

Hyatt Hotels Analysis

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```
library("NPS")

library('ggplot2')

library('ggmap')

library("kernlab")

##
## Attaching package: 'kernlab'

## The following object is masked from 'package:ggplot2':
##
##      alpha

library("arules")

## Loading required package: Matrix

##
## Attaching package: 'arules'

## The following object is masked from 'package:kernlab':
##
##      size

## The following objects are masked from 'package:base':
##
##      abbreviate, write

library("arulesViz")

## Loading required package: grid

## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 1.29852988910633
##
## Number of Support Vectors : 280
##
```

```
## Objective Function Value : -643.3392
## Training error : 0.179876
## Cross validation error : 0.605835
## Laplace distr. width : 0.960896

## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 1.38917949119374
##
## Number of Support Vectors : 518
##
## Objective Function Value : -1330.923
## Training error : 0.463584
## Cross validation error : 1.574282
## Laplace distr. width : 0.202321

## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 1.52169435094586
##
## Number of Support Vectors : 506
##
## Objective Function Value : -1571.558
## Training error : 0.624767
## Cross validation error : 2.274693
## Laplace distr. width : 0.141641

## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 1.25168668460535
##
## Number of Support Vectors : 508
##
## Objective Function Value : -1384.188
## Training error : 0.484886
## Cross validation error : 1.60406
## Laplace distr. width : 0.202614
```

```
## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 0.927587556744811
##
## Number of Support Vectors : 525
##
## Objective Function Value : -1385.77
## Training error : 0.560446
## Cross validation error : 1.951855
## Laplace distr. width : 0.083644

## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 1.08509676016525
##
## Number of Support Vectors : 527
##
## Objective Function Value : -1686.513
## Training error : 0.681072
## Cross validation error : 2.345712
## Laplace distr. width : 0.054231

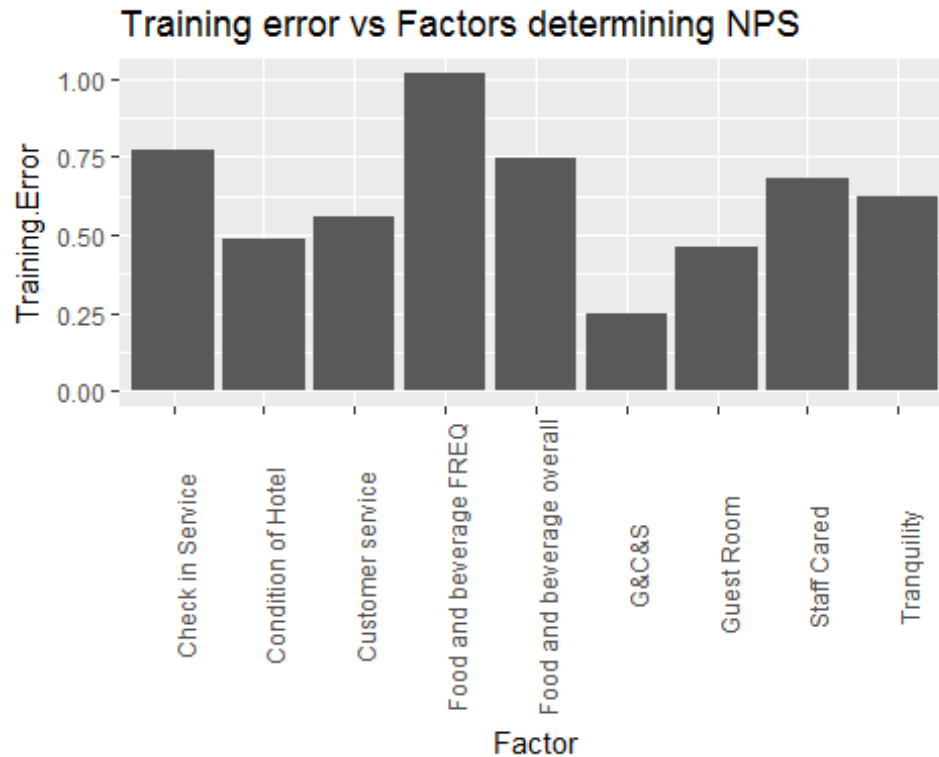
## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 0.965614277560339
##
## Number of Support Vectors : 595
##
## Objective Function Value : -1724.075
## Training error : 0.770192
## Cross validation error : 2.671181
## Laplace distr. width : 0.007262

## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
```

```
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 0.282090671885192
##
## Number of Support Vectors : 829
##
## Objective Function Value : -2429.297
## Training error : 1.143793
## Cross validation error : 3.739261
## Laplace distr. width : 0

## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 2.6844362968749
##
## Number of Support Vectors : 587
##
## Objective Function Value : -1798.526
## Training error : 0.752409
## Cross validation error : 2.5828
## Laplace distr. width : 0.034876

## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 0.905529743334848
##
## Number of Support Vectors : 479
##
## Objective Function Value : -876.2466
## Training error : 0.241863
## Cross validation error : 1.322208
## Laplace distr. width : 0.738954
```



```
##
## Call:
## lm(formula = Likelihood_Recommend_H ~ Guest_Room_H, data = jandata1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -8.7111 -0.2625  0.2889  0.2889  4.3700
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   1.54891    0.22868   6.773 2.31e-11 ***
## Guest_Room_H   0.81622    0.02537  32.167 < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.227 on 874 degrees of freedom
## Multiple R-squared:  0.5421, Adjusted R-squared:  0.5416
## F-statistic: 1035 on 1 and 874 DF, p-value: < 2.2e-16

##
## Call:
## lm(formula = Likelihood_Recommend_H ~ Tranquility_H, data = jandata1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -8.5677 -0.5677  0.4323  0.4323  5.7093
##
```

```

## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)   2.97149    0.25159   11.81  <2e-16 ***
## Tranquility_H 0.65962    0.02803   23.53  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.419 on 874 degrees of freedom
## Multiple R-squared:  0.3878, Adjusted R-squared:  0.3871
## F-statistic: 553.7 on 1 and 874 DF,  p-value: < 2.2e-16

##
## Call:
## lm(formula = Likelihood_Recommend_H ~ Condition_Hotel_H, data = jandata1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -8.6736 -0.6736  0.3264  0.3264  3.7517
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)     1.11036    0.24984   4.444 9.95e-06 ***
## Condition_Hotel_H 0.85633    0.02748  31.158 < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.248 on 874 degrees of freedom
## Multiple R-squared:  0.5262, Adjusted R-squared:  0.5257
## F-statistic: 970.8 on 1 and 874 DF,  p-value: < 2.2e-16

##
## Call:
## lm(formula = Likelihood_Recommend_H ~ Customer_SVC_H, data = jandata1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -8.4963 -0.4963  0.5037  0.5037  4.9071
##
## Coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)     0.34852    0.31874   1.093   0.274
## Customer_SVC_H 0.91478    0.03422  26.736 <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.345 on 874 degrees of freedom
## Multiple R-squared:  0.4499, Adjusted R-squared:  0.4493
## F-statistic: 714.8 on 1 and 874 DF,  p-value: < 2.2e-16

```

```
##
## Call:
## lm(formula = Likelihood_Recommend_H ~ Staff_Cared_H, data = jandata1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -8.4769 -0.4769  0.5231  0.5231  4.2760
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   1.97371    0.32840    6.01 2.72e-09 ***
## Staff_Cared_H  0.75032    0.03577   20.98 < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.479 on 874 degrees of freedom
## Multiple R-squared:  0.3349, Adjusted R-squared:  0.3342
## F-statistic: 440.1 on 1 and 874 DF,  p-value: < 2.2e-16

##
## Call:
## lm(formula = Likelihood_Recommend_H ~ Check_In_H, data = jandata1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -8.2535 -0.2535  0.7465  0.7465  4.7536
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   2.57493    0.37055    6.949 7.2e-12 ***
## Check_In_H    0.66786    0.03945   16.929 < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.573 on 874 degrees of freedom
## Multiple R-squared:  0.2469, Adjusted R-squared:  0.2461
## F-statistic: 286.6 on 1 and 874 DF,  p-value: < 2.2e-16

##
## Call:
## lm(formula = Likelihood_Recommend_H ~ F.B_FREQ_H, data = jandata1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -7.9408 -0.7318  0.2682  1.2682  1.2682
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   8.62733    0.14906   57.879 <2e-16 ***
## F.B_FREQ_H    0.10449    0.09116    1.146  0.252
```

```

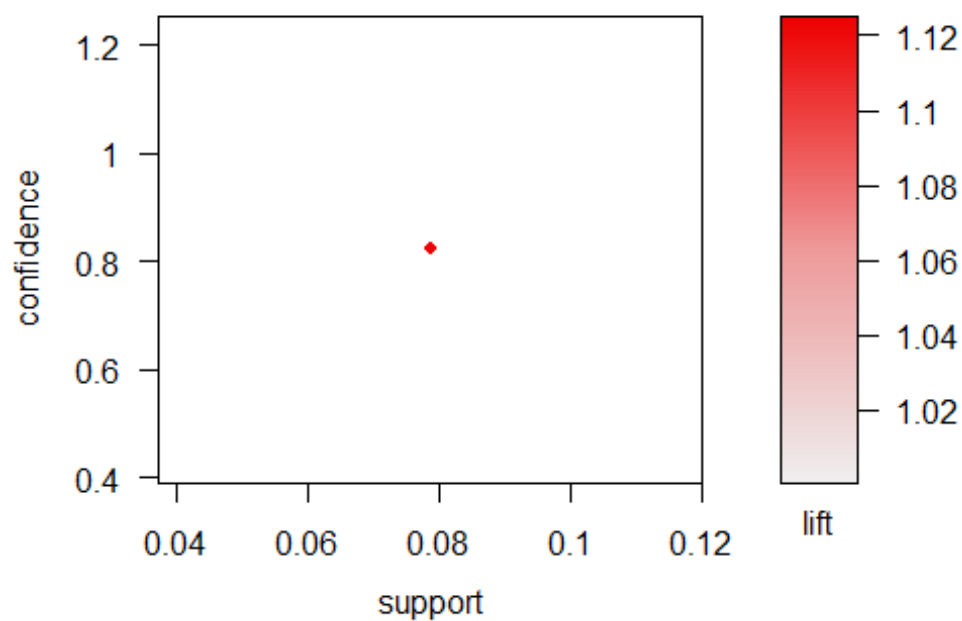
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.812 on 874 degrees of freedom
## Multiple R-squared:  0.001501, Adjusted R-squared:  0.0003584
## F-statistic: 1.314 on 1 and 874 DF, p-value: 0.252

##
## Call:
## lm(formula = Likelihood_Recommend_H ~ F.B_Overall_Experience_H,
##     data = jandata1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -8.4899 -0.4449  0.5101  0.5551  5.7348
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      4.26524    0.28086   15.19  <2e-16 ***
## F.B_Overall_Experience_H  0.52246    0.03188   16.39  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.586 on 874 degrees of freedom
## Multiple R-squared:  0.235, Adjusted R-squared:  0.2342
## F-statistic: 268.5 on 1 and 874 DF, p-value: < 2.2e-16

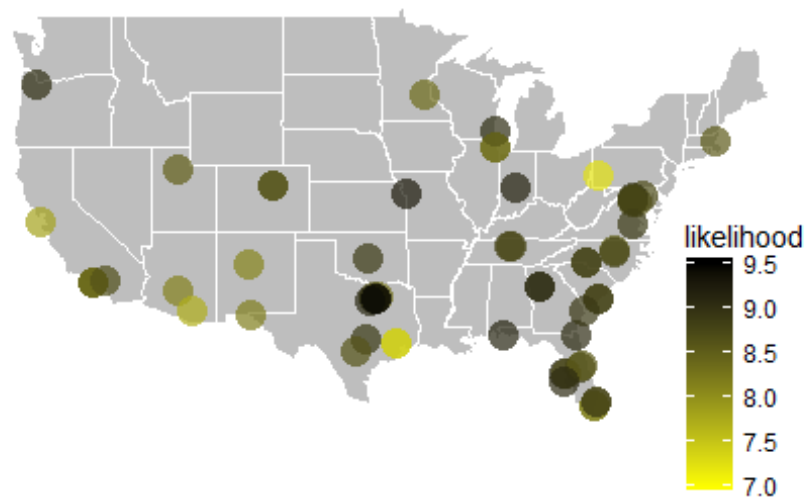
## Apriori
##
## Parameter specification:
## confidence minval  smax  arem  aval originalSupport  maxtime support minlen
##      0.82    0.1    1 none FALSE               TRUE      5     0.06    1
## maxlen target  ext
##      10   rules FALSE
##
## Algorithmic control:
## filter tree heap memopt load sort verbose
##    0.1 TRUE TRUE  FALSE TRUE    2    TRUE
##
## Absolute minimum support count: 52
##
## set item appearances ...[3 item(s)] done [0.00s].
## set transactions ...[28 item(s), 876 transaction(s)] done [0.00s].
## sorting and recoding items ... [24 item(s)] done [0.00s].
## creating transaction tree ... done [0.00s].
## checking subsets of size 1 2 3 4 5 6 7 8 9 10 done [0.02s].
## writing ... [16 rule(s)] done [0.00s].
## creating S4 object ... done [0.00s].

```


Scatter plot for 16 rules



likelihood to recommend of hotel |



```
april <- read.csv(file="C:/Users/Surabhi/Downloads/Surabhi docs/final
submission/out-201404.csv", header=TRUE, sep=",")
```

```
aprildata <- april[-  
c(1:18,20:55,57:65,67:82,84:106,108:136,148:170,172:181,183:195,197:198,199,2  
01,203,204,209,210,211,213,214,216,217,218,220,222,223,224,225,226,227,228:23  
1,233:237)]
```

```
aprildata1 <- na.omit(aprildata)
```

```
aprildata1 <- aprildata1[aprildata1$Location_PL == "Airport",]  
aprildata1 <- aprildata1[aprildata1$Country_PL == "United States",]
```

#Support Vector Machine for Likelihood_Recommend vs various other factors for April

```
ksvm(Likelihood_Recommend_H ~ Overall_Sat_H, data=aprildata1,  
kernel="rbfdot", kpar="automatic", C=5, cross=3, prob.model=TRUE)
```

```
## Support Vector Machine object of class "ksvm"  
##  
## SV type: eps-svr (regression)  
## parameter : epsilon = 0.1 cost C = 5  
##  
## Gaussian Radial Basis kernel function.  
## Hyperparameter : sigma = 1.22132654400997  
##  
## Number of Support Vectors : 752  
##  
## Objective Function Value : -1833.895  
## Training error : 0.200486  
## Cross validation error : 0.608207  
## Laplace distr. width : 0.687585
```

#0.0.200486

```
ksvm(Likelihood_Recommend_H ~ Guest_Room_H, data=aprildata1, kernel="rbfdot",  
kpar="automatic", C=5, cross=3, prob.model=TRUE)
```

```
## Support Vector Machine object of class "ksvm"  
##  
## SV type: eps-svr (regression)  
## parameter : epsilon = 0.1 cost C = 5  
##  
## Gaussian Radial Basis kernel function.  
## Hyperparameter : sigma = 1.1316670074068  
##  
## Number of Support Vectors : 1387  
##  
## Objective Function Value : -4021.085  
## Training error : 0.514624
```

```

## Cross validation error : 1.586866
## Laplace distr. width : 0.150622

#0.514624
ksvm(Likelihood_Recommend_H ~ Tranquility_H, data=aprildata1,
kernel="rbfdot", kpar="automatic", C=5, cross=3, prob.model=TRUE)

## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 1.43796388617841
##
## Number of Support Vectors : 1441
##
## Objective Function Value : -4622.198
## Training error : 0.629776
## Cross validation error : 1.953466
## Laplace distr. width : 0.082364

#0.629776
ksvm(Likelihood_Recommend_H ~ Condition_Hotel_H, data=aprildata1,
kernel="rbfdot", kpar="automatic", C=5, cross=3, prob.model=TRUE)

## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 0.891103500638568
##
## Number of Support Vectors : 1373
##
## Objective Function Value : -4151.001
## Training error : 0.549694
## Cross validation error : 1.673905
## Laplace distr. width : 0.097838

#0.549731
ksvm(Likelihood_Recommend_H ~ Customer_SVC_H, data=aprildata1,
kernel="rbfdot", kpar="automatic", C=5, cross=3, prob.model=TRUE)

## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.

```

```

## Hyperparameter : sigma = 0.800878954109436
##
## Number of Support Vectors : 1418
##
## Objective Function Value : -3916.713
## Training error : 0.522283
## Cross validation error : 1.577482
## Laplace distr. width : 0.244702

#0.522276
ksvm(Likelihood_Recommend_H ~ Staff_Cared_H, data=aprildata1,
kernel="rbfdot", kpar="automatic", C=5, cross=3, prob.model=TRUE)

## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 1.03406453484034
##
## Number of Support Vectors : 1483
##
## Objective Function Value : -4603.966
## Training error : 0.621754
## Cross validation error : 1.907458
## Laplace distr. width : 0.0313

#0.621754
ksvm(Likelihood_Recommend_H ~ Check_In_H, data=aprildata1, kernel="rbfdot",
kpar="automatic", C=5, cross=3, prob.model=TRUE)

## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 0.773925077644863
##
## Number of Support Vectors : 1636
##
## Objective Function Value : -5245.065
## Training error : 0.832011
## Cross validation error : 2.553088
## Laplace distr. width : 0.001662

#0.832011
ksvm(Likelihood_Recommend_H ~ F.B_FREQ_H, data=aprildata1, kernel="rbfdot",
kpar="automatic", C=5, cross=3, prob.model=TRUE)

```

```

## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 0.287324942470387
##
## Number of Support Vectors : 2537
##
## Objective Function Value : -7043.648
## Training error : 1.095466
## Cross validation error : 3.497218
## Laplace distr. width : 0

#1.095466
ksvm(Likelihood_Recommend_H ~ F.B_Overall_Experience_H, data=aprildata1,
kernel="rbfdot", kpar="automatic", C=5, cross=3, prob.model=TRUE)

## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 2.28230549695806
##
## Number of Support Vectors : 1659
##
## Objective Function Value : -5352.137
## Training error : 0.762873
## Cross validation error : 2.34318
## Laplace distr. width : 0

#0.760601

ksvm(Likelihood_Recommend_H ~ Guest_Room_H + Condition_Hotel_H +
Customer_SVC_H, data=aprildata1, kernel="rbfdot", kpar="automatic", C=5,
cross=3, prob.model=TRUE)

## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 0.783094322044681
##
## Number of Support Vectors : 1397
##
## Objective Function Value : -2894.979

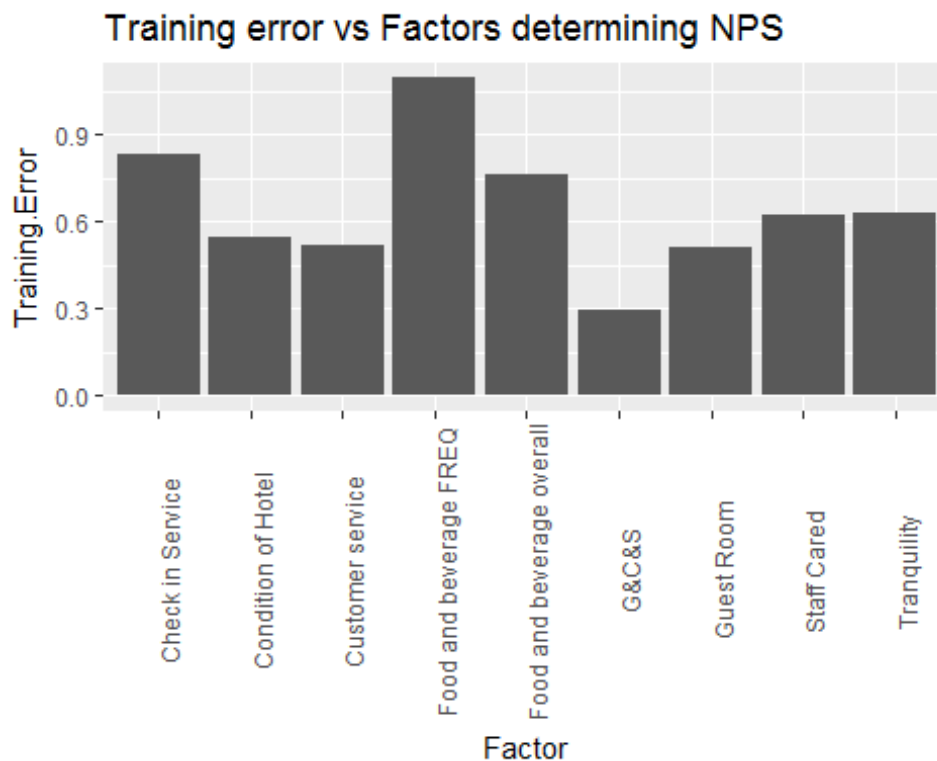
```

```
## Training error : 0.29274
## Cross validation error : 1.307147
## Laplace distr. width : 0.278364

#0.292883

aprg <- read.csv(file = "C:/Users/Surabhi/Downloads/Surabhi docs/final
submission/4.csv")

ggplot(aprg, aes(x= Factor, y = Training.Error)) +
  geom_bar(stat="identity")+theme(axis.text.x = element_text(
angle=90))+ggtitle("Training error vs Factors determining NPS")
```



#linear modle for april

```
lmguestroom4 <- lm(formula = Likelihood_Recommend_H ~ Guest_Room_H, data =
aprildata1)
lmTranquility4 <- lm(formula = Likelihood_Recommend_H ~ Tranquility_H, data =
aprildata1)
lmCondition_Hotel4 <- lm(formula = Likelihood_Recommend_H ~
Condition_Hotel_H, data = aprildata1)
lmCustomer_SVC4 <- lm(formula = Likelihood_Recommend_H ~ Customer_SVC_H, data
= aprildata1)
lmStaff_Cared4 <- lm(formula = Likelihood_Recommend_H ~ Staff_Cared_H, data =
aprildata1)
lmCheck_In4 <- lm(formula = Likelihood_Recommend_H ~ Check_In_H, data =
```

```

aprildata1)
lmF.B_FREQ4 <- lm(formula = Likelihood_Recommend_H ~ F.B_FREQ_H, data =
aprildata1)
lmF.B_Overall4 <- lm(formula = Likelihood_Recommend_H ~
F.B_Overall_Experience_H, data = aprildata1)

```

#Summary of linear models created for April
summary(lmguestroom4)

```

##
## Call:
## lm(formula = Likelihood_Recommend_H ~ Guest_Room_H, data = aprildata1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -8.7120 -0.0408  0.2880  0.2880  5.1370
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   1.35625    0.15042   9.016  <2e-16 ***
## Guest_Room_H   0.83558    0.01645  50.785  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.228 on 2613 degrees of freedom
## Multiple R-squared:  0.4967, Adjusted R-squared:  0.4965
## F-statistic: 2579 on 1 and 2613 DF, p-value: < 2.2e-16

```

#0.4965

summary(lmTranquility4)

```

##
## Call:
## lm(formula = Likelihood_Recommend_H ~ Tranquility_H, data = aprildata1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -8.6144 -0.3139  0.3856  0.3856  5.2380
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   3.11168    0.14384  21.63  <2e-16 ***
## Tranquility_H  0.65027    0.01589  40.92  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.351 on 2613 degrees of freedom
## Multiple R-squared:  0.3905, Adjusted R-squared:  0.3903
## F-statistic: 1674 on 1 and 2613 DF, p-value: < 2.2e-16

```

#0.3903

summary(lmCondition_Hotel4)

```
##
## Call:
## lm(formula = Likelihood_Recommend_H ~ Condition_Hotel_H, data =
aprildata1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -8.6729  0.0452  0.3271  0.3271  5.6693
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.61259    0.17740   3.453 0.000563 ***
## Condition_Hotel_H 0.90603    0.01921  47.169 < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.272 on 2613 degrees of freedom
## Multiple R-squared:  0.4599, Adjusted R-squared:  0.4597
## F-statistic: 2225 on 1 and 2613 DF, p-value: < 2.2e-16
```

#0.4597

summary(lmCustomer_SVC4)

```
##
## Call:
## lm(formula = Likelihood_Recommend_H ~ Customer_SVC_H, data = aprildata1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -7.6119 -0.5959  0.4041  0.4041  8.2604
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.24441    0.18494  -1.322   0.186
## Customer_SVC_H 0.98403    0.01974  49.861 <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.239 on 2613 degrees of freedom
## Multiple R-squared:  0.4876, Adjusted R-squared:  0.4874
## F-statistic: 2486 on 1 and 2613 DF, p-value: < 2.2e-16
```

#0.4874

summary(lmStaff_Cared4)

```
##
## Call:
## lm(formula = Likelihood_Recommend_H ~ Staff_Cared_H, data = aprildata1)
```



```
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -8.5774 -0.5774  0.4226  0.4226  6.4402
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   1.78005    0.17423   10.22  <2e-16 ***
## Staff_Cared_H 0.77973    0.01887   41.33  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.346 on 2613 degrees of freedom
## Multiple R-squared:  0.3953, Adjusted R-squared:  0.395
## F-statistic: 1708 on 1 and 2613 DF, p-value: < 2.2e-16

#0.395
summary(lmCheck_In4)

##
## Call:
## lm(formula = Likelihood_Recommend_H ~ Check_In_H, data = aprildata1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -8.320 -0.320  0.680  0.680  5.742
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   2.58389    0.24064   10.74  <2e-16 ***
## Check_In_H     0.67361    0.02547   26.44  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.537 on 2613 degrees of freedom
## Multiple R-squared:  0.2111, Adjusted R-squared:  0.2108
## F-statistic: 699.3 on 1 and 2613 DF, p-value: < 2.2e-16

#0.2108
summary(lmF.B_FREQ4)

##
## Call:
## lm(formula = Likelihood_Recommend_H ~ F.B_FREQ_H, data = aprildata1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -7.930  0.070  1.070  1.113  1.113
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
```

```

## (Intercept)  8.86488    0.08236 107.637 <2e-16 ***
## F.B_FREQ_H   0.02170    0.04992   0.435   0.664
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.731 on 2613 degrees of freedom
## Multiple R-squared:  7.23e-05, Adjusted R-squared: -0.0003104
## F-statistic: 0.1889 on 1 and 2613 DF, p-value: 0.6638

#-0.0003104
summary(lmF.B_Overall4)

##
## Call:
## lm(formula = Likelihood_Recommend_H ~ F.B_Overall_Experience_H,
##     data = aprildata1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -8.5793 -0.0864  0.4207  0.4207  5.4065
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      4.59348    0.14790   31.06 <2e-16 ***
## F.B_Overall_Experience_H  0.49858    0.01679   29.69 <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.497 on 2613 degrees of freedom
## Multiple R-squared:  0.2522, Adjusted R-squared:  0.2519
## F-statistic: 881.4 on 1 and 2613 DF, p-value: < 2.2e-16

#0.2519

# April association rules

apcc <- aprildata1[-c(1:20)]
apcc <- na.omit(apcc)

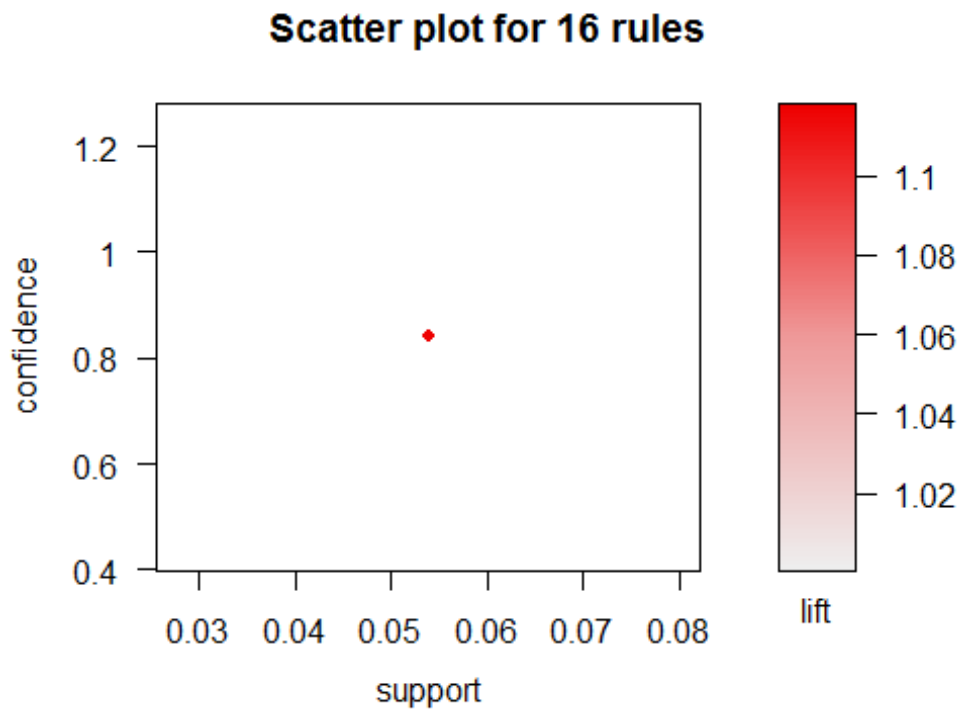
aprule <- apriori(apcc,parameter =
list(support=0.05,confidence=0.81),appearance =
list(rhs=c("NPS_Type=Promoter","NPS_Type=Detractor","NPS_Type=Passive"),defau
lt="lhs"))

## Apriori
##
## Parameter specification:
## confidence minval  smax  arem  aval originalSupport  maxtime support minlen
##      0.81      0.1    1 none FALSE               TRUE         5     0.05      1
## maxlen target   ext

```

```
##      10 rules FALSE
##
## Algorithmic control:
## filter tree heap memopt load sort verbose
##      0.1 TRUE TRUE  FALSE TRUE      2      TRUE
##
## Absolute minimum support count: 130
##
## set item appearances ...[3 item(s)] done [0.00s].
## set transactions ...[26 item(s), 2615 transaction(s)] done [0.00s].
## sorting and recoding items ... [24 item(s)] done [0.00s].
## creating transaction tree ... done [0.00s].
## checking subsets of size 1 2 3 4 5 6 7 8 9 10 done [0.00s].
## writing ... [16 rule(s)] done [0.00s].
## creating S4 object ... done [0.00s].

#inspect(aprule)
plot(aprule)
```



```
aprSurvey <- april[!is.na(april$Survey_ID_H),]
usapr <- subset(aprSurvey, Country_PL == "United States")

aprdata <- subset(usapr, Location_PL == "Airport")

hotels2 <- aggregate(aprdata$Likelihood_Recommend_H,
list(aprdata$Property_ID_PL), mean, na.rm = TRUE)
jandata[,175]
```

```

locations2 <- aggregate(aprdata[,175:176], list(aprdata$Property_ID_PL),
unique, na.rm = TRUE)

hotel_location2 <- merge(hotels2, locations2)
colnames(hotel_location2) <- c('hotelID', 'likelihood', 'lat', 'lon')
us2 <- map_data('state')

hotelmap2 <- ggplot() +
  geom_map(data=us2, aes(x=long, y=lat, group = group, map_id = region),
    colour="white", fill="grey", map = us) +
  geom_point(data = hotel_location2,
    aes(x = lon, y = lat, color = likelihood), size = 5, alpha =
0.7, shape = 16) +
  scale_color_gradient(low = 'yellow', high = 'black') +
  coord_map(xlim=c(-130,-62), ylim=c(23, 50))

## Warning: Ignoring unknown aesthetics: x, y

hotelmap2 <- hotelmap2 + labs(x="", y="") +
  theme(panel.background = element_rect(fill = "transparent", colour = NA),
    panel.grid = element_blank(),
    axis.text = element_blank(),
    axis.ticks = element_blank(),
    plot.title = element_text(face = 'bold', size = 20),
    legend.position = c(0.9, 0.2)) +
  ggtitle('likelihood to recommend of hotel located near the airports in the
United States April ')

July <- read.csv(file="C:/Users/Surabhi/Downloads/Surabhi docs/final
submission/out-201407.csv",
  header=TRUE, sep=",")

Julydata <- July[-
c(1:18,20:55,57:65,67:82,84:106,108:136,148:170,172:181,183:195,197:198,199,2
01,203,204,209,210,211,213,214,216,217,218,220,222,223,224,225,226,227,228:23
1,233:237)]

Julydata1 <- na.omit(Julydata)

Julydata1 <- Julydata1[Julydata1$Location_PL == "Airport",]
Julydata1 <- Julydata1[Julydata1$Country_PL == "United States",]

#Support Vector Machine for Likelihood_Recommend vs various other factors for July

ksvm(Likelihood_Recommend_H ~ Overall_Sat_H, data=Julydata1, kernel="rbfdot",
kpar="automatic", C=5, cross=3, prob.model=TRUE)

```

```

## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 1.22759157716475
##
## Number of Support Vectors : 830
##
## Objective Function Value : -1954.027
## Training error : 0.203054
## Cross validation error : 0.594352
## Laplace distr. width : 0.762412

#0.203012
ksvm(Likelihood_Recommend_H ~ Guest_Room_H, data=Julydata1, kernel="rbfdot",
kpar="automatic", C=5, cross=3, prob.model=TRUE)

## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 1.15867597934484
##
## Number of Support Vectors : 1344
##
## Objective Function Value : -4002.156
## Training error : 0.528223
## Cross validation error : 1.57332
## Laplace distr. width : 0.133803

#0.528223
ksvm(Likelihood_Recommend_H ~ Tranquility_H, data=Julydata1, kernel="rbfdot",
kpar="automatic", C=5, cross=3, prob.model=TRUE)

## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 1.35027660317563
##
## Number of Support Vectors : 1451
##
## Objective Function Value : -4726.668
## Training error : 0.663344

```

```

## Cross validation error : 1.971206
## Laplace distr. width : 0.034294

#0.663344
ksvm(Likelihood_Recommend_H ~ Condition_Hotel_H, data=Julydata1,
kernel="rbfdot", kpar="automatic", C=5, cross=3, prob.model=TRUE)

## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 0.901506221069737
##
## Number of Support Vectors : 1306
##
## Objective Function Value : -4205.342
## Training error : 0.586719
## Cross validation error : 1.737633
## Laplace distr. width : 0.093221

#0.586719
ksvm(Likelihood_Recommend_H ~ Customer_SVC_H, data=Julydata1,
kernel="rbfdot", kpar="automatic", C=5, cross=3, prob.model=TRUE)

## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 0.907464430056477
##
## Number of Support Vectors : 1419
##
## Objective Function Value : -3997.77
## Training error : 0.538674
## Cross validation error : 1.616458
## Laplace distr. width : 0.190958

#0.538674
ksvm(Likelihood_Recommend_H ~ Staff_Cared_H, data=Julydata1, kernel="rbfdot",
kpar="automatic", C=5, cross=3, prob.model=TRUE)

## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.

```

```

## Hyperparameter : sigma = 1.15185713760192
##
## Number of Support Vectors : 1510
##
## Objective Function Value : -4696.933
## Training error : 0.643394
## Cross validation error : 1.946103
## Laplace distr. width : 0.06886

#0.643344
ksvm(Likelihood_Recommend_H ~ Check_In_H, data=Julydata1, kernel="rbfdot",
kpar="automatic", C=5, cross=3, prob.model=TRUE)

## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 0.927288322249374
##
## Number of Support Vectors : 1639
##
## Objective Function Value : -5158.674
## Training error : 0.828464
## Cross validation error : 2.429554
## Laplace distr. width : 0.007657

#0.828464
ksvm(Likelihood_Recommend_H ~ F.B_FREQ_H, data=Julydata1, kernel="rbfdot",
kpar="automatic", C=5, cross=3, prob.model=TRUE)

## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 0.288727483480203
##
## Number of Support Vectors : 2519
##
## Objective Function Value : -7089.006
## Training error : 1.124516
## Cross validation error : 3.436173
## Laplace distr. width : 0

#1.124516
ksvm(Likelihood_Recommend_H ~ F.B_Overall_Experience_H, data=Julydata1,
kernel="rbfdot", kpar="automatic", C=5, cross=3, prob.model=TRUE)

```

```
## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 1.38732775389657
##
## Number of Support Vectors : 1672
##
## Objective Function Value : -5438.322
## Training error : 0.805785
## Cross validation error : 2.500249
## Laplace distr. width : 0.001209
```

#0.808481

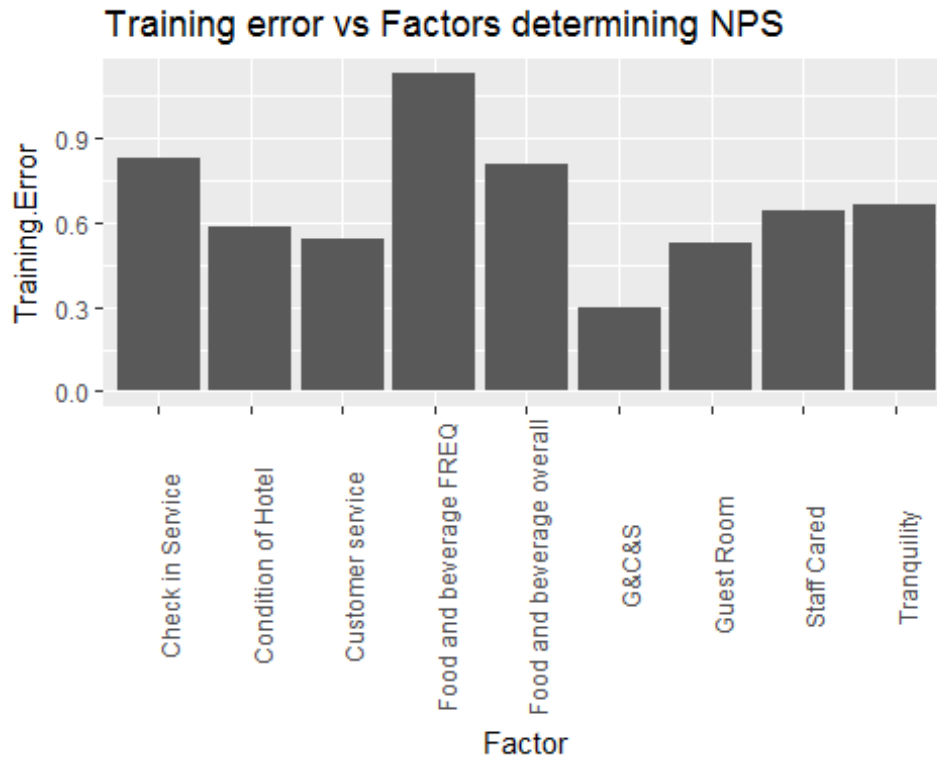
```
ksvm(Likelihood_Recommend_H ~ Guest_Room_H + Condition_Hotel_H +
Customer_SVC_H, data=Julydata1, kernel="rbfdot", kpar="automatic", C=5,
cross=3, prob.model=TRUE)
```

```
## Support Vector Machine object of class "ksvm"
##
## SV type: eps-svr (regression)
## parameter : epsilon = 0.1 cost C = 5
##
## Gaussian Radial Basis kernel function.
## Hyperparameter : sigma = 0.877758735973695
##
## Number of Support Vectors : 1312
##
## Objective Function Value : -2879.248
## Training error : 0.294213
## Cross validation error : 1.23128
## Laplace distr. width : 0.299474
```

#0.29536

```
julyg <- read.csv(file = "C:/Users/Surabhi/Downloads/Surabhi docs/final
submission/7.csv")
```

```
ggplot(julyg, aes(x= Factor, y = Training.Error)) +
geom_bar(stat="identity")+theme(axis.text.x = element_text(
angle=90))+ggtitle("Training error vs Factors determining NPS")
```

#Linear model

```
lmguestroom7 <- lm(formula = Likelihood_Recommend_H ~ Guest_Room_H, data =
Julydata1)
lmTranquility7 <- lm(formula = Likelihood_Recommend_H ~ Tranquility_H, data =
Julydata1)
lmCondition_Hotel7 <- lm(formula = Likelihood_Recommend_H ~
Condition_Hotel_H, data = Julydata1)
lmCustomer_SVC7 <- lm(formula = Likelihood_Recommend_H ~ Customer_SVC_H, data
= Julydata1)
lmStaff_Cared7 <- lm(formula = Likelihood_Recommend_H ~ Staff_Cared_H, data =
Julydata1)
lmCheck_In7 <- lm(formula = Likelihood_Recommend_H ~ Check_In_H, data =
Julydata1)
lmF.B_FREQ7 <- lm(formula = Likelihood_Recommend_H ~ F.B_FREQ_H, data =
Julydata1)
lmF.B_Overall7 <- lm(formula = Likelihood_Recommend_H ~
F.B_Overall_Experience_H, data = Julydata1)
```

#Summary of linear models created for July

summary(lmguestroom7)

##

Call:

lm(formula = Likelihood_Recommend_H ~ Guest_Room_H, data = Julydata1)

```
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -8.7051 -0.0941  0.2949  0.2949  5.9337
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   1.64969    0.14788   11.16  <2e-16 ***
## Guest_Room_H   0.80554    0.01619   49.74  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.225 on 2621 degrees of freedom
## Multiple R-squared:  0.4856, Adjusted R-squared:  0.4854
## F-statistic: 2474 on 1 and 2621 DF, p-value: < 2.2e-16

#0.4854
summary(lmTranquility7)

##
## Call:
## lm(formula = Likelihood_Recommend_H ~ Tranquility_H, data = Julydata1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -8.5519 -0.3214  0.4481  0.4481  4.7549
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   3.39929    0.15327   22.18  <2e-16 ***
## Tranquility_H  0.61526    0.01685   36.52  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.39 on 2621 degrees of freedom
## Multiple R-squared:  0.3373, Adjusted R-squared:  0.337
## F-statistic: 1334 on 1 and 2621 DF, p-value: < 2.2e-16

#0.337
summary(lmCondition_Hotel7)

##
## Call:
## lm(formula = Likelihood_Recommend_H ~ Condition_Hotel_H, data = Julydata1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -8.6413  0.1037  0.3587  0.3587  4.7214
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
```

```
## (Intercept)      0.91595    0.18376    4.984 6.62e-07 ***
## Condition_Hotel_H 0.87254    0.01987   43.913 < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.296 on 2621 degrees of freedom
## Multiple R-squared:  0.4239, Adjusted R-squared:  0.4237
## F-statistic: 1928 on 1 and 2621 DF, p-value: < 2.2e-16

#0.4237
summary(lmCustomer_SVC7)

##
## Call:
## lm(formula = Likelihood_Recommend_H ~ Customer_SVC_H, data = Julydata1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -8.5831 -0.5831  0.4169  0.4169  6.6567
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.66917    0.17410   3.843 0.000124 ***
## Customer_SVC_H 0.89139    0.01865  47.795 < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.248 on 2621 degrees of freedom
## Multiple R-squared:  0.4657, Adjusted R-squared:  0.4655
## F-statistic: 2284 on 1 and 2621 DF, p-value: < 2.2e-16

#0.4655
summary(lmStaff_Cared7)

##
## Call:
## lm(formula = Likelihood_Recommend_H ~ Staff_Cared_H, data = Julydata1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -8.5405 -0.5405  0.4595  0.4595  5.7893
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    2.5074    0.1660   15.11 <2e-16 ***
## Staff_Cared_H  0.7033    0.0180   39.06 <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.357 on 2621 degrees of freedom
```

```
## Multiple R-squared:  0.368, Adjusted R-squared:  0.3677
## F-statistic: 1526 on 1 and 2621 DF, p-value: < 2.2e-16

#0.3677
summary(lmCheck_In7)

##
## Call:
## lm(formula = Likelihood_Recommend_H ~ Check_In_H, data = Julydata1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -8.3048 -0.3048  0.6952  0.6952  6.1003
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  3.29911     0.21082   15.65  <2e-16 ***
## Check_In_H    0.60057     0.02235   26.87  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.512 on 2621 degrees of freedom
## Multiple R-squared:  0.216, Adjusted R-squared:  0.2157
## F-statistic: 722.1 on 1 and 2621 DF, p-value: < 2.2e-16

#0.2157
summary(lmF.B_FREQ7)

##
## Call:
## lm(formula = Likelihood_Recommend_H ~ F.B_FREQ_H, data = Julydata1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -7.9282 -0.9022  1.0718  1.0978  1.0978
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  8.88917     0.08019 110.854  <2e-16 ***
## F.B_FREQ_H    0.01300     0.04906   0.265    0.791
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.708 on 2621 degrees of freedom
## Multiple R-squared:  2.68e-05, Adjusted R-squared: -0.0003547
## F-statistic: 0.07026 on 1 and 2621 DF, p-value: 0.791

#-0.0003547
summary(lmF.B_Overall7)
```

```
##
## Call:
## lm(formula = Likelihood_Recommend_H ~ F.B_Overall_Experience_H,
##     data = Julydata1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -8.5598 -0.3112  0.4402  0.4402  5.4125
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      4.58752    0.16093   28.51  <2e-16 ***
## F.B_Overall_Experience_H  0.49723    0.01821   27.31  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.507 on 2621 degrees of freedom
## Multiple R-squared:  0.2215, Adjusted R-squared:  0.2212
## F-statistic: 745.8 on 1 and 2621 DF,  p-value: < 2.2e-16

#0.2212

# July association rules

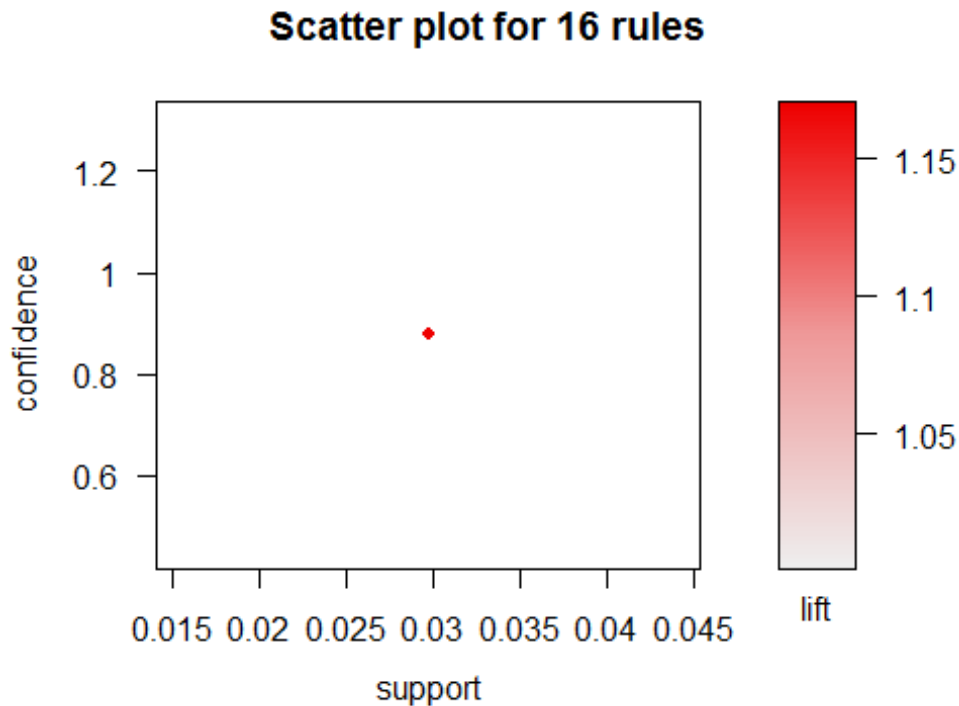
Julycc <- Julydata1[-c(1:20)]
Julycc <- na.omit(Julycc)

Jurule <- apriori(Julycc,parameter =
list(support=0.029,confidence=0.86),appearance =
list(rhs=c("NPS_Type=Promoter","NPS_Type=Detractor","NPS_Type=Passive"),defau
lt="lhs"))

## Apriori
##
## Parameter specification:
## confidence minval smax arem  aval originalSupport maxtime support minlen
##      0.86    0.1    1 none FALSE                TRUE         5    0.029    1
## maxlen target  ext
##      10  rules FALSE
##
## Algorithmic control:
## filter tree heap memopt load sort verbose
##    0.1 TRUE TRUE  FALSE TRUE    2    TRUE
##
## Absolute minimum support count: 76
##
## set item appearances ...[3 item(s)] done [0.00s].
## set transactions ...[26 item(s), 2623 transaction(s)] done [0.01s].
```

```
## sorting and recoding items ... [25 item(s)] done [0.00s].
## creating transaction tree ... done [0.00s].
## checking subsets of size 1 2 3 4 5 6 7 8 9 10 done [0.00s].
## writing ... [16 rule(s)] done [0.00s].
## creating S4 object ... done [0.00s].
```

```
#inspect(Jurule)
plot(Jurule)
```



```
julySurvey <- July[!is.na(July$Survey_ID_H),]
usjuly <- subset(julySurvey, Country_PL == "United States")

julydata <- subset(usjuly, Location_PL == "Airport")

hotels3 <- aggregate(julydata$Likelihood_Recommend_H,
list(julydata$Property_ID_PL), mean, na.rm = TRUE)

locations3 <- aggregate(julydata[,175:176], list(julydata$Property_ID_PL),
unique, na.rm = TRUE)

hotel_location3 <- merge(hotels3, locations3)
colnames(hotel_location3) <- c('hotelID', 'likelihood', 'lat', 'lon')
us3 <- map_data('state')
```

```

hotelmap3 <- ggplot() +
  geom_map(data=us3, aes(x=long, y=lat, group = group, map_id = region),
    colour="white", fill="grey", map = us) +
  geom_point(data = hotel_location3,
    aes(x = lon, y = lat, color = likelihood), size = 5, alpha =
0.7, shape = 16) +
  scale_color_gradient(low = 'yellow', high = 'black') +
  coord_map(xlim=c(-130,-62), ylim=c(23, 50))

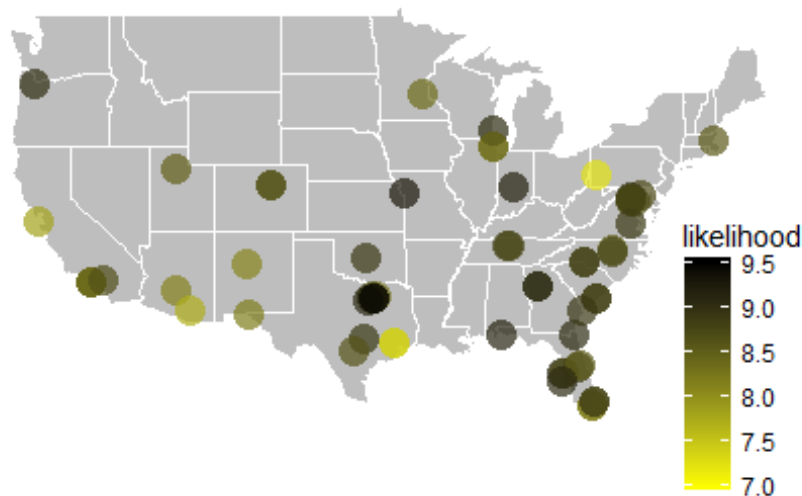
## Warning: Ignoring unknown aesthetics: x, y

hotelmap3 <- hotelmap3 + labs(x="", y="") +
  theme(panel.background = element_rect(fill = "transparent", colour = NA),
    panel.grid = element_blank(),
    axis.text = element_blank(),
    axis.ticks = element_blank(),
    plot.title = element_text(face = 'bold', size = 20),
    legend.position = c(0.9, 0.2)) +
  ggtitle('likelihood to recommend of hotel located near the airports in the
United States July ')

hotelmap

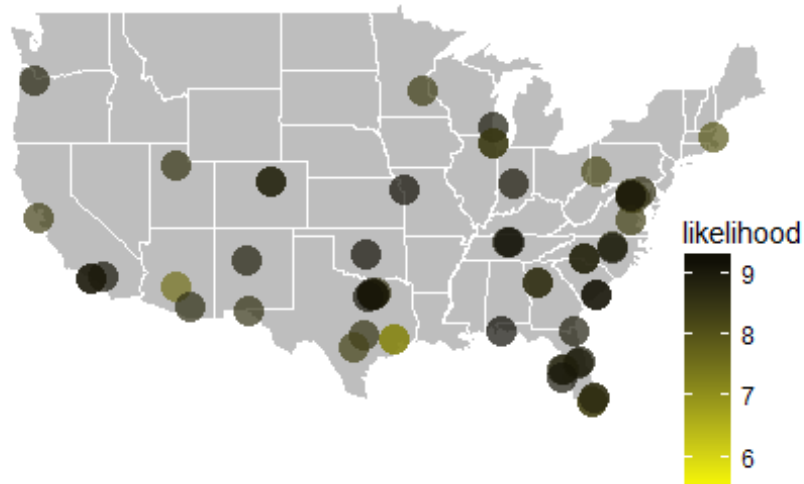
```

likelihood to recommend of hotel |



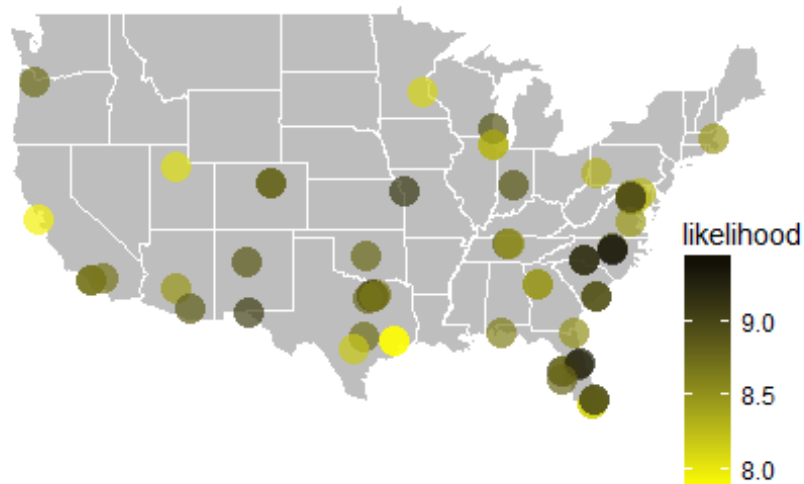
hotelmap2

likelihood to recommend of hotel |



hotelmap3

likelihood to recommend of hotel |

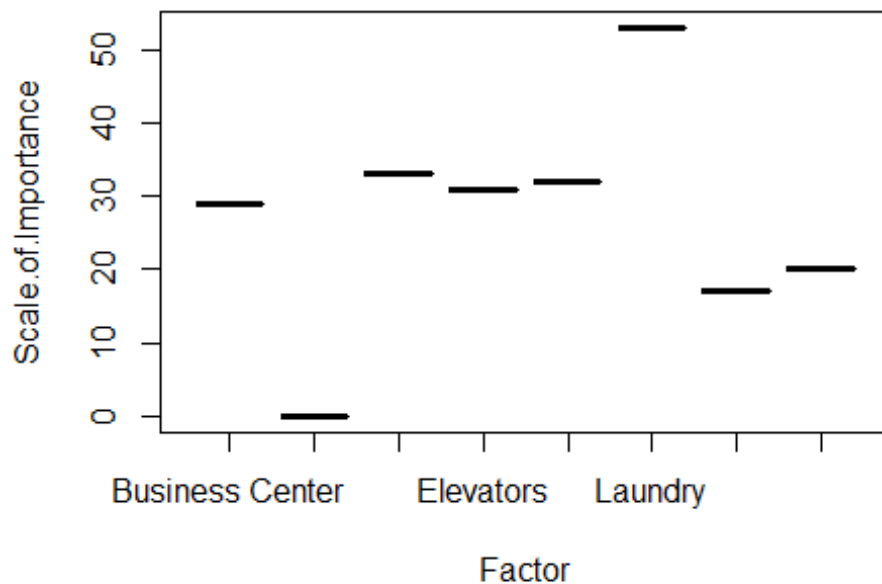



```
association <- read.csv(file = "C:/Users/Surabhi/Downloads/Surabhi docs/final submission/Association Rules Calculation.csv")
```

```
association
```

```
##          Factor Scale.of.Importance
## 1      Laundry          53
## 2 Dry Cleaning          33
## 3 Fitness Center        32
## 4      Elevators         31
## 5 Business Center        29
## 6 Shuttle Service        20
## 7   Pool Indoor         17
## 8   convention           0
```

```
plot(association)
```



```
ggplot(association, aes(x= Factor, y = Scale.of.Importance)) +  
geom_bar(stat="identity")+ggtitle("Association rule")
```

