,17,18,19)]
df$booking_status <- factor(df$booking_status)
df$type_of_meal_plan <- factor(df$type_of_meal_plan)
df$room_type_reserved <- factor(df$room_type_reserved)
df$market_segment_type <- factor(df$market_segment_type)
```

Run PCA on Data

```
i <- sample(1:150, 100, replace=FALSE)
train <- df[i,]
test <- df[-i,]

set.seed(1234)
pca_out <- preProcess(train[,c(4,7,11,12)], method=c("center", "scale", "pca"))
pca_out
```

```
## Created from 100 samples and 4 variables
##
## Pre-processing:
##    - centered (4)
##    - ignored (0)
##    - principal component signal extraction (4)
##    - scaled (4)
##
## PCA needed 4 components to capture 95 percent of the variance
```

PCA Plot

```
train_pc <- predict(pca_out, train[,c(4,7,11,12)])
test_pc <- predict(pca_out, test[,])
plot(test_pc$PC1, test_pc$PC2, pch=c(23,21,22)[unclass(test_pc$booking_status)], bg=c("red","gre
en")[unclass(test_pc$booking_status)])
```


###
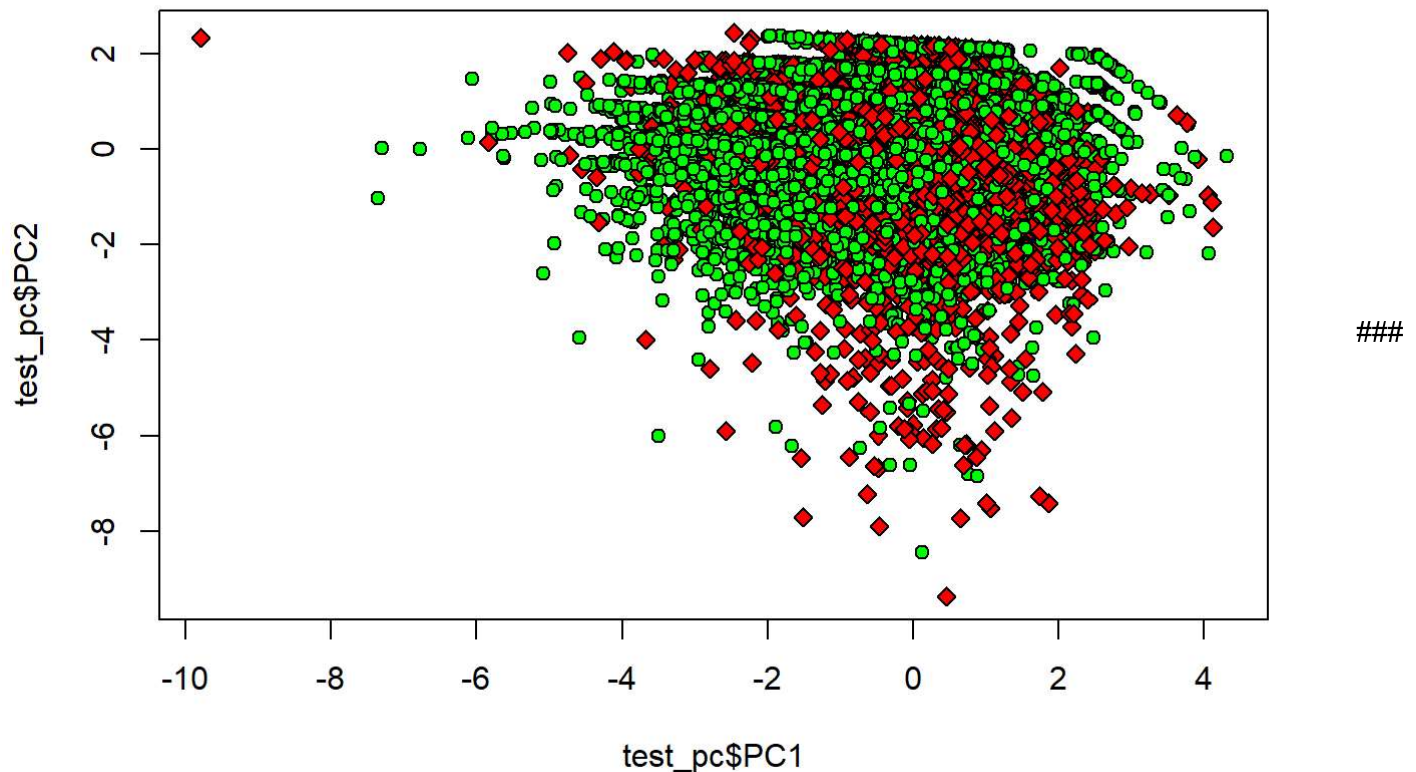
PCA Data in Knn

```
train_df <- data.frame(train_pc$PC1, train_pc$PC2, train$booking_status)
test_df <- data.frame(test_pc$PC1, test_pc$PC2, test$booking_status)
library(class)
set.seed(1234)
pred <- knn(train=train_df[,1:2], test=test_df[,1:2], cl=train_df[,3], k=3)
mean(pred==test$booking_status)
```

```
## [1] 0.6217554
```

```
library(tree)
```

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

```
colnames(train_df) <- c("PC1", "PC2", "booking_status")
colnames(test_df) <- c("PC1", "PC2", "booking_status")
set.seed(1234)
tree1 <- tree(booking_status~., data=train_df)
plot(tree1)
text(tree1, cex=0.5, pretty=0)
```
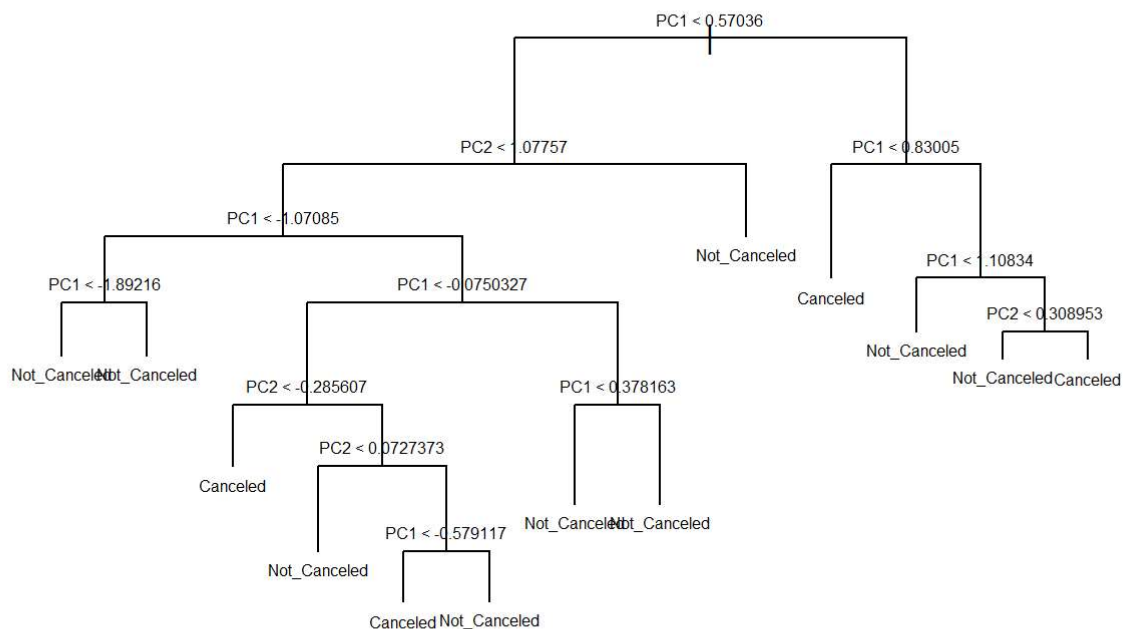


```
pred <- predict(tree1, newdata=test_df, type="class")
mean(pred==test$booking_status)
```

```
## [1] 0.5963511
```

Decision tree and accuracy

LDA

```
train <- train[,c(4,7,11,12,13)]
library(MASS)
lda1 <- lda(booking_status~., data=train)
lda1$means
```

```
##                 no_of_week_nights lead_time avg_price_per_room
## Canceled                 2.280000 128.84000           101.7148
## Not_Canceled             2.186667  76.53333           101.2107
##                 no_of_special_requests
## Canceled                     0.5200000
## Not_Canceled                 0.9066667
```

Predicting on test

```
test <- test[,c(4,7,11,12,13)]
lda_pred <- predict(lda1, newdata=test, type="class")
lda_pred$class
```

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## [35941] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Canceled
## [35946] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Not_Canceled
## [35951] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Not_Canceled
## [35956] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Not_Canceled
## [35961] Canceled     Not_Canceled Not_Canceled Not_Canceled Not_Canceled
## [35966] Not_Canceled Not_Canceled Not_Canceled Canceled     Canceled
## [35971] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Not_Canceled
## [35976] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Not_Canceled
## [35981] Not_Canceled Canceled     Not_Canceled Not_Canceled Not_Canceled
## [35986] Not_Canceled Canceled     Canceled     Not_Canceled Not_Canceled
## [35991] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Not_Canceled
## [35996] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Not_Canceled
## [36001] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Canceled
## [36006] Canceled     Not_Canceled Not_Canceled Not_Canceled Not_Canceled
## [36011] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Not_Canceled
## [36016] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Not_Canceled
## [36021] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Not_Canceled
## [36026] Not_Canceled Canceled     Canceled     Canceled     Not_Canceled
## [36031] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Not_Canceled
## [36036] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Canceled
## [36041] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Canceled
## [36046] Not_Canceled Not_Canceled Canceled     Not_Canceled Not_Canceled
## [36051] Not_Canceled Not_Canceled Not_Canceled Canceled     Not_Canceled
## [36056] Not_Canceled Not_Canceled Canceled     Not_Canceled Not_Canceled
## [36061] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Not_Canceled
## [36066] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Not_Canceled
## [36071] Not_Canceled Canceled     Not_Canceled Canceled     Not_Canceled
## [36076] Not_Canceled Canceled     Not_Canceled Canceled     Not_Canceled
## [36081] Not_Canceled Canceled     Canceled     Not_Canceled Not_Canceled
## [36086] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Canceled
## [36091] Not_Canceled Canceled     Not_Canceled Not_Canceled Not_Canceled
## [36096] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Not_Canceled
## [36101] Canceled     Not_Canceled Not_Canceled Canceled     Not_Canceled
## [36106] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Canceled
## [36111] Not_Canceled Not_Canceled Not_Canceled Canceled     Not_Canceled
## [36116] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Not_Canceled
## [36121] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Not_Canceled
## [36126] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Not_Canceled
## [36131] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Not_Canceled
## [36136] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Not_Canceled
```

```
## [36141] Not_Canceled Canceled     Not_Canceled Not_Canceled Not_Canceled
## [36146] Canceled     Not_Canceled Not_Canceled Canceled     Canceled
## [36151] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Not_Canceled
## [36156] Not_Canceled Not_Canceled Canceled     Not_Canceled Not_Canceled
## [36161] Not_Canceled Canceled     Not_Canceled Not_Canceled Canceled
## [36166] Not_Canceled Not_Canceled Not_Canceled Canceled     Not_Canceled
## [36171] Not_Canceled Not_Canceled Not_Canceled Not_Canceled Canceled
## Levels: Canceled Not_Canceled
```

```
mean(lda_pred$class==test$booking_status)
```

```
## [1] 0.7588113
```

Plot

```
lda1
```

```
## Call:
## lda(booking_status ~ ., data = train)
##
## Prior probabilities of groups:
##     Canceled Not_Canceled
##         0.25         0.75
##
## Group means:
##              no_of_week_nights lead_time avg_price_per_room
## Canceled              2.280000 128.84000            101.7148
## Not_Canceled          2.186667  76.53333            101.2107
##              no_of_special_requests
## Canceled                  0.5200000
## Not_Canceled              0.9066667
##
## Coefficients of linear discriminants:
##                              LD1
## no_of_week_nights     -0.095079780
## lead_time             -0.009430817
## avg_price_per_room    -0.013579397
## no_of_special_requests  0.883843403
```

```
plot(lda_pred$x[,1], lda_pred$x[,1], pch=c(23,21,22)[unclass(lda_pred$class)], bg=c("red","gree
n")[unclass(test_pc$booking_status)])
```
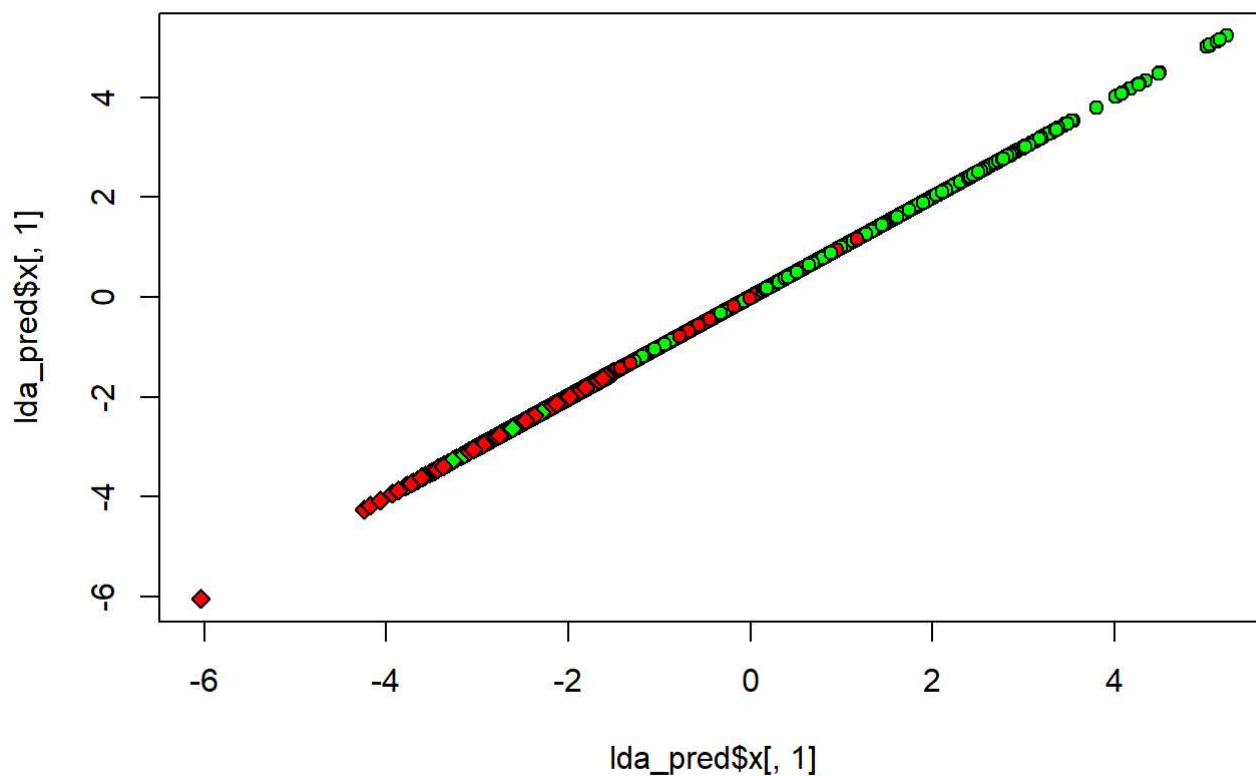
Summary

For prepossessing we used 4 features which was number of weeknights, lead time, average room price, and number of special requests. Also using booking status as the factor. We build a PCA Plot showing a good amount of overlap, but still having some distinction between the two components that were built. This would make classification more of a challenge. We then used the PCA data in KNN and got any accuracy of 62%. However, when we used the data on decision trees we got a slightly higher accuracy of 65%. Then we applied LDA to the data set. Where we got a higher accuracy of 76%. The plot for LDA was interesting. Since it looked linear and see more a bit more clear the separation of data. This makes sense since LDA tries to find the linear combination of the predictors. With the increase in accuracy it shows that LDA is better than PCA when the classes are know.