Regressão Logística

Carregar Dados

```
TEBATRANSF <- read_excel("TEBATRANSF.xlsx")
tt=TEBATRANSF[,-1]
```

Separando X e Y

```
tt$cancelsim=ifelse(tt$cancel=="sim",1,0)  # Variavel a ser prevista
tt=tt[,-10] #Variaveveis previsoras
```

Separar texte e treino

```
set.seed(123)
index=sample(1:2000, 1200 )
lrn= tt[index,] #arquivo para desenvolvimento
tst=tt[-index,] #arquivo para teste
```

Criar modelo

```
mod1=glm(data = lrn, cancelsim~.,family = binomial() )
summary(mod1)
```

```
##
## Call:
## glm(formula = cancelsim ~ ., family = binomial(), data = lrn)
##
## Deviance Residuals:
##      Min        1Q    Median        3Q       Max
## -2.37301  -0.58238  -0.30429  -0.08389   2.70625
##
## Coefficients:
##             Estimate Std. Error z value Pr(>|z|)
## (Intercept)  7.31615    3.21496   2.276  0.02287 *
## idade       -0.04307    0.01338  -3.220  0.00128 **
## klinhas      0.10801    0.12457   0.867  0.38589
## Ltempcli    -3.28898    0.44001  -7.475 7.73e-14 ***
## Lrenda      -0.41845    1.07523  -0.389  0.69715
## Sfatura      0.11789    0.01112  10.597  < 2e-16 ***
## temp_rsd     0.02289    0.04362   0.525  0.59978
## localB       2.09913    0.24530   8.557  < 2e-16 ***
## localC      -0.48927    0.27177  -1.800  0.07181 .
## localD       1.32211    0.22050   5.996 2.02e-09 ***
```

```
## tvcabosim    0.27492    0.18989   1.448  0.14769
## debautsim   -0.28410    0.17701  -1.605  0.10850
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 1303.85  on 1199  degrees of freedom
## Residual deviance:  870.38  on 1188  degrees of freedom
## AIC: 894.38
##
## Number of Fisher Scoring iterations: 6
```

Selecao de variaveis com base no criterio AIC

```
mod2=step(mod1)
```

```
## Start:  AIC=894.38
## cancelsim ~ idade + klinhas + Ltempcli + Lrenda + Sfatura + temp_rsd +
##     local + tvcabo + debaut
##
##            Df Deviance     AIC
## - Lrenda    1   870.53  892.53
## - temp_rsd  1   870.66  892.66
## - klinhas   1   871.13  893.13
## <none>          870.38  894.38
## - tvcabo    1   872.51  894.51
## - debaut    1   872.99  894.99
## - idade     1   881.11  903.11
## - Ltempcli  1   931.92  953.92
## - local     3  1002.64 1020.64
## - Sfatura   1  1009.99 1031.99
##
## Step:  AIC=892.53
## cancelsim ~ idade + klinhas + Ltempcli + Sfatura + temp_rsd +
##     local + tvcabo + debaut
##
##            Df Deviance     AIC
## - temp_rsd  1   870.80  890.80
## - klinhas   1   871.13  891.13
## <none>          870.53  892.53
## - tvcabo    1   872.65  892.65
## - debaut    1   873.14  893.14
## - idade     1   883.08  903.08
## - Ltempcli  1   971.16  991.16
## - local     3  1003.85 1019.85
## - Sfatura   1  1023.34 1043.34
##
## Step:  AIC=890.8
## cancelsim ~ idade + klinhas + Ltempcli + Sfatura + local + tvcabo +
##     debaut
##
```

```
##            Df Deviance     AIC
## - klinhas   1   871.38  889.38
## <none>          870.80  890.80
## - tvcabo    1   872.85  890.85
## - debaut    1   873.49  891.49
## - idade     1   883.22  901.22
## - Ltempcli  1   971.73  989.73
## - local     3  1004.58 1018.58
## - Sfatura   1  1024.25 1042.25
##
## Step:  AIC=889.38
## cancelsim ~ idade + Ltempcli + Sfatura + local + tvcabo + debaut
##
##            Df Deviance     AIC
## - tvcabo    1   873.34  889.34
## <none>          871.38  889.38
## - debaut    1   874.06  890.06
## - idade     1   883.35  899.35
## - Ltempcli  1   985.34 1001.34
## - local     3  1005.06 1017.06
## - Sfatura   1  1032.29 1048.29
##
## Step:  AIC=889.34
## cancelsim ~ idade + Ltempcli + Sfatura + local + debaut
##
##            Df Deviance     AIC
## <none>          873.34  889.34
## - debaut    1   876.02  890.02
## - idade     1   885.64  899.64
## - Ltempcli  1   986.74 1000.74
## - local     3  1009.26 1019.26
## - Sfatura   1  1034.39 1048.39
```

```
summary(mod2)
```

```
##
## Call:
## glm(formula = cancelsim ~ idade + Ltempcli + Sfatura + local +
##     debaut, family = binomial(), data = lrn)
##
## Deviance Residuals:
##      Min        1Q    Median        3Q       Max
## -2.48985  -0.57591  -0.30731  -0.08443   2.73478
##
## Coefficients:
##             Estimate Std. Error z value Pr(>|z|)
## (Intercept)  6.65609    0.86555   7.690 1.47e-14 ***
## idade       -0.04364    0.01267  -3.444 0.000574 ***
## Ltempcli    -3.43924    0.35218  -9.766  < 2e-16 ***
## Sfatura      0.11794    0.01049  11.239  < 2e-16 ***
## localB       2.12125    0.24439   8.680  < 2e-16 ***
## localC      -0.48770    0.27098  -1.800 0.071894 .
## localD       1.32915    0.21920   6.064 1.33e-09 ***
## debautsim   -0.28769    0.17656  -1.629 0.103214
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 1303.85  on 1199  degrees of freedom
## Residual deviance:  873.34  on 1192  degrees of freedom
## AIC: 889.34
##
## Number of Fisher Scoring iterations: 6
```

Criar previsoes

```
tst$ps=predict(mod2, newdata = tst, type = "response")
print(head(tst), digits=3)
```

```
## # A tibble: 6 x 11
##   idade klinhas Ltempcli Lrenda Sfatura temp_rsd local tvcabo debaut
##   <dbl>   <dbl>    <dbl>  <dbl>   <dbl>    <dbl> <chr> <chr>  <chr>
## 1    35       1     2.71   3.69    24.4      4.8 A     nao    nao
## 2    27       1     2.89   3.75    35.7      4.8 D     nao    sim
## 3    30       1     3.14   3.76    29.3      8.1 B     nao    nao
## 4    39       2     3.04   3.84    24.4      2.8 A     nao    nao
## 5    45       3     2.89   3.85    16.9      8   A     sim    sim
## 6    33       1     3.18   3.81    14.4      4.3 C     sim    sim
## # ... with 2 more variables: cancelsim <dbl>, ps <dbl>
```

Fazer testes

Hosmer Lemeshow

```
library(ResourceSelection)
```

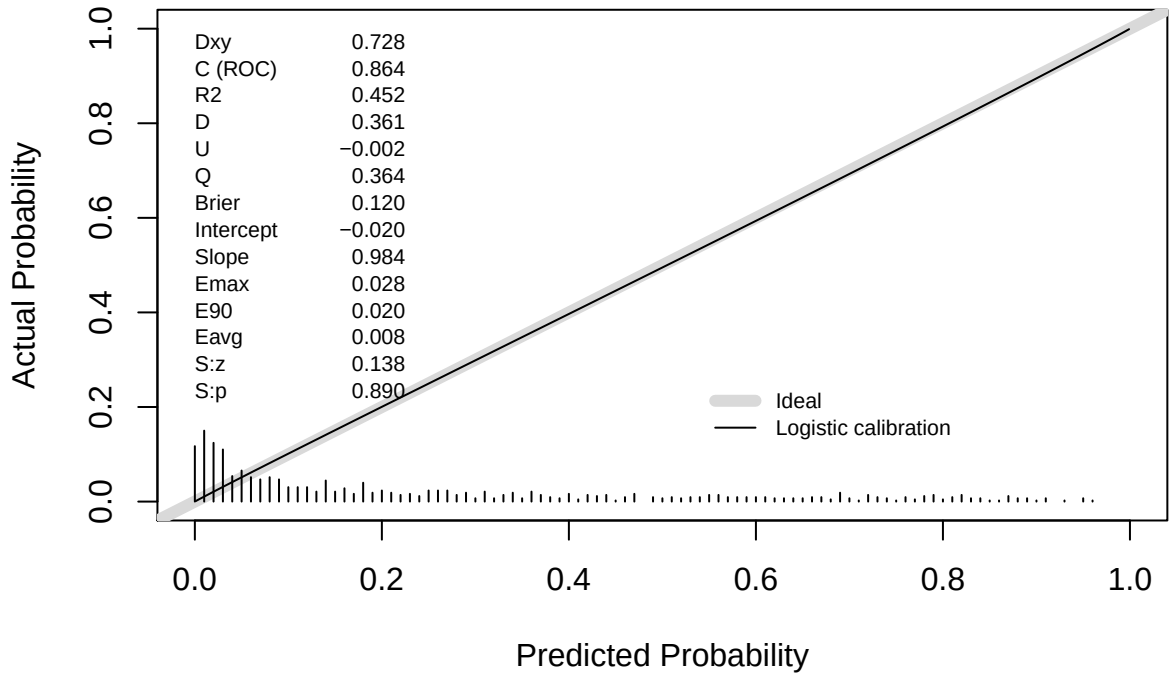
```
## ResourceSelection 0.3-5   2019-07-22
```

```
hoslem.test(mod2$y, fitted(mod2), g=10)
```

```
##
##  Hosmer and Lemeshow goodness of fit (GOF) test
##
## data:  mod2$y, fitted(mod2)
## X-squared = 3.1873, df = 8, p-value = 0.9221
```

Spiegelhalter

```
library (rms)
val.prob (tst$ps, tst$cancelsim, smooth = F)
```




```
##           Dxy       C (ROC)            R2             D      D:Chi-sq
##   0.728481114   0.864240557   0.451974209   0.361106357 289.885085879
##           D:p             U      U:Chi-sq          U:p             Q
##            NA  -0.002436801   0.050559016   0.975037343   0.363543159
##         Brier     Intercept         Slope          Emax           E90
##   0.119721123  -0.020023035   0.984019371   0.027986824   0.019574397
##          Eavg           S:z           S:p
##   0.008116074   0.138458673   0.889877929
```

Zoyowsky

```
library(arules)
```

```
## Loading required package: Matrix
```

```
##
## Attaching package: 'arules'
```

```
## The following object is masked from 'package:car':
##
##     recode
```

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

```
kp=discretize(tst$ps, method = 'frequency', breaks = 5)
m=table(kp, tst$cancelsim)
mp=prop.table(m,1)
print(mp,digits=2)
```

```
##
## kp                       0      1
```

```
##   [0.000386,0.0292) 0.9938 0.0063
##   [0.0292,0.0852)   0.9187 0.0813
##   [0.0852,0.212)    0.8688 0.1313
##   [0.212,0.477)     0.6813 0.3187
##   [0.477,0.965]     0.3063 0.6937
```

Matriz de classificação

```
PC=0.50  # Ponto de corte para classificacao
klas=ifelse(tst$ps>=PC,"prev_sim","prev_nao")
table(tst$cancelsim,klas)
```

```
##    klas
##     prev_nao prev_sim
##   0      557       46
##   1       88      109
```

Criar previsao

```
novo.indiv=data.frame(idade=51,Ltempcli=3,Sfatura=25,local="A", debaut = "nao")
novo.p=predict(mod2, novo.indiv, type="response")
novo.p
```

```
##          1
## 0.05026981
```

Criar previsoes com base em faixas de frequência

```
library(arules)
xx=c("0.00 a 0.50","0.50 a 0.75", "0.75 a 1.00")
kps=discretize(tst$ps, method = "fixed", breaks = c(0,.50,.75,1),labels  = xx)
class=table(kps,tst$cancelsim)
class
```

```
##
## kps             0   1
##   0.00 a 0.50 557  88
##   0.50 a 0.75  39  58
##   0.75 a 1.00   7  51
```

```
print(prop.table(class,1), digits=3)
```

```
##
## kps               0     1
##   0.00 a 0.50 0.864 0.136
##   0.50 a 0.75 0.402 0.598
##   0.75 a 1.00 0.121 0.879
```

Calcular indicadores

```
library(hmeasure)
HMeasure(tst$cancelsim, tst$ps)$metric
```

```
##                H      Gini       AUC      AUCH        KS  MER       MWL
## scores 0.4470573 0.7284811 0.8642406 0.8728186 0.5683006 0.16 0.1602563
##        Spec.Sens95 Sens.Spec95     ER      Sens      Spec Precision
## scores   0.4626866   0.5025381 0.1675 0.5532995 0.9237148 0.7032258
##           Recall       TPR        FPR         F    Youden  TP FP  TN FN
## scores 0.5532995 0.5532995 0.07628524 0.6193182 0.4770143 109 46 557 88
```

Cross validation

```
library(boot)
```

```
##
## Attaching package: 'boot'
```

```
## The following object is masked from 'package:survival':
##
##     aml
```

```
## The following object is masked from 'package:lattice':
##
##     melanoma
```

```
## The following object is masked from 'package:car':
##
##     logit
```

```
mod3=glm(data = tt, cancelsim~.,family = binomial())
mod4=step(mod3)
```

```
## Start:  AIC=1491.63
## cancelsim ~ idade + klinhas + Ltempcli + Lrenda + Sfatura + temp_rsd +
##     local + tvcabo + debaut
##
##            Df Deviance    AIC
## - Lrenda    1   1467.8 1489.8
## - debaut    1   1467.8 1489.8
## - klinhas   1   1468.6 1490.6
## - tvcabo    1   1468.8 1490.8
## - temp_rsd  1   1469.2 1491.2
## <none>          1467.6 1491.6
## - idade     1   1485.8 1507.8
## - Ltempcli  1   1579.2 1601.2
## - local     3   1674.6 1692.6
## - Sfatura   1   1726.1 1748.1
##
## Step:  AIC=1489.77
## cancelsim ~ idade + klinhas + Ltempcli + Sfatura + temp_rsd +
##     local + tvcabo + debaut
##
```

```
##            Df Deviance    AIC
## - debaut    1   1468.0 1488.0
## - klinhas   1   1468.7 1488.7
## - tvcabo    1   1469.0 1489.0
## - temp_rsd  1   1469.4 1489.4
## <none>          1467.8 1489.8
## - idade     1   1488.9 1508.9
## - Ltempcli  1   1640.7 1660.7
## - local     3   1675.8 1691.8
## - Sfatura   1   1753.1 1773.1
##
## Step:  AIC=1487.97
## cancelsim ~ idade + klinhas + Ltempcli + Sfatura + temp_rsd +
##     local + tvcabo
##
##            Df Deviance    AIC
## - klinhas   1   1468.9 1486.9
## - tvcabo    1   1469.2 1487.2
## - temp_rsd  1   1469.6 1487.6
## <none>          1468.0 1488.0
## - idade     1   1489.2 1507.2
## - Ltempcli  1   1640.8 1658.8
## - local     3   1675.8 1689.8
## - Sfatura   1   1753.2 1771.2
##
## Step:  AIC=1486.86
## cancelsim ~ idade + Ltempcli + Sfatura + temp_rsd + local + tvcabo
##
##            Df Deviance    AIC
## - tvcabo    1   1470.0 1486.0
## - temp_rsd  1   1470.5 1486.5
## <none>          1468.9 1486.9
## - idade     1   1489.3 1505.3
## - Ltempcli  1   1661.8 1677.8
## - local     3   1676.8 1688.8
## - Sfatura   1   1768.5 1784.5
##
## Step:  AIC=1486.02
## cancelsim ~ idade + Ltempcli + Sfatura + temp_rsd + local
##
##            Df Deviance    AIC
## - temp_rsd  1   1471.7 1485.7
## <none>          1470.0 1486.0
## - idade     1   1490.9 1504.9
## - Ltempcli  1   1662.3 1676.3
## - local     3   1678.6 1688.6
## - Sfatura   1   1769.7 1783.7
##
## Step:  AIC=1485.65
## cancelsim ~ idade + Ltempcli + Sfatura + local
##
##            Df Deviance    AIC
## <none>          1471.7 1485.7
## - idade     1   1492.2 1504.2
```

```
## - Ltempcli  1   1663.7 1675.7
## - local     3   1680.0 1688.0
## - Sfatura   1   1770.7 1782.7
```

```
#mod4
set.seed(11)
cvglm=cv.glm(data = tt, glmfit = mod4, K = 10)
cvglm$delta[1]
```

```
## [1] 0.1178127
```

```
cv.glm(data = tt, glmfit = mod4)$delta[1]
```

```
## [1] 0.1175945
```