Demo Day Módulo 2 RStudio

PERLA CONCHITA PEÑA CAMPOS

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Data set

Decribe los datos de dos hoteles del 01 julio 2015 al 31 Agosto 2017

- H1: Hotel resort

- H2: Hotel ciudad

La variable que se estudia es la cancelación de la reservación con respecto al resto.

Se hizo limpieza de la base de datos y transformación de variables (revisar pdf DemoDay_M2)

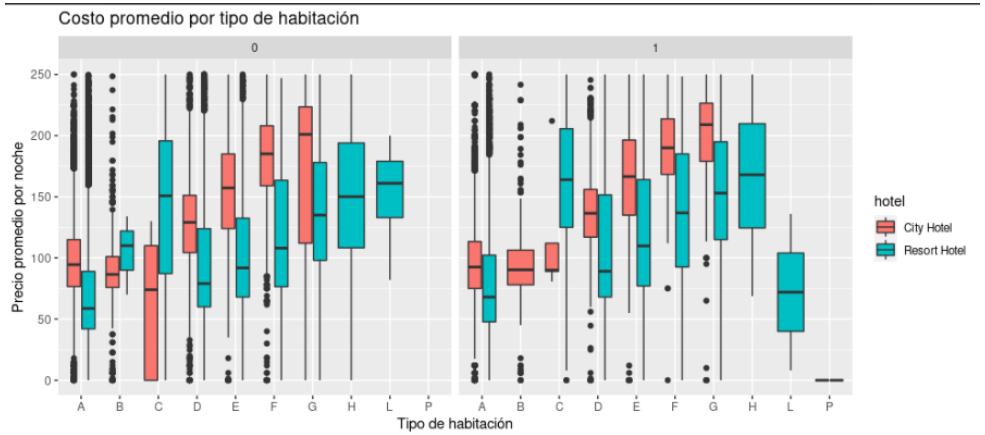
https://www.sciencedirect.com/science/article/pii/S2352340918315191

```
> str(booking)
'data.frame': 119390 obs. of  32 variables:
 $ hotel                         : chr  "Resort Hotel" "Resort Hotel" "R
 $ is_canceled                   : int  0 0 0 0 0 0 0 0 1 1 ...
 $ lead_time                     : int  342 737 7 13 14 14 0 9 85 75 ...
 $ arrival_date_year             : int  2015 2015 2015 2015 2015 2015 20
 $ arrival_date_month            : chr  "July" "July" "July" "July" ...
 $ arrival_date_week_number      : int  27 27 27 27 27 27 27 27 27 27 ..
 $ arrival_date_day_of_month     : int  1 1 1 1 1 1 1 1 1 1 ...
 $ stays_in_weekend_nights       : int  0 0 0 0 0 0 0 0 0 0 ...
 $ stays_in_week_nights          : int  0 0 1 1 2 2 2 2 3 3 ...
 $ adults                        : int  2 2 1 1 2 2 2 2 2 2 ...
 $ children                      : int  0 0 0 0 0 0 0 0 0 0 ...
 $ babies                        : int  0 0 0 0 0 0 0 0 0 0 ...
 $ meal                          : chr  "BB" "BB" "BB" "BB" ...
 $ country                       : chr  "PRT" "PRT" "GBR" "GBR" ...
 $ market_segment                : chr  "Direct" "Direct" "Direct" "Corp
 $ distribution_channel          : chr  "Direct" "Direct" "Direct" "Corp
 $ is_repeated_guest             : int  0 0 0 0 0 0 0 0 0 0 ...
 $ previous_cancellations        : int  0 0 0 0 0 0 0 0 0 0 ...
 $ previous_bookings_not_canceled: int  0 0 0 0 0 0 0 0 0 0 ...
 $ reserved_room_type            : chr  "C" "C" "A" "A" ...
 $ assigned_room_type            : chr  "C" "C" "C" "A" ...
 $ booking_changes               : int  3 4 0 0 0 0 0 0 0 0 ...
 $ deposit_type                  : chr  "No Deposit" "No Deposit" "No De
```

EDA

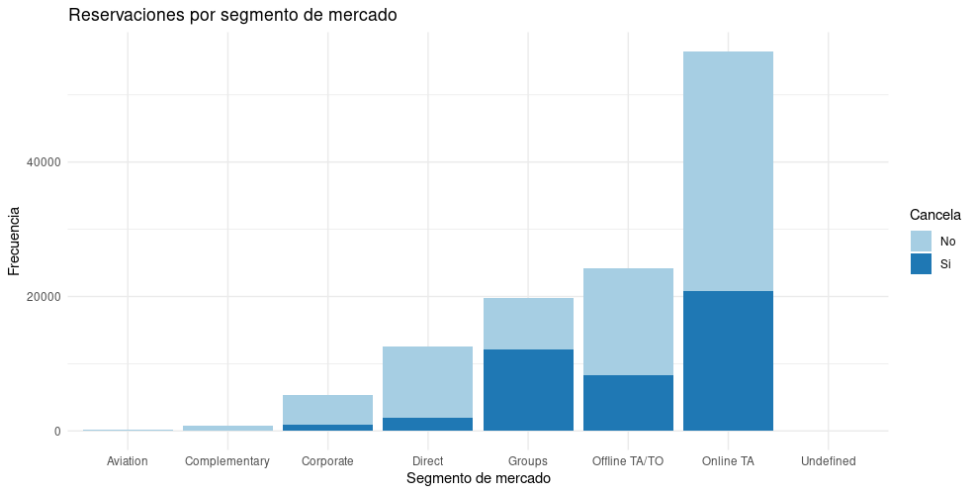
Costo promedio por habitación

```
b1 %>%
  ggplot(aes(x=reserved_room_type, y = adr, fill = hotel))+
  geom_boxplot()+
  facet_wrap("is_canceled") +
  ylim(0,250)+
  ggtitle("Costo promedio por tipo de habitación") +
  xlab("Tipo de habitación") +
  ylab("Precio promedio por noche")+
  theme(plot.title = element_text(size=12))+
  theme_gray()
```



Frecuencia (tipo de mercado)

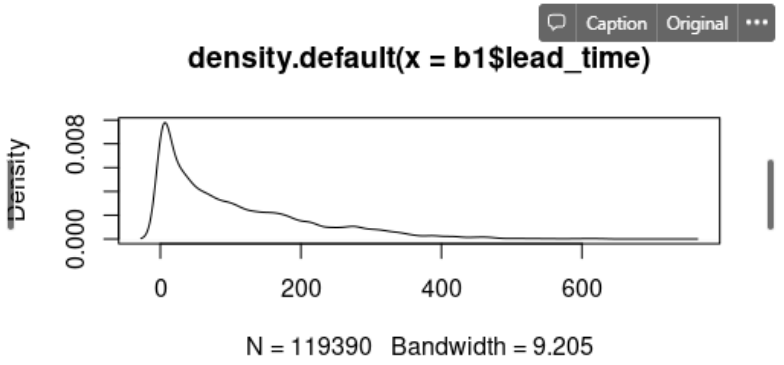
```
b1 %>%
  ggplot(aes(x=market_segment, y=frequency(market_segment), fill=is_canceled)) +
  geom_bar(stat="identity")+
  scale_fill_brewer(palette="Paired", name = "Cancela", labels = c("No", "Si"))+
  theme_minimal()+
  ggtitle("Reservaciones por segmento de mercado") +
  xlab("Segmento de mercado") +
  ylab("Frecuencia")
```



Prueba estadística de hipótesis

Prueba de normalidad *ejemplo de una variable

```r
#Verificar la normalidad de los datos con un histograma
hist(b1$lead_time)

#Densidad
d <- density(b1$lead_time)
plot(d)

#Prueba de  shapiro test
lt.test <- shapiro.test(b1$lead_time[0:5000])
lt.test

Shapiro-Wilk normality test

data:  b1$lead_time[0:5000]
W = 0.88581, p-value < 2.2e-16
```



Clasificación

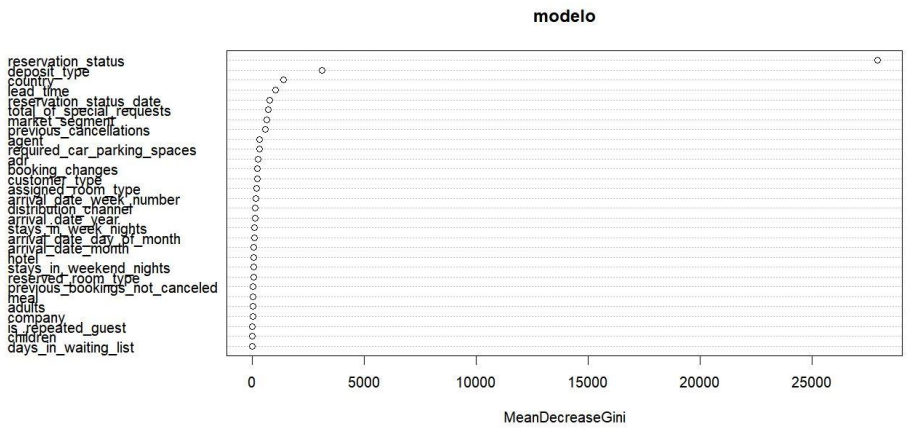
RANDOM FOREST, REGRESIÓN LOGÍSTICA Y SVM

Random Forest

```
#Crear semilla, datos test y datos tain
set.seed(101)
tamano.total <- nrow(bforest)
tamano.entreno <- round(tamano.total*0.7)
datos.indices <- sample(1:tamano.total , size=tamano.entreno)
datos.entreno <- bforest[datos.indices,]
datos.test <- bforest[-datos.indices,]

#Modelo Random Forest
modelo <- randomForest(is_canceled~., data=datos.test)
modelo

#gráficos y resultados
varImpPlot(modelo)
plot(modelo)
legend("right", colnames(modelo$err.rate), lty = 1:5, col = 1:6)
importance(modelo2)

# Separar árboles
> split_var_1 <- sapply(seq_len(modelo$ntree),
+                       function(i) getTree(modelo, i, labelVar=TRUE)[1, "split var"])
> table(split_var_1)
split_var_1
```

```
Call:
 randomForest(formula = is_canceled ~ ., data = datos.test
               Type of random forest: classification
                     Number of trees: 500
No. of variables tried at each split: 5

        OOB estimate of  error rate: 0.01%
Confusion matrix:
      0     1  class.error
0 22522     0 0.0000000000
1     2 13293 0.0001504325
> |
```

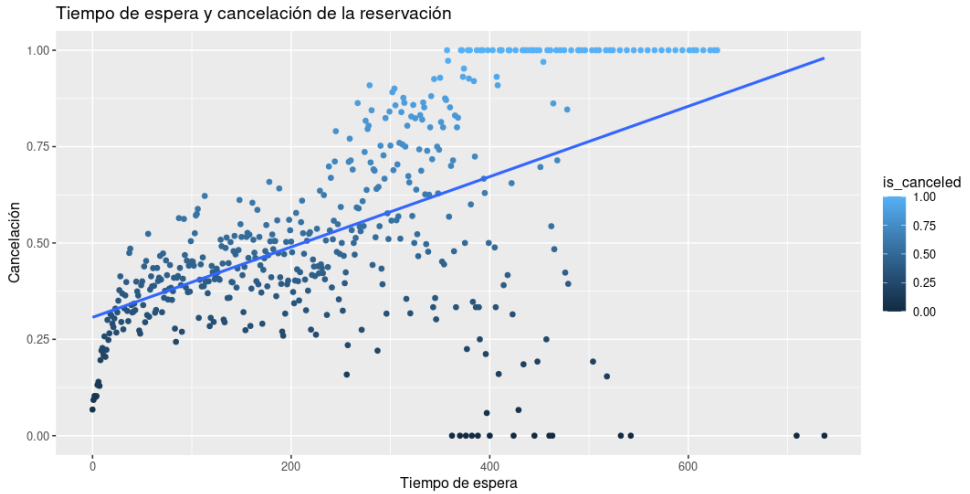
varImPlot



- Se rescatan del modelo:
  - deposit_type
  - country
  - lead_time
  - total_of_special_requests

EDA random forest
*ejemplo: tiempo de espera

```r
#agrupar por lead_time (Tiempo de espera)
grouplead_time <- aggregate(booking["is_canceled"], by=booking["lead_time"], mean)
grouplead_time

grouplead_time %>%
  ggplot(aes(x=lead_time, y = (is_canceled), color = is_canceled))+
  geom_point()+
  geom_smooth(method = "lm", se = FALSE)+
  ggtitle("Tiempo de espera y cancelación de la reservación") +
  xlab("Tiempo de espera") +
  ylab("Cancelación")

#agrupar por deposit_type (Tipo de deposito)
groupdeposit_type <- aggregate(booking["is_canceled"], by=booking["deposit_type"], mean)
groupdeposit_type
```



Regresión logística

```r
#set.seed(1)
df <- bforest
nobs <- nrow(bforest)
itrain <- sample(nobs, 0.8 * nobs)
train <- df[itrain, ]
test <- df[-itrain, ]

#Regresión logística con todas las variables
rl <- glm(is_canceled ~., data = train)
rl
summary(rl)
#Regresión logística con las variables de random forest
rl2 <- glm(is_canceled ~ deposit_type + country + lead_time +
           market_segment + adr, family = binomial, data = train)
rl2
summary(rl2)
#Ajuste de la regresión logística sin la variable que no aporta
rl3 <- update(rl2, ~. -country)
summary(rl3)
#Ajuste de la regresión logística con la variable faltante
rl4 <- update(rl3, ~. +total_of_special_requests)
summary(rl4)
#coeficientes
rl4$coef
plot(rl4)
```

```
                                Estimate Std. Error z value
(Intercept)                   -1.540e+00  1.724e-01  -8.932
deposit_typeNon Refund         6.123e+00  1.186e-01  51.631
deposit_typeRefundable        -2.658e-01  2.067e-01  -1.286
lead_time                      3.925e-03  8.776e-05  44.724
market_segmentComplementary   -4.413e-01  2.117e-01  -2.084
market_segmentCorporate       -6.177e-01  1.779e-01  -3.472
market_segmentDirect          -7.840e-01  1.740e-01  -4.507
market_segmentGroups          -2.633e-01  1.739e-01  -1.514
market_segmentOffline TA/TO   -7.958e-01  1.734e-01  -4.591
market_segmentOnline TA        3.001e-01  1.720e-01   1.745
market_segmentUndefined        1.106e+01  5.124e+01   0.216
adr                            2.958e-03  1.710e-04  17.295
                              Pr(>|z|)
(Intercept)                    < 2e-16 ***
deposit_typeNon Refund         < 2e-16 ***
deposit_typeRefundable        0.198390
lead_time                      < 2e-16 ***
market_segmentComplementary   0.037156 *
market_segmentCorporate       0.000517 ***
market_segmentDirect          6.59e-06 ***
market_segmentGroups          0.130061
market_segmentOffline TA/TO   4.41e-06 ***
market_segmentOnline TA       0.081027 .
market_segmentUndefined       0.829173
adr                            < 2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Deposit_type, lead_time, market_segment, adr

SVM

```r
# Partición de los datos
set.seed(1)
df <- bforest
nobs <- nrow(bforest)
itrain <- sample(nobs, 0.8 * nobs)
train <- df[itrain, ]
test <- df[-itrain, ]

#Instalar paquete
install.packages("kernlab")
library(kernlab)
library(e1071)


## Preparar datos
set.seed(2022)
train = sample(nrow(bforest),
               round(nrow(bforest)/2))
tail(bforest[train, ])

# Modelo con todo el data set
best <- svm(is_canceled~.,  data = bforest[train,],
            kernel = "radial",
            cost = 100,
            gamma = 1.51)
```

```r
# svm con lead time y adr
best2 <- svm(is_canceled ~ lead_time + adr,  data = train,
             kernel = "radial",
             cost = 100,
             gamma = 1.51)
best2
summary(best2)
# resultados
names(best2)
# plot del modelo de svm
plot(best2, test, lead_time ~ adr)

plot(best2, train, lead_time ~ adr)

#Matriz de confusión con modelo actual y predictivo
table(train$is_canceled, fitted(best2), dnn = c("Actual", "Predicho"))
pred <- predict(best2, test)
pred
table(test$is_canceled, pred)

#tuning
set.seed(2)
tune.out <- tune(svm, is_canceled ~ lead_time + adr, data = train,
     kernel = "radial",
     ranges = list(
       cost = c(0.1, 1, 10, 100, 1000),
       gama = c(0.5, 1, 2, 3, 4)
     ))
```

Matriz de confusión y plot SVM

```
Call:
svm(formula = is_canceled ~ lead_time + adr, data = train,
    kernel = "radial", cost = 100, gamma = 1.51)


Parameters:
   SVM-Type:  C-classification
 SVM-Kernel:  radial
       cost:  100

Number of Support Vectors:  63100

 ( 31901 31199 )


Number of Classes:  2

Levels:
 0 1
```

```
table(train$is_canceled, fitted(best2), dnn = c("Actual", "Predicho"))
      Predicho
Actual     0     1
     0 55424  4755
     1 25772  9561

table(test$is_canceled, pred)
predict
pred
       0     1
  0 13854  1133
  1  6597  2294
```