link_tree

syh

June 10, 2017

```
# import link data
link_data <- read.csv(file = "data/model_data.csv", stringsAsFactor = F)[-1]
```

```
#
# head(link_data)
str(link_data)
```

```
## 'data.frame':    47012 obs. of  8 variables:
##  $ num_vac_taxi : int  10 17 5 1 5 22 31 15 9 8 ...
##  $ vac_avg_speed: num  14.36 5.61 15.79 19.58 28.39 ...
##  $ num_occ_taxi : int  3 8 24 0 4 29 14 13 7 14 ...
##  $ occ_avg_speed: num  16.22 11.14 9.43 0 26.25 ...
##  $ demo         : int  0 0 0 0 0 0 0 0 0 0 ...
##  $ rrate        : num  0.231 0.32 0.828 0 0.444 ...
##  $ holiday      : int  0 1 0 0 0 1 0 0 0 0 ...
##  $ time_range   : chr  "evening" "working" "afternoon_commute" "evening" ...
```

```
# summary(link_data)
```

```
link_data$demo <- as.factor(link_data$demo)
link_data$holiday <- as.factor(link_data$holiday)
link_data$time_range <- as.factor(link_data$time_range)
```

```
summary(link_data)
```

```
##   num_vac_taxi    vac_avg_speed      num_occ_taxi    occ_avg_speed
##  Min.   :  0.00   Min.   :  0.000   Min.   :  0.00   Min.   : 0.000
##  1st Qu.:  1.00   1st Qu.:  3.178   1st Qu.:  2.00   1st Qu.: 8.512
##  Median :  4.00   Median :  9.491   Median :  5.00   Median :13.168
##  Mean   : 11.86   Mean   : 11.002   Mean   : 12.69   Mean   :14.971
##  3rd Qu.: 13.00   3rd Qu.: 15.147   3rd Qu.: 13.00   3rd Qu.:19.926
##  Max.   :384.00   Max.   :115.332   Max.   :275.00   Max.   :89.751
##  demo          rrate        holiday               time_range
##  0:23613   Min.   :0.0000   0:14647   afternoon_commute:21900
##  1:23399   1st Qu.:0.3333   1:32365   evening          :13228
##            Median :0.5833             morning_commute  : 4346
##            Mean   :0.5745             working          : 7538
##            3rd Qu.:0.8462
##            Max.   :1.0000
```

```
# missing value?
sapply(link_data, function(x){sum(is.na(x))})
```

```
##  num_vac_taxi vac_avg_speed  num_occ_taxi occ_avg_speed          demo
##             0             0             0             0             0
##         rrate       holiday    time_range
##             0             0             0
```

```
table(link_data[,"demo"])
```

```
##
##     0     1
## 23613 23399
```

```
#we know the data set is seriously imbalanced
```

```
cand_data <- link_data
```

```
# if we drop holiday, time_range
link_data <- subset(cand_data,select = - c(time_range,holiday))
```

```
# let split data into train and test
set.seed(1)
train_ind <- sample(x = c(1:dim(link_data)[1]), size = dim(link_data)[1] * 0.7)

train_data <- link_data[train_ind,]
test_data <- link_data[-train_ind,]
```

```
dim(train_data)
```

```
## [1] 32908     6
```

```
# let's first use rpart to train a decision tr
library(rpart)
tree <- rpart(formula = "demo ~. -demo", data = train_data,
              method = "class",
              control = rpart.control(minsplit = 20, cp = 0))
```

```
# look at what the tree is like
tree
```

```
## n= 32908
##
## node), split, n, loss, yval, (yprob)
##       * denotes terminal node
##
##         1) root 32908 16353 0 (0.503069163 0.496930837)
##           2) num_vac_taxi>=5.5 13652  3300 0 (0.758277176 0.241722824)
##             4) occ_avg_speed>=12.14529 7968   665 0 (0.916541165 0.083458835)
##               8) num_vac_taxi>=7.5 6721   294 0 (0.956256509 0.043743491)
##                16) rrate>=0.1012821 6318   179 0 (0.971668249 0.028331751)
##                  32) vac_avg_speed>=8.242975 5414    41 0 (0.992427041 0.007572959)
##                    64) occ_avg_speed>=14.08712 4656     0 0 (1.000000000 0.000000000) *
##                    65) occ_avg_speed< 14.08712 758    41 0 (0.945910290 0.054089710)
##                     130) occ_avg_speed< 14.08533 717     0 0 (1.000000000 0.000000000) *
##                     131) occ_avg_speed>=14.08533 41     0 1 (0.000000000 1.000000000) *
##                  33) vac_avg_speed< 8.242975 904   138 0 (0.847345133 0.152654867)
##                    66) vac_avg_speed< 8.234724 875   109 0 (0.875428571 0.124571429)
##                     132) num_occ_taxi< 96.5 821    71 0 (0.913520097 0.086479903)
##                       264) vac_avg_speed>=3.179651 735    37 0 (0.949659864 0.050340136)
##                         528) vac_avg_speed< 7.9826 622     0 0 (1.000000000 0.000000000) *
##                         529) vac_avg_speed>=7.9826 113    37 0 (0.672566372 0.327433628)
##                          1058) vac_avg_speed>=7.991695 76     0 0 (1.000000000 0.000000000) *
##                          1059) vac_avg_speed< 7.991695 37     0 1 (0.000000000 1.000000000) *
##                       265) vac_avg_speed< 3.179651 86    34 0 (0.604651163 0.395348837)
##                         530) vac_avg_speed< 3.166028 52     0 0 (1.000000000 0.000000000) *
##                         531) vac_avg_speed>=3.166028 34     0 1 (0.000000000 1.000000000) *
```

```
##                     133) num_occ_taxi>=96.5 54    16 1 (0.296296296 0.703703704)
##                       266) num_occ_taxi>=98.5 16     0 0 (1.000000000 0.000000000) *
##                       267) num_occ_taxi< 98.5 38     0 1 (0.000000000 1.000000000) *
##                     67) vac_avg_speed>=8.234724 29     0 1 (0.000000000 1.000000000) *
##                  17) rrate< 0.1012821 403   115 0 (0.714640199 0.285359801)
##                    34) occ_avg_speed>=21.838 151     0 0 (1.000000000 0.000000000) *
##                    35) occ_avg_speed< 21.838 252   115 0 (0.543650794 0.456349206)
##                      70) occ_avg_speed< 21.253 168    38 0 (0.773809524 0.226190476)
##                       140) occ_avg_speed>=12.75767 121     0 0 (1.000000000 0.000000000) *
##                       141) occ_avg_speed< 12.75767 47     9 1 (0.191489362 0.808510638)
##                         282) occ_avg_speed< 12.74767 9     0 0 (1.000000000 0.000000000) *
##                         283) occ_avg_speed>=12.74767 38     0 1 (0.000000000 1.000000000) *
##                      71) occ_avg_speed>=21.253 84     7 1 (0.083333333 0.916666667)
##                       142) occ_avg_speed< 21.8255 45     7 1 (0.155555556 0.844444444)
##                         284) num_vac_taxi>=10 7     0 0 (1.000000000 0.000000000) *
##                         285) num_vac_taxi< 10 38     0 1 (0.000000000 1.000000000) *
##                       143) occ_avg_speed>=21.8255 39     0 1 (0.000000000 1.000000000) *
##                9) num_vac_taxi< 7.5 1247   371 0 (0.702485966 0.297514034)
##                  18) vac_avg_speed>=14.60864 571    39 0 (0.931698774 0.068301226)
##                    36) occ_avg_speed>=14.7863 472     0 0 (1.000000000 0.000000000) *
##                    37) occ_avg_speed< 14.7863 99    39 0 (0.606060606 0.393939394)
##                      74) occ_avg_speed< 14.76387 60     0 0 (1.000000000 0.000000000) *
##                      75) occ_avg_speed>=14.76387 39     0 1 (0.000000000 1.000000000) *
##                  19) vac_avg_speed< 14.60864 676   332 0 (0.508875740 0.491124260)
##                    38) vac_avg_speed< 13.10807 444   158 0 (0.644144144 0.355855856)
##                      76) rrate< 0.7593103 350    82 0 (0.765714286 0.234285714)
##                       152) vac_avg_speed>=4.884143 244     0 0 (1.000000000 0.000000000) *
##                       153) vac_avg_speed< 4.884143 106    24 1 (0.226415094 0.773584906)
##                         306) occ_avg_speed< 21.5745 19     0 0 (1.000000000 0.000000000) *
##                         307) occ_avg_speed>=21.5745 87     5 1 (0.057471264 0.942528736) *
##                      77) rrate>=0.7593103 94    18 1 (0.191489362 0.808510638)
##                       154) occ_avg_speed< 16.12681 11     0 0 (1.000000000 0.000000000) *
##                       155) occ_avg_speed>=16.12681 83     7 1 (0.084337349 0.915662651)
##                         310) occ_avg_speed>=16.57256 7     0 0 (1.000000000 0.000000000) *
##                         311) occ_avg_speed< 16.57256 76     0 1 (0.000000000 1.000000000) *
##                    39) vac_avg_speed>=13.10807 232    58 1 (0.250000000 0.750000000)
##                      78) num_vac_taxi< 6.5 33     0 0 (1.000000000 0.000000000) *
##                      79) num_vac_taxi>=6.5 199    25 1 (0.125628141 0.874371859)
##                       158) occ_avg_speed>=15.78421 109    23 1 (0.211009174 0.788990826)
##                         316) num_occ_taxi>=1.5 19     0 0 (1.000000000 0.000000000) *
##                         317) num_occ_taxi< 1.5 90     4 1 (0.044444444 0.955555556) *
##                       159) occ_avg_speed< 15.78421 90     2 1 (0.022222222 0.977777778) *
##             5) occ_avg_speed< 12.14529 5684  2635 0 (0.536418015 0.463581985)
##              10) num_vac_taxi>=50.5 606   118 0 (0.805280528 0.194719472)
##                20) vac_avg_speed< 9.668546 412     0 0 (1.000000000 0.000000000) *
##                21) vac_avg_speed>=9.668546 194    76 1 (0.391752577 0.608247423)
##                  42) rrate< 0.3902381 35     0 0 (1.000000000 0.000000000) *
##                  43) rrate>=0.3902381 159    41 1 (0.257861635 0.742138365)
##                    86) num_vac_taxi< 60.5 16     0 0 (1.000000000 0.000000000) *
##                    87) num_vac_taxi>=60.5 143    25 1 (0.174825175 0.825174825)
##                     174) num_vac_taxi>=67 61    23 1 (0.377049180 0.622950820)
##                       348) vac_avg_speed>=9.681523 23     0 0 (1.000000000 0.000000000) *
##                       349) vac_avg_speed< 9.681523 38     0 1 (0.000000000 1.000000000) *
##                     175) num_vac_taxi< 67 82     2 1 (0.024390244 0.975609756) *
```

```
##               11) num_vac_taxi< 50.5 5078  2517 0 (0.504332414 0.495667586)
##                 22) vac_avg_speed>=8.468992 2286   876 0 (0.616797900 0.383202100)
##                   44) occ_avg_speed< 5.3514 238     0 0 (1.000000000 0.000000000) *
##                   45) occ_avg_speed>=5.3514 2048   876 0 (0.572265625 0.427734375)
##                     90) num_occ_taxi< 109 1913   754 0 (0.605854679 0.394145321)
##                      180) num_occ_taxi>=5.5 1438   468 0 (0.674547983 0.325452017)
##                        360) occ_avg_speed< 11.65395 1136   301 0 (0.735035211 0.264964789)
##                          720) vac_avg_speed< 10.56004 419    46 0 (0.890214797 0.109785203)
##                           1440) num_vac_taxi>=9.5 301     0 0 (1.000000000 0.000000000) *
##                           1441) num_vac_taxi< 9.5 118    46 0 (0.610169492 0.389830508)
##                             2882) num_vac_taxi< 8.5 53     0 0 (1.000000000 0.000000000) *
##                             2883) num_vac_taxi>=8.5 65    19 1 (0.292307692 0.707692308)
##                               5766) num_occ_taxi>=12 14     0 0 (1.000000000 0.000000000) *
##                               5767) num_occ_taxi< 12 51     5 1 (0.098039216 0.901960784) *
##                          721) vac_avg_speed>=10.56004 717   255 0 (0.644351464 0.355648536)
##                           1442) occ_avg_speed>=8.132591 538   141 0 (0.737918216 0.262081784)
##                             2884) rrate>=0.5978723 168     0 0 (1.000000000 0.000000000) *
##                             2885) rrate< 0.5978723 370   141 0 (0.618918919 0.381081081)
##                               5770) num_occ_taxi< 27 262    67 0 (0.744274809 0.255725191)
##                                 11540) num_occ_taxi>=9.5 128     0 0 (1.000000000 0.000000000) *
##                                 11541) num_occ_taxi< 9.5 134    67 0 (0.500000000 0.500000000)
##                                   23082) rrate< 0.3900966 33     0 0 (1.000000000 0.000000000) *
##                                   23083) rrate>=0.3900966 101    34 1 (0.336633663 0.663366337)
##                                     46166) rrate>=0.4330357 32     0 0 (1.000000000 0.000000000) *
##                                     46167) rrate< 0.4330357 69     2 1 (0.028985507 0.971014493) *
##                               5771) num_occ_taxi>=27 108    34 1 (0.314814815 0.685185185)
##                                 11542) num_vac_taxi>=35.5 19     0 0 (1.000000000 0.000000000) *
##                                 11543) num_vac_taxi< 35.5 89    15 1 (0.168539326 0.831460674)
##                                   23086) vac_avg_speed>=13.43386 7     0 0 (1.000000000 0.000000000) *
##                                   23087) vac_avg_speed< 13.43386 82     8 1 (0.097560976 0.902439024)
##                                     46174) num_vac_taxi< 33 36     8 1 (0.222222222 0.777777778)
##                                       92348) num_vac_taxi>=20.5 8     0 0 (1.000000000 0.000000000) *
##                                       92349) num_vac_taxi< 20.5 28     0 1 (0.000000000 1.000000000) *
##                                     46175) num_vac_taxi>=33 46     0 1 (0.000000000 1.000000000) *
##                           1443) occ_avg_speed< 8.132591 179    65 1 (0.363128492 0.636871508)
##                             2886) occ_avg_speed< 7.713799 58     0 0 (1.000000000 0.000000000) *
##                             2887) occ_avg_speed>=7.713799 121     7 1 (0.057851240 0.942148760)
##                               5774) occ_avg_speed< 8.061266 41     7 1 (0.170731707 0.829268293)
##                                 11548) num_vac_taxi>=7 7     0 0 (1.000000000 0.000000000) *
##                                 11549) num_vac_taxi< 7 34     0 1 (0.000000000 1.000000000) *
##                               5775) occ_avg_speed>=8.061266 80     0 1 (0.000000000 1.000000000) *
##                        361) occ_avg_speed>=11.65395 302   135 1 (0.447019868 0.552980132)
##                          722) num_vac_taxi< 12.5 50     0 0 (1.000000000 0.000000000) *
##                          723) num_vac_taxi>=12.5 252    85 1 (0.337301587 0.662698413)
##                           1446) rrate< 0.4868946 33     0 0 (1.000000000 0.000000000) *
##                           1447) rrate>=0.4868946 219    52 1 (0.237442922 0.762557078)
##                             2894) rrate>=0.5630481 80    40 0 (0.500000000 0.500000000)
##                               5788) vac_avg_speed>=10.32264 35     0 0 (1.000000000 0.000000000) *
##                               5789) vac_avg_speed< 10.32264 45     5 1 (0.111111111 0.888888889) *
##                             2895) rrate< 0.5630481 139    12 1 (0.086330935 0.913669065)
##                               5790) vac_avg_speed< 9.526172 8     0 0 (1.000000000 0.000000000) *
##                               5791) vac_avg_speed>=9.526172 131     4 1 (0.030534351 0.969465649) *
##                      181) num_occ_taxi< 5.5 475   189 1 (0.397894737 0.602105263)
##                        362) num_vac_taxi>=13.5 55     0 0 (1.000000000 0.000000000) *
```

```
##                       363) num_vac_taxi< 13.5 420   134 1 (0.319047619 0.680952381)
##                         726) vac_avg_speed>=16.05506 32     0 0 (1.000000000 0.000000000) *
##                         727) vac_avg_speed< 16.05506 388   102 1 (0.262886598 0.737113402)
##                          1454) occ_avg_speed>=11.65 14     0 0 (1.000000000 0.000000000) *
##                          1455) occ_avg_speed< 11.65 374    88 1 (0.235294118 0.764705882)
##                            2910) vac_avg_speed< 8.966571 10     0 0 (1.000000000 0.000000000) *
##                            2911) vac_avg_speed>=8.966571 364    78 1 (0.214285714 0.785714286)
##                              5822) vac_avg_speed>=12.41749 57    26 1 (0.456140351 0.543859649)
##                               11644) vac_avg_speed< 15.76339 26     0 0 (1.000000000 0.000000000) *
##                               11645) vac_avg_speed>=15.76339 31     0 1 (0.000000000 1.000000000) *
##                              5823) vac_avg_speed< 12.41749 307    52 1 (0.169381107 0.830618893)
##                               11646) occ_avg_speed>=8.0078 117    36 1 (0.307692308 0.692307692)
##                                 23292) occ_avg_speed< 10.94817 31     0 0 (1.000000000 0.000000000) *
##                                 23293) occ_avg_speed>=10.94817 86     5 1 (0.058139535 0.941860465) *
##                               11647) occ_avg_speed< 8.0078 190    16 1 (0.084210526 0.915789474)
##                                 23294) rrate< 0.3033088 84    13 1 (0.154761905 0.845238095)
##                                   46588) rrate>=0.2264957 7     0 0 (1.000000000 0.000000000) *
##                                   46589) rrate< 0.2264957 77     6 1 (0.077922078 0.922077922) *
##                                 23295) rrate>=0.3033088 106     3 1 (0.028301887 0.971698113) *
##                     91) num_occ_taxi>=109 135    13 1 (0.096296296 0.903703704)
##                      182) rrate>=0.7554859 10     0 0 (1.000000000 0.000000000) *
##                      183) rrate< 0.7554859 125     3 1 (0.024000000 0.976000000) *
##                   23) vac_avg_speed< 8.468992 2792  1151 1 (0.412249284 0.587750716)
##                     46) num_vac_taxi>=22.5 743   315 0 (0.576043069 0.423956931)
##                       92) num_occ_taxi< 25.5 328    46 0 (0.859756098 0.140243902)
##                        184) vac_avg_speed>=2.892345 239     0 0 (1.000000000 0.000000000) *
##                        185) vac_avg_speed< 2.892345 89    43 1 (0.483146067 0.516853933)
##                          370) vac_avg_speed< 2.841427 43     0 0 (1.000000000 0.000000000) *
##                          371) vac_avg_speed>=2.841427 46     0 1 (0.000000000 1.000000000) *
##                       93) num_occ_taxi>=25.5 415   146 1 (0.351807229 0.648192771)
##                        186) num_vac_taxi< 30.5 37     0 0 (1.000000000 0.000000000) *
##                        187) num_vac_taxi>=30.5 378   109 1 (0.288359788 0.711640212)
##                          374) occ_avg_speed< 6.934843 22     0 0 (1.000000000 0.000000000) *
##                          375) occ_avg_speed>=6.934843 356    87 1 (0.244382022 0.755617978)
##                            750) rrate< 0.425236 19     0 0 (1.000000000 0.000000000) *
##                            751) rrate>=0.425236 337    68 1 (0.201780415 0.798219585)
##                             1502) num_occ_taxi>=38.5 172    54 1 (0.313953488 0.686046512)
##                               3004) num_occ_taxi< 67 31     0 0 (1.000000000 0.000000000) *
##                               3005) num_occ_taxi>=67 141    23 1 (0.163120567 0.836879433)
##                                 6010) num_vac_taxi< 38.5 9     0 0 (1.000000000 0.000000000) *
##                                 6011) num_vac_taxi>=38.5 132    14 1 (0.106060606 0.893939394)
##                                  12022) num_vac_taxi>=42.5 52    11 1 (0.211538462 0.788461538)
##                                    24044) vac_avg_speed< 8.285798 11     0 0 (1.000000000 0.000000000) *
##                                    24045) vac_avg_speed>=8.285798 41     0 1 (0.000000000 1.000000000) *
##                                  12023) num_vac_taxi< 42.5 80     3 1 (0.037500000 0.962500000) *
##                             1503) num_occ_taxi< 38.5 165    14 1 (0.084848485 0.915151515)
##                               3006) num_vac_taxi>=31.5 85    14 1 (0.164705882 0.835294118)
##                                 6012) num_vac_taxi< 34.5 9     0 0 (1.000000000 0.000000000) *
##                                 6013) num_vac_taxi>=34.5 76     5 1 (0.065789474 0.934210526) *
##                               3007) num_vac_taxi< 31.5 80     0 1 (0.000000000 1.000000000) *
##                     47) num_vac_taxi< 22.5 2049   723 1 (0.352855051 0.647144949)
##                       94) num_occ_taxi>=41.5 45     0 0 (1.000000000 0.000000000) *
##                       95) num_occ_taxi< 41.5 2004   678 1 (0.338323353 0.661676647)
##                        190) vac_avg_speed>=8.270811 36     0 0 (1.000000000 0.000000000) *
```

```
##                     191) vac_avg_speed< 8.270811 1968   642 1 (0.326219512 0.673780488)
##                       382) rrate< 0.5823643 1271   492 1 (0.387096774 0.612903226)
##                         764) num_occ_taxi>=14.5 59     0 0 (1.000000000 0.000000000) *
##                         765) num_occ_taxi< 14.5 1212   433 1 (0.357260726 0.642739274)
##                          1530) vac_avg_speed>=5.268182 580   277 1 (0.477586207 0.522413793)
##                            3060) vac_avg_speed< 6.2173 108     0 0 (1.000000000 0.000000000) *
##                            3061) vac_avg_speed>=6.2173 472   169 1 (0.358050847 0.641949153)
##                              6122) occ_avg_speed>=8.561682 134    45 0 (0.664179104 0.335820896)
##                               12244) rrate< 0.5486111 84     0 0 (1.000000000 0.000000000) *
##                               12245) rrate>=0.5486111 50     5 1 (0.100000000 0.900000000) *
##                              6123) occ_avg_speed< 8.561682 338    80 1 (0.236686391 0.763313609)
##                               12246) num_vac_taxi>=6.5 196    71 1 (0.362244898 0.637755102)
##                                 24492) occ_avg_speed< 5.821042 47     0 0 (1.000000000 0.000000000) *
##                                 24493) occ_avg_speed>=5.821042 149    24 1 (0.161073826 0.838926174)
##                                   48986) num_vac_taxi< 10.5 8     0 0 (1.000000000 0.000000000) *
##                                   48987) num_vac_taxi>=10.5 141    16 1 (0.113475177 0.886524823)
##                                     97974) num_vac_taxi>=15.5 7     0 0 (1.000000000 0.000000000) *
##                                     97975) num_vac_taxi< 15.5 134     9 1 (0.067164179 0.932835821)
##                                      195950) occ_avg_speed>=7.3435 52     7 1 (0.134615385 0.8653846
##                                        391900) num_vac_taxi< 14.5 7     0 0 (1.000000000 0.000000000
##                                        391901) num_vac_taxi>=14.5 45     0 1 (0.000000000 1.000000000
##                                      195951) occ_avg_speed< 7.3435 82     2 1 (0.024390244 0.9756097
##                               12247) num_vac_taxi< 6.5 142     9 1 (0.063380282 0.936619718)
##                                 24494) vac_avg_speed< 7.669833 49     9 1 (0.183673469 0.816326531)
##                                   48988) vac_avg_speed>=6.659333 8     0 0 (1.000000000 0.000000000)
##                                   48989) vac_avg_speed< 6.659333 41     1 1 (0.024390244 0.975609756
##                                 24495) vac_avg_speed>=7.669833 93     0 1 (0.000000000 1.000000000) *
##                          1531) vac_avg_speed< 5.268182 632   156 1 (0.246835443 0.753164557)
##                            3062) rrate< 0.1302521 79    34 0 (0.569620253 0.430379747)
##                              6124) vac_avg_speed>=0.8563333 44     0 0 (1.000000000 0.000000000) *
##                              6125) vac_avg_speed< 0.8563333 35     1 1 (0.028571429 0.971428571) *
##                            3063) rrate>=0.1302521 553   111 1 (0.200723327 0.799276673)
##                              6126) vac_avg_speed< 1.78919 20     0 0 (1.000000000 0.000000000) *
##                              6127) vac_avg_speed>=1.78919 533    91 1 (0.170731707 0.829268293)
##                               12254) rrate>=0.4104278 75    37 0 (0.506666667 0.493333333)
##                                 24508) occ_avg_speed< 11.82917 38     0 0 (1.000000000 0.000000000) *
##                                 24509) occ_avg_speed>=11.82917 37     0 1 (0.000000000 1.000000000) *
##                               12255) rrate< 0.4104278 458    53 1 (0.115720524 0.884279476)
##                                 24510) num_vac_taxi>=13.5 98    27 1 (0.275510204 0.724489796)
##                                   49020) num_vac_taxi< 20.5 24     0 0 (1.000000000 0.000000000) *
##                                   49021) num_vac_taxi>=20.5 74     3 1 (0.040540541 0.959459459) *
##                                 24511) num_vac_taxi< 13.5 360    26 1 (0.072222222 0.927777778)
##                                   49022) occ_avg_speed>=9.258667 59    13 1 (0.220338983 0.779661017
##                                     98044) vac_avg_speed>=2.069959 13     0 0 (1.000000000 0.0000000
##                                     98045) vac_avg_speed< 2.069959 46     0 1 (0.000000000 1.0000000
##                                   49023) occ_avg_speed< 9.258667 301    13 1 (0.043189369 0.9568106
##                                     98046) occ_avg_speed>=3.17625 159    12 1 (0.075471698 0.9245283
##                                      196092) num_vac_taxi< 11.5 71    11 1 (0.154929577 0.845070423)
##                                        392184) num_occ_taxi>=2.5 9     0 0 (1.000000000 0.000000000)
##                                        392185) num_occ_taxi< 2.5 62     2 1 (0.032258065 0.967741935
##                                      196093) num_vac_taxi>=11.5 88     1 1 (0.011363636 0.988636364)
##                                     98047) occ_avg_speed< 3.17625 142     1 1 (0.007042254 0.9929577
##                       383) rrate>=0.5823643 697   150 1 (0.215208034 0.784791966)
##                         766) occ_avg_speed< 4.56295 18     0 0 (1.000000000 0.000000000) *
```

```
##                         767) occ_avg_speed>=4.56295 679   132 1 (0.194403535 0.805596465)
##                          1534) rrate>=0.7825059 13     0 0 (1.000000000 0.000000000) *
##                          1535) rrate< 0.7825059 666   119 1 (0.178678679 0.821321321)
##                            3070) occ_avg_speed>=11.75305 10     0 0 (1.000000000 0.000000000) *
##                            3071) occ_avg_speed< 11.75305 656   109 1 (0.166158537 0.833841463)
##                              6142) num_occ_taxi< 16.5 68    30 1 (0.441176471 0.558823529)
##                               12284) vac_avg_speed>=5.711411 25     0 0 (1.000000000 0.000000000) *
##                               12285) vac_avg_speed< 5.711411 43     5 1 (0.116279070 0.883720930) *
##                              6143) num_occ_taxi>=16.5 588    79 1 (0.134353741 0.865646259)
##                               12286) rrate>=0.7165179 69    24 1 (0.347826087 0.652173913)
##                                 24572) rrate< 0.7735043 24     0 0 (1.000000000 0.000000000) *
##                                 24573) rrate>=0.7735043 45     0 1 (0.000000000 1.000000000) *
##                               12287) rrate< 0.7165179 519    55 1 (0.105973025 0.894026975)
##                                 24574) vac_avg_speed>=7.295036 71    19 1 (0.267605634 0.732394366)
##                                   49148) vac_avg_speed< 8.267367 19     0 0 (1.000000000 0.000000000)
##                                   49149) vac_avg_speed>=8.267367 52     0 1 (0.000000000 1.000000000)
##                                 24575) vac_avg_speed< 7.295036 448    36 1 (0.080357143 0.919642857)
##                                   49150) rrate< 0.7047996 320    35 1 (0.109375000 0.890625000)
##                                     98300) occ_avg_speed>=9.468843 56    16 1 (0.285714286 0.7142857
##                                      196600) occ_avg_speed< 11.64881 16     0 0 (1.000000000 0.000000
##                                      196601) occ_avg_speed>=11.64881 40     0 1 (0.000000000 1.000000
##                                     98301) occ_avg_speed< 9.468843 264    19 1 (0.071969697 0.928030
##                                      196602) occ_avg_speed< 8.862976 144    19 1 (0.131944444 0.8680
##                                        393204) rrate< 0.6747944 12     0 0 (1.000000000 0.000000000)
##                                        393205) rrate>=0.6747944 132     7 1 (0.053030303 0.946969697)
##                                          786410) num_occ_taxi>=25.5 52     7 1 (0.134615385 0.865384
##                                           1572820) vac_avg_speed< 7.26125 7     0 0 (1.000000000 0.0
##                                           1572821) vac_avg_speed>=7.26125 45     0 1 (0.000000000 1.0
##                                          786411) num_occ_taxi< 25.5 80     0 1 (0.000000000 1.000000
##                                       196603) occ_avg_speed>=8.862976 120     0 1 (0.000000000 1.0000
##                                     49151) rrate>=0.7047996 128     1 1 (0.007812500 0.992187500) *
##           3) num_vac_taxi< 5.5 19256  6203 1 (0.322133361 0.677866639)
##             6) vac_avg_speed>=14.69205 4850  2027 0 (0.582061856 0.417938144)
##              12) occ_avg_speed>=20.17341 1471   189 0 (0.871515976 0.128484024)
##                24) vac_avg_speed>=24.12783 801    34 0 (0.957553059 0.042446941)
##                  48) vac_avg_speed< 62.92008 730     0 0 (1.000000000 0.000000000) *
##                  49) vac_avg_speed>=62.92008 71    34 0 (0.521126761 0.478873239)
##                    98) vac_avg_speed>=63.043 37     0 0 (1.000000000 0.000000000) *
##                    99) vac_avg_speed< 63.043 34     0 1 (0.000000000 1.000000000) *
##                25) vac_avg_speed< 24.12783 670   155 0 (0.768656716 0.231343284)
##                  50) vac_avg_speed< 24.12608 634   119 0 (0.812302839 0.187697161)
##                   100) rrate< 0.6547619 285     0 0 (1.000000000 0.000000000) *
##                   101) rrate>=0.6547619 349   119 0 (0.659025788 0.340974212)
##                     202) num_occ_taxi>=7.5 139     0 0 (1.000000000 0.000000000) *
##                     203) num_occ_taxi< 7.5 210    91 1 (0.433333333 0.566666667)
##                       406) num_vac_taxi< 2.5 113    33 0 (0.707964602 0.292035398)
##                         812) vac_avg_speed< 21.31125 58     0 0 (1.000000000 0.000000000) *
##                         813) vac_avg_speed>=21.31125 55    22 1 (0.400000000 0.600000000)
##                          1626) vac_avg_speed>=21.3815 22     0 0 (1.000000000 0.000000000) *
##                          1627) vac_avg_speed< 21.3815 33     0 1 (0.000000000 1.000000000) *
##                       407) num_vac_taxi>=2.5 97    11 1 (0.113402062 0.886597938) *
##                  51) vac_avg_speed>=24.12608 36     0 1 (0.000000000 1.000000000) *
##              13) occ_avg_speed< 20.17341 3379  1541 1 (0.456052086 0.543947914)
##                26) num_vac_taxi>=3.5 530   141 0 (0.733962264 0.266037736)
```

```
##                   52) occ_avg_speed< 19.77192 481   107 0 (0.777546778 0.222453222)
##                    104) vac_avg_speed>=19.14235 179     0 0 (1.000000000 0.000000000) *
##                    105) vac_avg_speed< 19.14235 302   107 0 (0.645695364 0.354304636)
##                      210) vac_avg_speed< 19.13985 257    62 0 (0.758754864 0.241245136)
##                        420) occ_avg_speed>=8.026342 136     0 0 (1.000000000 0.000000000) *
##                        421) occ_avg_speed< 8.026342 121    59 1 (0.487603306 0.512396694)
##                          842) occ_avg_speed< 7.506208 86    27 0 (0.686046512 0.313953488)
##                           1684) vac_avg_speed>=15.09208 54     0 0 (1.000000000 0.000000000) *
##                           1685) vac_avg_speed< 15.09208 32     5 1 (0.156250000 0.843750000) *
##                          843) occ_avg_speed>=7.506208 35     0 1 (0.000000000 1.000000000) *
##                      211) vac_avg_speed>=19.13985 45     0 1 (0.000000000 1.000000000) *
##                   53) occ_avg_speed>=19.77192 49    15 1 (0.306122449 0.693877551)
##                    106) occ_avg_speed>=19.89322 15     0 0 (1.000000000 0.000000000) *
##                    107) occ_avg_speed< 19.89322 34     0 1 (0.000000000 1.000000000) *
##                 27) num_vac_taxi< 3.5 2849  1152 1 (0.404352404 0.595647596)
##                   54) num_occ_taxi>=14.5 91     0 0 (1.000000000 0.000000000) *
##                   55) num_occ_taxi< 14.5 2758  1061 1 (0.384699057 0.615300943)
##                    110) occ_avg_speed< 1.256125 991   474 1 (0.478304743 0.521695257)
##                      220) vac_avg_speed>=26.314 182     0 0 (1.000000000 0.000000000) *
##                      221) vac_avg_speed< 26.314 809   292 1 (0.360939431 0.639060569)
##                        442) vac_avg_speed< 15.82425 40     0 0 (1.000000000 0.000000000) *
##                        443) vac_avg_speed>=15.82425 769   252 1 (0.327698309 0.672301691)
##                          886) vac_avg_speed< 21.969 394   167 1 (0.423857868 0.576142132)
##                           1772) vac_avg_speed>=17.59083 105     0 0 (1.000000000 0.000000000) *
##                           1773) vac_avg_speed< 17.59083 289    62 1 (0.214532872 0.785467128)
##                             3546) vac_avg_speed< 17.4945 237    62 1 (0.261603376 0.738396624)
##                               7092) vac_avg_speed>=17.32467 9     0 0 (1.000000000 0.000000000) *
##                               7093) vac_avg_speed< 17.32467 228    53 1 (0.232456140 0.767543860)
##                                14186) vac_avg_speed< 17.27842 182    53 1 (0.291208791 0.708791209)
##                                  28372) vac_avg_speed>=16.68258 23     0 0 (1.000000000 0.000000000) *
##                                  28373) vac_avg_speed< 16.68258 159    30 1 (0.188679245 0.811320755)
##                                    56746) vac_avg_speed>=15.83917 117    30 1 (0.256410256 0.74358974
##                                     113492) vac_avg_speed< 16.1995 17     0 0 (1.000000000 0.00000000
##                                     113493) vac_avg_speed>=16.1995 100    13 1 (0.130000000 0.8700000
##                                       226986) vac_avg_speed>=16.222 53    13 1 (0.245283019 0.7547169
##                                         453972) vac_avg_speed< 16.61617 13     0 0 (1.000000000 0.000
##                                         453973) vac_avg_speed>=16.61617 40     0 1 (0.000000000 1.000
##                                       226987) vac_avg_speed< 16.222 47     0 1 (0.000000000 1.0000000
##                                    56747) vac_avg_speed< 15.83917 42     0 1 (0.000000000 1.0000000
##                                14187) vac_avg_speed>=17.27842 46     0 1 (0.000000000 1.000000000) *
##                             3547) vac_avg_speed>=17.4945 52     0 1 (0.000000000 1.000000000) *
##                           887) vac_avg_speed>=21.969 375    85 1 (0.226666667 0.773333333)
##                           1774) vac_avg_speed>=22.4005 293    81 1 (0.276450512 0.723549488)
##                             3548) vac_avg_speed< 23.4465 19     0 0 (1.000000000 0.000000000) *
##                             3549) vac_avg_speed>=23.4465 274    62 1 (0.226277372 0.773722628)
##                               7098) vac_avg_speed>=23.454 222    62 1 (0.279279279 0.720720721)
##                                14196) vac_avg_speed< 24.35 28     0 0 (1.000000000 0.000000000) *
##                                14197) vac_avg_speed>=24.35 194    34 1 (0.175257732 0.824742268)
##                                  28394) vac_avg_speed< 26.306 152    34 1 (0.223684211 0.776315789)
##                                    56788) vac_avg_speed>=25.55475 17     0 0 (1.000000000 0.0000000
##                                    56789) vac_avg_speed< 25.55475 135    17 1 (0.125925926 0.8740740
##                                     113578) vac_avg_speed< 25.34325 93    17 1 (0.182795699 0.817204
##                                       227156) vac_avg_speed>=24.938 7     0 0 (1.000000000 0.0000000
##                                       227157) vac_avg_speed< 24.938 86    10 1 (0.116279070 0.8837209
```

```
##                                   454314) vac_avg_speed>=24.4085 46    10 1 (0.217391304 0.7826
##                                     908628) vac_avg_speed< 24.8745 10     0 0 (1.000000000 0.000
##                                     908629) vac_avg_speed>=24.8745 36     0 1 (0.000000000 1.000
##                                   454315) vac_avg_speed< 24.4085 40     0 1 (0.000000000 1.00000
##                                 113579) vac_avg_speed>=25.34325 42     0 1 (0.000000000 1.0000000
##                               28395) vac_avg_speed>=26.306 42     0 1 (0.000000000 1.000000000) *
##                             7099) vac_avg_speed< 23.454 52     0 1 (0.000000000 1.000000000) *
##                          1775) vac_avg_speed< 22.4005 82     4 1 (0.048780488 0.951219512) *
##                       111) occ_avg_speed>=1.256125 1767   587 1 (0.332201471 0.667798529)
##                         222) occ_avg_speed>=14.12875 611   301 1 (0.492635025 0.507364975)
##                           444) occ_avg_speed< 19.104 373   114 0 (0.694369973 0.305630027)
##                             888) vac_avg_speed< 39.916 248     0 0 (1.000000000 0.000000000) *
##                             889) vac_avg_speed>=39.916 125    11 1 (0.088000000 0.912000000)
##                              1778) vac_avg_speed>=43.3785 9     0 0 (1.000000000 0.000000000) *
##                              1779) vac_avg_speed< 43.3785 116     2 1 (0.017241379 0.982758621) *
##                           445) occ_avg_speed>=19.104 238    42 1 (0.176470588 0.823529412)
##                             890) num_occ_taxi>=3.5 25     0 0 (1.000000000 0.000000000) *
##                             891) num_occ_taxi< 3.5 213    17 1 (0.079812207 0.920187793)
##                              1782) vac_avg_speed>=25.7515 7     0 0 (1.000000000 0.000000000) *
##                              1783) vac_avg_speed< 25.7515 206    10 1 (0.048543689 0.951456311)
##                                3566) vac_avg_speed>=21.3715 47     7 1 (0.148936170 0.851063830)
##                                  7132) vac_avg_speed< 24.28225 7     0 0 (1.000000000 0.000000000) *
##                                  7133) vac_avg_speed>=24.28225 40     0 1 (0.000000000 1.000000000) *
##                                3567) vac_avg_speed< 21.3715 159     3 1 (0.018867925 0.981132075) *
##                         223) occ_avg_speed< 14.12875 1156   286 1 (0.247404844 0.752595156)
##                           446) vac_avg_speed< 27.994 763   244 1 (0.319790301 0.680209699)
##                             892) vac_avg_speed>=25.2165 23     0 0 (1.000000000 0.000000000) *
##                             893) vac_avg_speed< 25.2165 740   221 1 (0.298648649 0.701351351)
##                              1786) num_occ_taxi>=11.5 17     0 0 (1.000000000 0.000000000) *
##                              1787) num_occ_taxi< 11.5 723   204 1 (0.282157676 0.717842324)
##                                3574) vac_avg_speed>=15.6315 531   181 1 (0.340866290 0.659133710)
##                                  7148) rrate< 0.7928571 298   145 1 (0.486577181 0.513422819)
##                                   14296) rrate>=0.5357143 97     0 0 (1.000000000 0.000000000) *
##                                   14297) rrate< 0.5357143 201    48 1 (0.238805970 0.761194030)
##                                     28594) occ_avg_speed>=11.78958 19     0 0 (1.000000000 0.000000000) *
##                                     28595) occ_avg_speed< 11.78958 182    29 1 (0.159340659 0.840659341)
##                                       57190) vac_avg_speed< 16.44683 7     0 0 (1.000000000 0.000000000)
##                                       57191) vac_avg_speed>=16.44683 175    22 1 (0.125714286 0.87428571
##                                        114382) vac_avg_speed< 20.2985 51    13 1 (0.254901961 0.74509803
##                                          228764) vac_avg_speed>=16.77008 13     0 0 (1.000000000 0.00000
##                                          228765) vac_avg_speed< 16.77008 38     0 1 (0.000000000 1.00000
##                                        114383) vac_avg_speed>=20.2985 124     9 1 (0.072580645 0.92741935
##                                          228766) occ_avg_speed< 10.82667 80     9 1 (0.112500000 0.88750
##                                            457532) vac_avg_speed< 25.0525 42     9 1 (0.214285714 0.7857
##                                              915064) num_vac_taxi>=1.5 9     0 0 (1.000000000 0.00000000
##                                              915065) num_vac_taxi< 1.5 33     0 1 (0.000000000 1.00000000
##                                            457533) vac_avg_speed>=25.0525 38     0 1 (0.000000000 1.00000
##                                          228767) occ_avg_speed>=10.82667 44     0 1 (0.000000000 1.00000
##                                  7149) rrate>=0.7928571 233    36 1 (0.154506438 0.845493562)
##                                   14298) vac_avg_speed>=19.269 69    24 1 (0.347826087 0.652173913)
##                                     28596) vac_avg_speed< 24.4745 21     0 0 (1.000000000 0.000000000) *
##                                     28597) vac_avg_speed>=24.4745 48     3 1 (0.062500000 0.937500000) *
##                                   14299) vac_avg_speed< 19.269 164    12 1 (0.073170732 0.926829268)
##                                     28598) rrate< 0.8397436 47     9 1 (0.191489362 0.808510638)
```

```
##                                 57196) vac_avg_speed< 18.64625 9     0 0 (1.000000000 0.000000000)
##                                 57197) vac_avg_speed>=18.64625 38     0 1 (0.000000000 1.000000000)
##                               28599) rrate>=0.8397436 117     3 1 (0.025641026 0.974358974) *
##                             3575) vac_avg_speed< 15.6315 192    23 1 (0.119791667 0.880208333)
##                               7150) vac_avg_speed< 15.35175 52    19 1 (0.365384615 0.634615385)
##                                 14300) rrate>=0.5357143 17     0 0 (1.000000000 0.000000000) *
##                                 14301) rrate< 0.5357143 35     2 1 (0.057142857 0.942857143) *
##                               7151) vac_avg_speed>=15.35175 140     4 1 (0.028571429 0.971428571) *
##                           447) vac_avg_speed>=27.994 393    42 1 (0.106870229 0.893129771)
##                             894) occ_avg_speed>=13.29289 8     0 0 (1.000000000 0.000000000) *
##                             895) occ_avg_speed< 13.29289 385    34 1 (0.088311688 0.911688312)
##                              1790) num_vac_taxi>=1.5 64    19 1 (0.296875000 0.703125000)
##                                3580) vac_avg_speed>=29.4455 19     0 0 (1.000000000 0.000000000) *
##                                3581) vac_avg_speed< 29.4455 45     0 1 (0.000000000 1.000000000) *
##                              1791) num_vac_taxi< 1.5 321    15 1 (0.046728972 0.953271028)
##                                3582) num_occ_taxi< 2.5 36     7 1 (0.194444444 0.805555556)
##                                  7164) occ_avg_speed< 12.51 7     0 0 (1.000000000 0.000000000) *
##                                  7165) occ_avg_speed>=12.51 29     0 1 (0.000000000 1.000000000) *
##                                3583) num_occ_taxi>=2.5 285     8 1 (0.028070175 0.971929825) *
##                     7) vac_avg_speed< 14.69205 14406  3380 1 (0.234624462 0.765375538)
##                      14) num_occ_taxi>=9.5 1083   535 1 (0.493998153 0.506001847)
##                        28) occ_avg_speed>=15.1422 278    41 0 (0.852517986 0.147482014)
##                          56) occ_avg_speed< 24.57277 176     0 0 (1.000000000 0.000000000) *
##                          57) occ_avg_speed>=24.57277 102    41 0 (0.598039216 0.401960784)
##                           114) occ_avg_speed>=24.58795 61     0 0 (1.000000000 0.000000000) *
##                           115) occ_avg_speed< 24.58795 41     0 1 (0.000000000 1.000000000) *
##                        29) occ_avg_speed< 15.1422 805   298 1 (0.370186335 0.629813665)
##                          58) vac_avg_speed< 5.06935 211    80 0 (0.620853081 0.379146919)
##                           116) occ_avg_speed< 14.33496 166    38 0 (0.771084337 0.228915663)
##                             232) occ_avg_speed>=2.316894 122     0 0 (1.000000000 0.000000000) *
##                             233) occ_avg_speed< 2.316894 44     6 1 (0.136363636 0.863636364) *
##                           117) occ_avg_speed>=14.33496 45     3 1 (0.066666667 0.933333333) *
##                          59) vac_avg_speed>=5.06935 594   167 1 (0.281144781 0.718855219)
##                           118) vac_avg_speed>=9.707475 169    74 0 (0.562130178 0.437869822)
##                             236) rrate< 0.8449519 67     0 0 (1.000000000 0.000000000) *
##                             237) rrate>=0.8449519 102    28 1 (0.274509804 0.725490196)
##                               474) vac_avg_speed< 12.388 19     0 0 (1.000000000 0.000000000) *
##                               475) vac_avg_speed>=12.388 83     9 1 (0.108433735 0.891566265)
##                                 950) vac_avg_speed>=12.9255 8     0 0 (1.000000000 0.000000000) *
##                                 951) vac_avg_speed< 12.9255 75     1 1 (0.013333333 0.986666667) *
##                           119) vac_avg_speed< 9.707475 425    72 1 (0.169411765 0.830588235)
##                             238) num_vac_taxi< 2.5 22     0 0 (1.000000000 0.000000000) *
##                             239) num_vac_taxi>=2.5 403    50 1 (0.124069479 0.875930521)
##                               478) occ_avg_speed>=12.2498 10     0 0 (1.000000000 0.000000000) *
##                               479) occ_avg_speed< 12.2498 393    40 1 (0.101781170 0.898218830)
##                                 958) occ_avg_speed>=9.601817 42    15 1 (0.357142857 0.642857143)
##                                  1916) vac_avg_speed>=5.442433 15     0 0 (1.000000000 0.000000000) *
##                                  1917) vac_avg_speed< 5.442433 27     0 1 (0.000000000 1.000000000) *
##                                 959) occ_avg_speed< 9.601817 351    25 1 (0.071225071 0.928774929)
##                                  1918) vac_avg_speed< 7.248025 80    14 1 (0.175000000 0.825000000)
##                                    3836) num_occ_taxi>=13.5 9     0 0 (1.000000000 0.000000000) *
##                                    3837) num_occ_taxi< 13.5 71     5 1 (0.070422535 0.929577465) *
##                                  1919) vac_avg_speed>=7.248025 271    11 1 (0.040590406 0.959409594) *
##                      15) num_occ_taxi< 9.5 13323  2845 1 (0.213540494 0.786459506)
```

```
##                 30) occ_avg_speed>=15.668 4647  1383 1 (0.297611362 0.702388638)
##                   60) vac_avg_speed>=6.1572 1041   485 1 (0.465898175 0.534101825)
##                    120) occ_avg_speed< 16.83387 71     0 0 (1.000000000 0.000000000) *
##                    121) occ_avg_speed>=16.83387 970   414 1 (0.426804124 0.573195876)
##                      242) vac_avg_speed< 8.1347 61     0 0 (1.000000000 0.000000000) *
##                      243) vac_avg_speed>=8.1347 909   353 1 (0.388338834 0.611661166)
##                        486) vac_avg_speed>=10.1232 519   257 0 (0.504816956 0.495183044)
##                          972) vac_avg_speed< 13.4729 232    46 0 (0.801724138 0.198275862)
##                           1944) rrate< 0.7386364 160     0 0 (1.000000000 0.000000000) *
##                           1945) rrate>=0.7386364 72    26 1 (0.361111111 0.638888889)
##                             3890) num_occ_taxi>=3.5 19     0 0 (1.000000000 0.000000000) *
##                             3891) num_occ_taxi< 3.5 53     7 1 (0.132075472 0.867924528) *
##                          973) vac_avg_speed>=13.4729 287    76 1 (0.264808362 0.735191638)
##                           1946) num_vac_taxi< 1.5 19     0 0 (1.000000000 0.000000000) *
##                           1947) num_vac_taxi>=1.5 268    57 1 (0.212686567 0.787313433)
##                             3894) num_occ_taxi>=7.5 7     0 0 (1.000000000 0.000000000) *
##                             3895) num_occ_taxi< 7.5 261    50 1 (0.191570881 0.808429119)
##                               7790) vac_avg_speed< 14.62833 198    50 1 (0.252525253 0.747474747)
##                                15580) vac_avg_speed>=14.02855 26     0 0 (1.000000000 0.000000000) *
##                                15581) vac_avg_speed< 14.02855 172    24 1 (0.139534884 0.860465116)
##                                  31162) vac_avg_speed< 13.95005 98    24 1 (0.244897959 0.755102041)
##                                    62324) rrate< 0.4722222 14     0 0 (1.000000000 0.000000000) *
##                                    62325) rrate>=0.4722222 84    10 1 (0.119047619 0.880952381)
##                                     124650) vac_avg_speed>=13.51925 46    10 1 (0.217391304 0.7826086
##                                       249300) occ_avg_speed< 29.0093 10     0 0 (1.000000000 0.0000000
##                                       249301) occ_avg_speed>=29.0093 36     0 1 (0.000000000 1.0000000
##                                     124651) vac_avg_speed< 13.51925 38     0 1 (0.000000000 1.0000000
##                                  31163) vac_avg_speed>=13.95005 74     0 1 (0.000000000 1.000000000) *
##                               7791) vac_avg_speed>=14.62833 63     0 1 (0.000000000 1.000000000) *
##                        487) vac_avg_speed< 10.1232 390    91 1 (0.233333333 0.766666667)
##                          974) num_vac_taxi< 1.5 20     0 0 (1.000000000 0.000000000) *
##                          975) num_vac_taxi>=1.5 370    71 1 (0.191891892 0.808108108)
##                           1950) rrate< 0.2678571 15     0 0 (1.000000000 0.000000000) *
##                           1951) rrate>=0.2678571 355    56 1 (0.157746479 0.842253521)
##                             3902) rrate< 0.6333333 180    43 1 (0.238888889 0.761111111)
##                               7804) occ_avg_speed< 19.124 14     0 0 (1.000000000 0.000000000) *
##                               7805) occ_avg_speed>=19.124 166    29 1 (0.174698795 0.825301205)
##                                15610) rrate>=0.5357143 8     0 0 (1.000000000 0.000000000) *
##                                15611) rrate< 0.5357143 158    21 1 (0.132911392 0.867088608)
##                                  31222) vac_avg_speed< 9.597292 60    17 1 (0.283333333 0.716666667)
##                                    62444) vac_avg_speed>=8.442 17     0 0 (1.000000000 0.000000000) *
##                                    62445) vac_avg_speed< 8.442 43     0 1 (0.000000000 1.000000000) *
##                                  31223) vac_avg_speed>=9.597292 98     4 1 (0.040816327 0.959183673) *
##                             3903) rrate>=0.6333333 175    13 1 (0.074285714 0.925714286)
##                               7806) rrate>=0.6794872 53    13 1 (0.245283019 0.754716981)
##                                15612) rrate< 0.7888889 13     0 0 (1.000000000 0.000000000) *
##                                15613) rrate>=0.7888889 40     0 1 (0.000000000 1.000000000) *
##                               7807) rrate< 0.6794872 122     0 1 (0.000000000 1.000000000) *
##                   61) vac_avg_speed< 6.1572 3606   898 1 (0.249029395 0.750970605)
##                    122) occ_avg_speed>=49.801 35     0 0 (1.000000000 0.000000000) *
##                    123) occ_avg_speed< 49.801 3571   863 1 (0.241669000 0.758331000)
##                      246) num_occ_taxi>=5.5 225   107 0 (0.524444444 0.475555556)
##                        492) rrate>=0.5916667 183    68 0 (0.628415301 0.371584699)
##                          984) occ_avg_speed>=19.71633 72     0 0 (1.000000000 0.000000000) *
```

```
##                         985) occ_avg_speed< 19.71633 111    43 1 (0.387387387 0.612612613)
##                          1970) occ_avg_speed< 19.59343 68    25 0 (0.632352941 0.367647059)
##                            3940) num_occ_taxi>=6.5 31     0 0 (1.000000000 0.000000000) *
##                            3941) num_occ_taxi< 6.5 37    12 1 (0.324324324 0.675675676)
##                              7882) occ_avg_speed>=17.935 9     0 0 (1.000000000 0.000000000) *
##                              7883) occ_avg_speed< 17.935 28     3 1 (0.107142857 0.892857143) *
##                          1971) occ_avg_speed>=19.59343 43     0 1 (0.000000000 1.000000000) *
##                       493) rrate< 0.5916667 42     3 1 (0.071428571 0.928571429) *
##                     247) num_occ_taxi< 5.5 3346   745 1 (0.222653915 0.777346085)
##                       494) occ_avg_speed>=25.2255 1095   339 1 (0.309589041 0.690410959)
##                         988) occ_avg_speed< 36.3985 566   245 1 (0.432862191 0.567137809)
##                          1976) occ_avg_speed>=34.786 29     0 0 (1.000000000 0.000000000) *
##                          1977) occ_avg_speed< 34.786 537   216 1 (0.402234637 0.597765363)
##                            3954) occ_avg_speed< 34.61325 500   216 1 (0.432000000 0.568000000)
##                              7908) occ_avg_speed>=32.4055 36     0 0 (1.000000000 0.000000000) *
##                              7909) occ_avg_speed< 32.4055 464   180 1 (0.387931034 0.612068966)
##                               15818) occ_avg_speed< 30.55067 272   133 1 (0.488970588 0.511029412)
##                                 31636) occ_avg_speed>=26.33775 132    35 0 (0.734848485 0.265151515)
##                                   63272) occ_avg_speed< 29.0075 70     0 0 (1.000000000 0.000000000)
##                                   63273) occ_avg_speed>=29.0075 62    27 1 (0.435483871 0.564516129)
##                                    126546) occ_avg_speed>=29.0895 27     0 0 (1.000000000 0.00000000
##                                    126547) occ_avg_speed< 29.0895 35     0 1 (0.000000000 1.00000000
##                                 31637) occ_avg_speed< 26.33775 140    36 1 (0.257142857 0.742857143)
##                                   63274) num_occ_taxi>=2.5 15     0 0 (1.000000000 0.000000000) *
##                                   63275) num_occ_taxi< 2.5 125    21 1 (0.168000000 0.832000000)
##                                    126550) occ_avg_speed< 25.971 48    18 1 (0.375000000 0.625000000)
##                                      253100) vac_avg_speed< 6.0515 18     0 0 (1.000000000 0.0000000
##                                      253101) vac_avg_speed>=6.0515 30     0 1 (0.000000000 1.0000000
##                                    126551) occ_avg_speed>=25.971 77     3 1 (0.038961039 0.961038961)
##                               15819) occ_avg_speed>=30.55067 192    47 1 (0.244791667 0.755208333)
##                                 31638) occ_avg_speed>=30.6091 120    47 1 (0.391666667 0.608333333)
##                                   63276) num_occ_taxi>=1.5 34     0 0 (1.000000000 0.000000000) *
##                                   63277) num_occ_taxi< 1.5 86    13 1 (0.151162791 0.848837209)
##                                    126554) occ_avg_speed< 32.272 56    13 1 (0.232142857 0.767857143)
##                                      253108) occ_avg_speed>=31.4205 7     0 0 (1.000000000 0.0000000
##                                      253109) occ_avg_speed< 31.4205 49     6 1 (0.122448980 0.877551
##                                    126555) occ_avg_speed>=32.272 30     0 1 (0.000000000 1.000000000)
##                                 31639) occ_avg_speed< 30.6091 72     0 1 (0.000000000 1.000000000) *
##                            3955) occ_avg_speed>=34.61325 37     0 1 (0.000000000 1.000000000) *
##                         989) occ_avg_speed>=36.3985 529    94 1 (0.177693762 0.822306238)
##                          1978) num_occ_taxi>=2.5 20     0 0 (1.000000000 0.000000000) *
##                          1979) num_occ_taxi< 2.5 509    74 1 (0.145383104 0.854616896)
##                            3958) occ_avg_speed>=36.674 417    74 1 (0.177458034 0.822541966)
##                              7916) num_occ_taxi>=1.5 17     0 0 (1.000000000 0.000000000) *
##                              7917) num_occ_taxi< 1.5 400    57 1 (0.142500000 0.857500000)
##                               15834) occ_avg_speed< 44.226 211    48 1 (0.227488152 0.772511848)
##                                 31668) occ_avg_speed>=42.1555 10     0 0 (1.000000000 0.000000000) *
##                                 31669) occ_avg_speed< 42.1555 201    38 1 (0.189054726 0.810945274)
##                                   63338) occ_avg_speed< 41.831 168    38 1 (0.226190476 0.773809524)
##                                    126676) occ_avg_speed>=39.6735 15     0 0 (1.000000000 0.00000000
##                                    126677) occ_avg_speed< 39.6735 153    23 1 (0.150326797 0.8496732
##                                      253354) occ_avg_speed< 39.5475 106    23 1 (0.216981132 0.78301
##                                        506708) occ_avg_speed>=38.6545 8     0 0 (1.000000000 0.00000
##                                        506709) occ_avg_speed< 38.6545 98    15 1 (0.153061224 0.8469
```

```
##                                 1013418) occ_avg_speed< 38.479 53    15 1 (0.283018868 0.7169
##                                   2026836) num_vac_taxi< 1 15     0 0 (1.000000000 0.0000000
##                                   2026837) num_vac_taxi>=1 38     0 1 (0.000000000 1.0000000
##                                 1013419) occ_avg_speed>=38.479 45     0 1 (0.000000000 1.000
##                               253355) occ_avg_speed>=39.5475 47     0 1 (0.000000000 1.000000
##                             63339) occ_avg_speed>=41.831 33     0 1 (0.000000000 1.000000000) *
##                          15835) occ_avg_speed>=44.226 189     9 1 (0.047619048 0.952380952)
##                            31670) occ_avg_speed>=44.5305 92     9 1 (0.097826087 0.902173913)
##                              63340) occ_avg_speed< 47.0945 7     0 0 (1.000000000 0.000000000) *
##                              63341) occ_avg_speed>=47.0945 85     2 1 (0.023529412 0.976470588)
##                             31671) occ_avg_speed< 44.5305 97     0 1 (0.000000000 1.000000000) *
##                       3959) occ_avg_speed< 36.674 92     0 1 (0.000000000 1.000000000) *
##                    495) occ_avg_speed< 25.2255 2251   406 1 (0.180364283 0.819635717)
##                      990) rrate< 0.2678571 15     0 0 (1.000000000 0.000000000) *
##                      991) rrate>=0.2678571 2236   391 1 (0.174865832 0.825134168)
##                       1982) occ_avg_speed< 15.85958 14     0 0 (1.000000000 0.000000000) *
##                       1983) occ_avg_speed>=15.85958 2222   377 1 (0.169666967 0.830333033)
##                         3966) rrate>=0.9 1919   358 1 (0.186555498 0.813444502)
##                           7932) occ_avg_speed< 24.62525 1741   350 1 (0.201033889 0.798966111)
##                            15864) occ_avg_speed>=23.79225 30     0 0 (1.000000000 0.000000000) *
##                            15865) occ_avg_speed< 23.79225 1711   320 1 (0.187025132 0.812974868)
##                              31730) num_occ_taxi< 4.5 1568   311 1 (0.198341837 0.801658163)
##                                63460) num_occ_taxi>=2.5 297   101 1 (0.340067340 0.659932660)
##                                 126920) occ_avg_speed>=17.186 143    71 1 (0.496503497 0.503496503
##                                   253840) occ_avg_speed< 21.00146 46     0 0 (1.000000000 0.000000
##                                   253841) occ_avg_speed>=21.00146 97    25 1 (0.257731959 0.742268
##                                     507682) num_occ_taxi< 3.5 12     0 0 (1.000000000 0.000000000
##                                     507683) num_occ_taxi>=3.5 85    13 1 (0.152941176 0.847058824
##                                      1015366) occ_avg_speed>=21.073 46    13 1 (0.282608696 0.7173
##                                        2030732) occ_avg_speed< 23.01675 9     0 0 (1.000000000 0.0
##                                        2030733) occ_avg_speed>=23.01675 37     4 1 (0.108108108 0
##                                      1015367) occ_avg_speed< 21.073 39     0 1 (0.000000000 1.000
##                                   126921) occ_avg_speed< 17.186 154    30 1 (0.194805195 0.805194805
##                                     253842) occ_avg_speed>=15.86058 106    30 1 (0.283018868 0.71698
##                                       507684) occ_avg_speed< 16.76713 16     0 0 (1.000000000 0.0000
##                                       507685) occ_avg_speed>=16.76713 90    14 1 (0.155555556 0.8444
##                                      1015370) occ_avg_speed< 17.16133 48    14 1 (0.291666667 0.70
##                                        2030740) occ_avg_speed>=16.87133 14     0 0 (1.000000000 0
##                                        2030741) occ_avg_speed< 16.87133 34     0 1 (0.000000000 1
##                                      1015371) occ_avg_speed>=17.16133 42     0 1 (0.000000000 1.00
##                                     253843) occ_avg_speed< 15.86058 48     0 1 (0.000000000 1.000000
##                                   63461) num_occ_taxi< 2.5 1271   210 1 (0.165224233 0.834775767)
##                                    126922) occ_avg_speed>=21.698 201    54 1 (0.268656716 0.731343284
##                                     253844) occ_avg_speed< 22.98175 37     0 0 (1.000000000 0.000000
##                                     253845) occ_avg_speed>=22.98175 164    17 1 (0.103658537 0.8963
##                                       507690) num_occ_taxi< 1.5 79    15 1 (0.189873418 0.810126582
##                                      1015380) occ_avg_speed>=23.085 51    15 1 (0.294117647 0.7058
##                                        2030760) occ_avg_speed< 23.432 11     0 0 (1.000000000 0.00
##                                        2030761) occ_avg_speed>=23.432 40     4 1 (0.100000000 0.90
##                                      1015381) occ_avg_speed< 23.085 28     0 1 (0.000000000 1.000
##                                       507691) num_occ_taxi>=1.5 85     2 1 (0.023529412 0.976470588
##                                    126923) occ_avg_speed< 21.698 1070   156 1 (0.145794393 0.8542056
##                                     253846) occ_avg_speed< 17.4265 213    55 1 (0.258215962 0.741784
##                                       507692) occ_avg_speed>=16.98325 18     0 0 (1.000000000 0.0000
```

```
##                                   507693) occ_avg_speed< 16.98325 195    37 1 (0.189743590 0.810
##                                    1015386) occ_avg_speed< 16.788 113    34 1 (0.300884956 0.699
##                                      2030772) num_occ_taxi>=1.5 18     0 0 (1.000000000 0.000000
##                                      2030773) num_occ_taxi< 1.5 95    16 1 (0.168421053 0.831578
##                                        4061546) occ_avg_speed>=16.324 8     0 0 (1.000000000 0.0
##                                        4061547) occ_avg_speed< 16.324 87     8 1 (0.091954023 0
##                                          8123094) occ_avg_speed< 16.274 52     8 1 (0.153846154
##                                           16246188) occ_avg_speed>=15.978 7     0 0 (1.000000000
##                                           16246189) occ_avg_speed< 15.978 45     1 1 (0.0222222
##                                          8123095) occ_avg_speed>=16.274 35     0 1 (0.000000000
##                                    1015387) occ_avg_speed>=16.788 82     3 1 (0.036585366 0.9634
##                                  253847) occ_avg_speed>=17.4265 857   101 1 (0.117852975 0.882147
##                                    507694) occ_avg_speed< 19.8055 365    58 1 (0.158904110 0.841
##                                    1015388) occ_avg_speed>=19.3205 10     0 0 (1.000000000 0.000
##                                    1015389) occ_avg_speed< 19.3205 355    48 1 (0.135211268 0.8
##                                      2030778) occ_avg_speed>=17.534 261    46 1 (0.176245211 0.8
##                                        4061556) occ_avg_speed< 17.9235 12     0 0 (1.000000000 0
##                                        4061557) occ_avg_speed>=17.9235 249    34 1 (0.136546185
##                                          8123114) occ_avg_speed>=18.1395 163    33 1 (0.2024539
##                                           16246228) occ_avg_speed< 18.57575 13     0 0 (1.000000
##                                           16246229) occ_avg_speed>=18.57575 150    20 1 (0.1333
##                                             32492458) occ_avg_speed< 19.26925 101    20 1 (0.198
##                                               64984916) occ_avg_speed>=19.036 8     0 0 (1.00000
##                                               64984917) occ_avg_speed< 19.036 93    12 1 (0.1290
##                                                129969834) occ_avg_speed< 19.01325 50    12 1 (0
##                                                  259939668) occ_avg_speed>=18.6295 12     0 0 (
##                                                  259939669) occ_avg_speed< 18.6295 38     0 1 (0
##                                                129969835) occ_avg_speed>=19.01325 43     0 1 (0
##                                             32492459) occ_avg_speed>=19.26925 49     0 1 (0.0000
##                                          8123115) occ_avg_speed< 18.1395 86     1 1 (0.011627907
##                                        2030779) occ_avg_speed< 17.534 94     2 1 (0.021276596 0.97
##                                      507695) occ_avg_speed>=19.8055 492    43 1 (0.087398374 0.9120
##                                       1015390) occ_avg_speed>=19.98875 293    39 1 (0.133105802 0.8
##                                        2030780) occ_avg_speed< 21.6675 263    39 1 (0.148288973 0
##                                          4061560) occ_avg_speed>=21.4855 7     0 0 (1.000000000 0
##                                          4061561) occ_avg_speed< 21.4855 256    32 1 (0.125000000
##                                            8123122) occ_avg_speed< 21.347 178    30 1 (0.168539326
##                                             16246244) occ_avg_speed>=21.00875 11     0 0 (1.000000
##                                             16246245) occ_avg_speed< 21.00875 167    19 1 (0.1137
##                                               32492490) occ_avg_speed< 20.91925 118    19 1 (0.161
##                                                 64984980) occ_avg_speed>=20.48525 9     0 0 (1.000
##                                                 64984981) occ_avg_speed< 20.48525 109    10 1 (0.0
##                                               32492491) occ_avg_speed>=20.91925 49     0 1 (0.0000
##                                            8123123) occ_avg_speed>=21.347 78     2 1 (0.025641026
##                                          2030781) occ_avg_speed>=21.6675 30     0 1 (0.000000000 1.0
##                                         1015391) occ_avg_speed< 19.98875 199     4 1 (0.020100503 0.9
##                                     31731) num_occ_taxi>=4.5 143     9 1 (0.062937063 0.937062937) *
##                                   7933) occ_avg_speed>=24.62525 178     8 1 (0.044943820 0.955056180) *
##                                3967) rrate< 0.9 303    19 1 (0.062706271 0.937293729)
##                                  7934) num_vac_taxi>=2.5 53     8 1 (0.150943396 0.849056604)
##                                   15868) num_vac_taxi< 4.5 8     0 0 (1.000000000 0.000000000) *
##                                   15869) num_vac_taxi>=4.5 45     0 1 (0.000000000 1.000000000) *
##                                  7935) num_vac_taxi< 2.5 250    11 1 (0.044000000 0.956000000)
##                                   15870) occ_avg_speed>=18.2505 81     9 1 (0.111111111 0.888888889)
```

```
##                                 31740) occ_avg_speed< 24.4516 43     9 1 (0.209302326 0.790697674)
##                                   63480) num_occ_taxi>=2.5 8     0 0 (1.000000000 0.000000000) *
##                                   63481) num_occ_taxi< 2.5 35     1 1 (0.028571429 0.971428571) *
##                                 31741) occ_avg_speed>=24.4516 38     0 1 (0.000000000 1.000000000) *
##                               15871) occ_avg_speed< 18.2505 169     2 1 (0.011834320 0.988165680) *
##                 31) occ_avg_speed< 15.668 8676  1462 1 (0.168510834 0.831489166)
##                   62) num_vac_taxi>=3.5 1142   314 1 (0.274956217 0.725043783)
##                    124) occ_avg_speed>=11.72603 116     0 0 (1.000000000 0.000000000) *
##                    125) occ_avg_speed< 11.72603 1026   198 1 (0.192982456 0.807017544)
##                      250) vac_avg_speed< 4.40775 30     0 0 (1.000000000 0.000000000) *
##                      251) vac_avg_speed>=4.40775 996   168 1 (0.168674699 0.831325301)
##                        502) num_occ_taxi>=7.5 11     0 0 (1.000000000 0.000000000) *
##                        503) num_occ_taxi< 7.5 985   157 1 (0.159390863 0.840609137)
##                         1006) num_occ_taxi< 1.5 341    90 1 (0.263929619 0.736070381)
##                           2012) num_occ_taxi>=0.5 20     0 0 (1.000000000 0.000000000) *
##                           2013) num_occ_taxi< 0.5 321    70 1 (0.218068536 0.781931464)
##                             4026) vac_avg_speed>=8.726975 115    44 1 (0.382608696 0.617391304)
##                               8052) vac_avg_speed< 12.55635 39     0 0 (1.000000000 0.000000000) *
##                               8053) vac_avg_speed>=12.55635 76     5 1 (0.065789474 0.934210526) *
##                             4027) vac_avg_speed< 8.726975 206    26 1 (0.126213592 0.873786408)
##                               8054) vac_avg_speed>=5.390225 129    23 1 (0.178294574 0.821705426)
##                                 16108) vac_avg_speed< 6.813525 12     0 0 (1.000000000 0.000000000) *
##                                 16109) vac_avg_speed>=6.813525 117    11 1 (0.094017094 0.905982906)
##                                   32218) vac_avg_speed< 8.1525 45     8 1 (0.177777778 0.822222222)
##                                     64436) vac_avg_speed>=7.050125 8     0 0 (1.000000000 0.000000000)
##                                     64437) vac_avg_speed< 7.050125 37     0 1 (0.000000000 1.000000000)
##                                   32219) vac_avg_speed>=8.1525 72     3 1 (0.041666667 0.958333333) *
##                               8055) vac_avg_speed< 5.390225 77     3 1 (0.038961039 0.961038961) *
##                         1007) num_occ_taxi>=1.5 644    67 1 (0.104037267 0.895962733)
##                           2014) occ_avg_speed>=9.351107 112    26 1 (0.232142857 0.767857143)
##                             4028) vac_avg_speed>=10.662 11     0 0 (1.000000000 0.000000000) *
##                             4029) vac_avg_speed< 10.662 101    15 1 (0.148514851 0.851485149)
##                               8058) vac_avg_speed< 10.30313 58    15 1 (0.258620690 0.741379310)
##                                 16116) rrate>=0.3095238 15     0 0 (1.000000000 0.000000000) *
##                                 16117) rrate< 0.3095238 43     0 1 (0.000000000 1.000000000) *
##                               8059) vac_avg_speed>=10.30313 43     0 1 (0.000000000 1.000000000) *
##                           2015) occ_avg_speed< 9.351107 532    41 1 (0.077067669 0.922932331)
##                             4030) occ_avg_speed< 8.063667 329    35 1 (0.106382979 0.893617021)
##                               8060) occ_avg_speed>=7.253417 12     0 0 (1.000000000 0.000000000) *
##                               8061) occ_avg_speed< 7.253417 317    23 1 (0.072555205 0.927444795)
##                                 16122) num_occ_taxi< 2.5 48    12 1 (0.250000000 0.750000000)
##                                   32244) vac_avg_speed>=9.61 9     0 0 (1.000000000 0.000000000) *
##                                   32245) vac_avg_speed< 9.61 39     3 1 (0.076923077 0.923076923) *
##                                 16123) num_occ_taxi>=2.5 269    11 1 (0.040892193 0.959107807) *
##                             4031) occ_avg_speed>=8.063667 203     6 1 (0.029556650 0.970443350) *
##                   63) num_vac_taxi< 3.5 7534  1148 1 (0.152375896 0.847624104)
##                    126) occ_avg_speed< 1.5745 1244   300 1 (0.241157556 0.758842444)
##                      252) vac_avg_speed< 1.382 23     0 0 (1.000000000 0.000000000) *
##                      253) vac_avg_speed>=1.382 1221   277 1 (0.226863227 0.773136773)
##                        506) occ_avg_speed>=0.839 11     0 0 (1.000000000 0.000000000) *
##                        507) occ_avg_speed< 0.839 1210   266 1 (0.219834711 0.780165289)
##                         1014) vac_avg_speed< 13.529 962   240 1 (0.249480249 0.750519751)
##                           2028) vac_avg_speed>=11.68133 55     0 0 (1.000000000 0.000000000) *
##                           2029) vac_avg_speed< 11.68133 907   185 1 (0.203969129 0.796030871)
```

```
##                           4058) vac_avg_speed< 4.3875 67    29 1 (0.432835821 0.567164179)
##                             8116) vac_avg_speed>=1.4755 29     0 0 (1.000000000 0.000000000) *
##                             8117) vac_avg_speed< 1.4755 38     0 1 (0.000000000 1.000000000) *
##                           4059) vac_avg_speed>=4.3875 840   156 1 (0.185714286 0.814285714)
##                             8118) vac_avg_speed< 11.4765 771   156 1 (0.202334630 0.797665370)
##                              16236) vac_avg_speed>=9.187 183    67 1 (0.366120219 0.633879781)
##                                32472) vac_avg_speed< 10.073 35     0 0 (1.000000000 0.000000000) *
##                                32473) vac_avg_speed>=10.073 148    32 1 (0.216216216 0.783783784)
##                                  64946) vac_avg_speed>=11.10325 8     0 0 (1.000000000 0.000000000)
##                                  64947) vac_avg_speed< 11.10325 140    24 1 (0.171428571 0.82857142
##                                   129894) vac_avg_speed< 11.06125 93    24 1 (0.258064516 0.7419354
##                                     259788) vac_avg_speed>=10.3255 20     0 0 (1.000000000 0.000000
##                                     259789) vac_avg_speed< 10.3255 73     4 1 (0.054794521 0.945205
##                                   129895) vac_avg_speed>=11.06125 47     0 1 (0.000000000 1.000000
##                              16237) vac_avg_speed< 9.187 588    89 1 (0.151360544 0.848639456)
##                                32474) vac_avg_speed< 8.762417 451    82 1 (0.181818182 0.818181818)
##                                  64948) vac_avg_speed>=8.49925 11     0 0 (1.000000000 0.000000000)
##                                  64949) vac_avg_speed< 8.49925 440    71 1 (0.161363636 0.838636364
##                                   129898) num_vac_taxi>=1.5 199    48 1 (0.241206030 0.758793970)
##                                     259796) vac_avg_speed< 5.221 9     0 0 (1.000000000 0.000000000
##                                     259797) vac_avg_speed>=5.221 190    39 1 (0.205263158 0.7947368
##                                       519594) vac_avg_speed>=7.065167 57    22 1 (0.385964912 0.614
##                                        1039188) vac_avg_speed< 8.463583 22     0 0 (1.000000000 0.00
##                                        1039189) vac_avg_speed>=8.463583 35     0 1 (0.000000000 1.00
##                                       519595) vac_avg_speed< 7.065167 133    17 1 (0.127819549 0.872
##                                        1039190) num_vac_taxi< 2.5 12     0 0 (1.000000000 0.000000000
##                                        1039191) num_vac_taxi>=2.5 121     5 1 (0.041322314 0.958677
##                                   129899) num_vac_taxi< 1.5 241    23 1 (0.095435685 0.904564315)
##                                     259798) vac_avg_speed>=5.6275 148    22 1 (0.148648649 0.851351
##                                       519596) vac_avg_speed< 6.498 7     0 0 (1.000000000 0.000000000
##                                       519597) vac_avg_speed>=6.498 141    15 1 (0.106382979 0.893617
##                                        1039194) vac_avg_speed< 8.0235 50    11 1 (0.220000000 0.780
##                                          2078388) vac_avg_speed>=6.586 11     0 0 (1.000000000 0.000
##                                          2078389) vac_avg_speed< 6.586 39     0 1 (0.000000000 1.000
##                                        1039195) vac_avg_speed>=8.0235 91     4 1 (0.043956044 0.956
##                                     259799) vac_avg_speed< 5.6275 93     1 1 (0.010752688 0.9892473
##                                32475) vac_avg_speed>=8.762417 137     7 1 (0.051094891 0.948905109)
##                             8119) vac_avg_speed>=11.4765 69     0 1 (0.000000000 1.000000000) *
##                         1015) vac_avg_speed>=13.529 248    26 1 (0.104838710 0.895161290)
##                           2030) vac_avg_speed>=13.6035 214    26 1 (0.121495327 0.878504673)
##                             4060) vac_avg_speed< 13.9035 7     0 0 (1.000000000 0.000000000) *
##                             4061) vac_avg_speed>=13.9035 207    19 1 (0.091787440 0.908212560)
##                               8122) vac_avg_speed>=14.128 121    17 1 (0.140495868 0.859504132)
##                                 16244) vac_avg_speed< 14.39267 35     9 1 (0.257142857 0.742857143) *
##                                 16245) vac_avg_speed>=14.39267 86     8 1 (0.093023256 0.906976744)
##                                   32490) vac_avg_speed>=14.43283 51     8 1 (0.156862745 0.843137255)
##                                     64980) num_vac_taxi< 2.5 7     0 0 (1.000000000 0.000000000) *
##                                     64981) num_vac_taxi>=2.5 44     1 1 (0.022727273 0.977272727) *
##                                   32491) vac_avg_speed< 14.43283 35     0 1 (0.000000000 1.000000000) *
##                               8123) vac_avg_speed< 14.128 86     2 1 (0.023255814 0.976744186) *
##                           2031) vac_avg_speed< 13.6035 34     0 1 (0.000000000 1.000000000) *
##                       127) occ_avg_speed>=1.5745 6290   848 1 (0.134817170 0.865182830)
##                         254) num_occ_taxi>=2.5 2774   480 1 (0.173035328 0.826964672)
##                           508) vac_avg_speed>=13.109 33     0 0 (1.000000000 0.000000000) *
```

```
##                          509) vac_avg_speed< 13.109 2741   447 1 (0.163079168 0.836920832)
##                           1018) occ_avg_speed< 3.988021 24     0 0 (1.000000000 0.000000000) *
##                           1019) occ_avg_speed>=3.988021 2717   423 1 (0.155686419 0.844313581)
##                             2038) occ_avg_speed>=5.934933 2189   394 1 (0.179990863 0.820009137)
##                               4076) rrate< 0.6833333 230    70 1 (0.304347826 0.695652174)
##                                 8152) occ_avg_speed>=12.53083 30     0 0 (1.000000000 0.000000000) *
##                                 8153) occ_avg_speed< 12.53083 200    40 1 (0.200000000 0.800000000)
##                                   16306) rrate>=0.6458333 19     0 0 (1.000000000 0.000000000) *
##                                   16307) rrate< 0.6458333 181    21 1 (0.116022099 0.883977901)
##                                     32614) vac_avg_speed>=10.7175 8     0 0 (1.000000000 0.000000000) *
##                                     32615) vac_avg_speed< 10.7175 173    13 1 (0.075144509 0.924855491)
##                                       65230) occ_avg_speed>=6.776133 95    13 1 (0.136842105 0.863157895)
##                                        130460) vac_avg_speed< 9.0635 8     0 0 (1.000000000 0.000000000)
##                                        130461) vac_avg_speed>=9.0635 87     5 1 (0.057471264 0.942528736)
##                                       65231) occ_avg_speed< 6.776133 78     0 1 (0.000000000 1.000000000)
##                               4077) rrate>=0.6833333 1959   324 1 (0.165390505 0.834609495)
##                                 8154) occ_avg_speed< 7.0473 23     0 0 (1.000000000 0.000000000) *
##                                 8155) occ_avg_speed>=7.0473 1936   301 1 (0.155475207 0.844524793)
##                                   16310) rrate>=0.7638889 1381   261 1 (0.188993483 0.811006517)
##                                     32620) vac_avg_speed>=11.6045 14     0 0 (1.000000000 0.000000000) *
##                                     32621) vac_avg_speed< 11.6045 1367   247 1 (0.180687637 0.819312363)
##                                       65242) occ_avg_speed>=13.06808 271    85 1 (0.313653137 0.686346863
##                                        130484) occ_avg_speed< 14.9491 100    36 0 (0.640000000 0.360000000
##                                          260968) num_occ_taxi< 8.5 62     0 0 (1.000000000 0.000000000) *
##                                          260969) num_occ_taxi>=8.5 38     2 1 (0.052631579 0.947368421) *
##                                        130485) occ_avg_speed>=14.9491 171    21 1 (0.122807018 0.877192982
##                                          260970) occ_avg_speed>=15.41013 44    14 1 (0.318181818 0.681818182
##                                            521940) num_occ_taxi< 7.5 13     0 0 (1.000000000 0.000000000)
##                                            521941) num_occ_taxi>=7.5 31     1 1 (0.032258065 0.967741935)
##                                          260971) occ_avg_speed< 15.41013 127     7 1 (0.055118110 0.944881890
##                                            521942) occ_avg_speed< 15.34831 49     7 1 (0.142857143 0.857142857
##                                             1043884) occ_avg_speed>=15.0076 7     0 0 (1.000000000 0.000000000
##                                             1043885) occ_avg_speed< 15.0076 42     0 1 (0.000000000 1.000000000
##                                            521943) occ_avg_speed>=15.34831 78     0 1 (0.000000000 1.000000000
##                                       65243) occ_avg_speed< 13.06808 1096   162 1 (0.147810219 0.852189781
##                                        130486) occ_avg_speed< 12.824 939   158 1 (0.168264111 0.831735889
##                                          260972) occ_avg_speed>=12.04697 27     0 0 (1.000000000 0.000000000
##                                          260973) occ_avg_speed< 12.04697 912   131 1 (0.143640351 0.856359649
##                                            521946) occ_avg_speed>=9.782083 329    69 1 (0.209726444 0.790273556
##                                             1043892) occ_avg_speed< 10.10983 17     0 0 (1.000000000 0.000000000
##                                             1043893) occ_avg_speed>=10.10983 312    52 1 (0.166666667 0.833333333
##                                               2087786) num_occ_taxi>=6.5 13     0 0 (1.000000000 0.000000000
##                                               2087787) num_occ_taxi< 6.5 299    39 1 (0.130434783 0.869565217
##                                                 4175574) num_occ_taxi>=3.5 136    32 1 (0.235294118 0.764705882
##                                                   8351148) num_occ_taxi< 4.5 16     0 0 (1.000000000 0.000000000
##                                                   8351149) num_occ_taxi>=4.5 120    16 1 (0.133333333 0.866666667
##                                                    16702298) occ_avg_speed>=10.1458 83    16 1 (0.192771084
##                                                      33404596) num_occ_taxi< 5.5 11     0 0 (1.000000000
##                                                      33404597) num_occ_taxi>=5.5 72     5 1 (0.069444444
##                                                    16702299) occ_avg_speed< 10.1458 37     0 1 (0.000000000
##                                                 4175575) num_occ_taxi< 3.5 163     7 1 (0.042944785 0.957055215
##                                            521947) occ_avg_speed< 9.782083 583    62 1 (0.106346484 0.893653516
##                                             1043894) occ_avg_speed< 7.820042 68    18 1 (0.264705882 0.735294118
##                                               2087788) vac_avg_speed< 11.442 18     0 0 (1.000000000 0.000000000
```

```
##                                       2087789) vac_avg_speed>=11.442 50     0 1 (0.000000000 1.00
##                                     1043895) occ_avg_speed>=7.820042 515    44 1 (0.085436893 0.9
##                                       2087790) occ_avg_speed>=8.8035 178    26 1 (0.146067416 0.8
##                                         4175580) num_occ_taxi< 4.5 18     0 0 (1.000000000 0.000
##                                         4175581) num_occ_taxi>=4.5 160     8 1 (0.050000000 0.950
##                                       2087791) occ_avg_speed< 8.8035 337    18 1 (0.053412463 0.9
##                                         4175582) occ_avg_speed>=7.885789 269    18 1 (0.066914498
##                                           8351164) occ_avg_speed< 8.277028 53     9 1 (0.1698113
##                                            16702328) occ_avg_speed>=8.018722 7     0 0 (1.000000
##                                            16702329) occ_avg_speed< 8.018722 46     2 1 (0.04347
##                                           8351165) occ_avg_speed>=8.277028 216     9 1 (0.041666
##                                         4175583) occ_avg_speed< 7.885789 68     0 1 (0.000000000
##                                   130487) occ_avg_speed>=12.824 157     4 1 (0.025477707 0.97452229
##                                16311) rrate< 0.7638889 555    40 1 (0.072072072 0.927927928)
##                                  32622) vac_avg_speed< 3.103417 8     0 0 (1.000000000 0.000000000) *
##                                  32623) vac_avg_speed>=3.103417 547    32 1 (0.058500914 0.941499086)
##                                    65246) occ_avg_speed< 8.914629 8     0 0 (1.000000000 0.000000000)
##                                    65247) occ_avg_speed>=8.914629 539    24 1 (0.044526902 0.95547309
##                                     130494) occ_avg_speed>=14.585 41     8 1 (0.195121951 0.80487804)
##                                     130495) occ_avg_speed< 14.585 498    16 1 (0.032128514 0.96787148
##                                       260990) vac_avg_speed>=5.770667 286    16 1 (0.055944056 0.9440
##                                         521980) vac_avg_speed< 8.7835 53     9 1 (0.169811321 0.83018
##                                          1043960) num_occ_taxi< 8.5 7     0 0 (1.000000000 0.000000000
##                                          1043961) num_occ_taxi>=8.5 46     2 1 (0.043478261 0.9565217
##                                         521981) vac_avg_speed>=8.7835 233     7 1 (0.030042918 0.9699
##                                       260991) vac_avg_speed< 5.770667 212     0 1 (0.000000000 1.0000
##                             2039) occ_avg_speed< 5.934933 528    29 1 (0.054924242 0.945075758)
##                               4078) occ_avg_speed< 5.197708 157    16 1 (0.101910828 0.898089172)
##                                 8156) occ_avg_speed>=4.823178 11     0 0 (1.000000000 0.000000000) *
##                                 8157) occ_avg_speed< 4.823178 146     5 1 (0.034246575 0.965753425) *
##                               4079) occ_avg_speed>=5.197708 371    13 1 (0.035040431 0.964959569)
##                                 8158) occ_avg_speed>=5.440458 119     9 1 (0.075630252 0.924369748)
##                                  16316) occ_avg_speed< 5.8605 8     0 0 (1.000000000 0.000000000) *
##                                  16317) occ_avg_speed>=5.8605 111     1 1 (0.009009009 0.990990991) *
##                                 8159) occ_avg_speed< 5.440458 252     4 1 (0.015873016 0.984126984) *
##                          255) num_occ_taxi< 2.5 3516   368 1 (0.104664391 0.895335609)
##                            510) occ_avg_speed>=10.0255 1784   233 1 (0.130605381 0.869394619)
##                             1020) rrate< 0.2916667 16     0 0 (1.000000000 0.000000000) *
##                             1021) rrate>=0.2916667 1768   217 1 (0.122737557 0.877262443)
##                               2042) occ_avg_speed< 10.27225 7     0 0 (1.000000000 0.000000000) *
##                               2043) occ_avg_speed>=10.27225 1761   210 1 (0.119250426 0.880749574)
##                                 4086) occ_avg_speed< 13.8905 929   155 1 (0.166846071 0.833153929)
##                                   8172) vac_avg_speed< 5.30925 555   128 1 (0.230630631 0.769369369)
##                                    16344) num_vac_taxi>=0.5 12     0 0 (1.000000000 0.000000000) *
##                                    16345) num_vac_taxi< 0.5 543   116 1 (0.213627993 0.786372007)
##                                      32690) occ_avg_speed>=13.5375 7     0 0 (1.000000000 0.000000000) *
##                                      32691) occ_avg_speed< 13.5375 536   109 1 (0.203358209 0.796641791)
##                                        65382) occ_avg_speed>=10.37375 488   109 1 (0.223360656 0.77663934
##                                         130764) occ_avg_speed< 10.925 21     0 0 (1.000000000 0.000000000)
##                                         130765) occ_avg_speed>=10.925 467    88 1 (0.188436831 0.81156316
##                                           261530) occ_avg_speed>=11.1395 346    83 1 (0.239884393 0.76011
##                                             523060) occ_avg_speed< 12.11525 33     0 0 (1.000000000 0.000
##                                             523061) occ_avg_speed>=12.11525 313    50 1 (0.159744409 0.840
##                                              1046122) num_occ_taxi< 1.5 145    34 1 (0.234482759 0.765517
```

```
##                                       2092244) occ_avg_speed>=13.0985 10     0 0 (1.000000000 0.0
##                                       2092245) occ_avg_speed< 13.0985 135    24 1 (0.177777778 0
##                                         4184490) occ_avg_speed< 13.028 95    24 1 (0.252631579 0
##                                           8368980) occ_avg_speed>=12.607 13     0 0 (1.000000000
##                                           8368981) occ_avg_speed< 12.607 82    11 1 (0.134146341
##                                            16737962) occ_avg_speed< 12.557 45    11 1 (0.2444444
##                                              33475924) occ_avg_speed>=12.1815 11     0 0 (1.0000
##                                              33475925) occ_avg_speed< 12.1815 34     0 1 (0.0000
##                                            16737963) occ_avg_speed>=12.557 37     0 1 (0.0000000
##                                         4184491) occ_avg_speed>=13.028 40     0 1 (0.000000000 1
##                                      1046123) num_occ_taxi>=1.5 168    16 1 (0.095238095 0.904761
##                                    261531) occ_avg_speed< 11.1395 121     5 1 (0.041322314 0.95867
##                                  65383) occ_avg_speed< 10.37375 48     0 1 (0.000000000 1.000000000)
##                             8173) vac_avg_speed>=5.30925 374    27 1 (0.072192513 0.927807487)
##                              16346) occ_avg_speed>=12.062 13     0 0 (1.000000000 0.000000000) *
##                              16347) occ_avg_speed< 12.062 361    14 1 (0.038781163 0.961218837)
##                                32694) rrate< 0.5833333 237    14 1 (0.059071730 0.940928270)
##                                  65388) occ_avg_speed< 10.8365 54     8 1 (0.148148148 0.851851852)
##                                   130776) vac_avg_speed< 13.63975 8     0 0 (1.000000000 0.00000000
##                                   130777) vac_avg_speed>=13.63975 46     0 1 (0.000000000 1.0000000
##                                  65389) occ_avg_speed>=10.8365 183     6 1 (0.032786885 0.967213115)
##                                32695) rrate>=0.5833333 124     0 1 (0.000000000 1.000000000) *
##                           4087) occ_avg_speed>=13.8905 832    55 1 (0.066105769 0.933894231)
##                             8174) occ_avg_speed>=14.406 540    49 1 (0.090740741 0.909259259)
##                              16348) occ_avg_speed< 14.835 15     0 0 (1.000000000 0.000000000) *
##                              16349) occ_avg_speed>=14.835 525    34 1 (0.064761905 0.935238095)
##                                32698) num_vac_taxi< 1.5 377    31 1 (0.082228117 0.917771883)
##                                  65396) occ_avg_speed>=14.90025 288    30 1 (0.104166667 0.89583333
##                                   130792) occ_avg_speed< 15.08225 8     0 0 (1.000000000 0.00000000
##                                   130793) occ_avg_speed>=15.08225 280    22 1 (0.078571429 0.921428
##                                     261586) occ_avg_speed< 15.43875 71    11 1 (0.154929577 0.84507
##                                       523172) occ_avg_speed>=15.1725 9     0 0 (1.000000000 0.00000
##                                       523173) occ_avg_speed< 15.1725 62     2 1 (0.032258065 0.9677
##                                     261587) occ_avg_speed>=15.43875 209    11 1 (0.052631579 0.9473
##                                       523174) occ_avg_speed>=15.48975 122    10 1 (0.081967213 0.918
##                                        1046348) occ_avg_speed< 15.598 7     0 0 (1.000000000 0.0000
##                                        1046349) occ_avg_speed>=15.598 115     3 1 (0.026086957 0.973
##                                       523175) occ_avg_speed< 15.48975 87     1 1 (0.011494253 0.9885
##                                  65397) occ_avg_speed< 14.90025 89     1 1 (0.011235955 0.988764045)
##                                32699) num_vac_taxi>=1.5 148     3 1 (0.020270270 0.979729730) *
##                             8175) occ_avg_speed< 14.406 292     6 1 (0.020547945 0.979452055) *
##                        511) occ_avg_speed< 10.0255 1732   135 1 (0.077944573 0.922055427)
##                         1022) occ_avg_speed< 9.001 1132   115 1 (0.101590106 0.898409894)
##                           2044) occ_avg_speed>=8.8055 7     0 0 (1.000000000 0.000000000) *
##                           2045) occ_avg_speed< 8.8055 1125   108 1 (0.096000000 0.904000000)
##                             4090) occ_avg_speed>=5.66 568    79 1 (0.139084507 0.860915493)
##                               8180) vac_avg_speed>=13.64558 8     0 0 (1.000000000 0.000000000) *
##                               8181) vac_avg_speed< 13.64558 560    71 1 (0.126785714 0.873214286)
##                                 16362) occ_avg_speed< 7.0655 69    26 1 (0.376811594 0.623188406)
##                                   32724) occ_avg_speed>=6.2675 20     0 0 (1.000000000 0.000000000) *
##                                   32725) occ_avg_speed< 6.2675 49     6 1 (0.122448980 0.877551020) *
##                                 16363) occ_avg_speed>=7.0655 491    45 1 (0.091649695 0.908350305)
##                                   32726) num_occ_taxi>=1.5 89    16 1 (0.179775281 0.820224719)
##                                     65452) occ_avg_speed< 8.46075 15     0 0 (1.000000000 0.000000000)
```

```
##                                     65453) occ_avg_speed>=8.46075 74     1 1 (0.013513514 0.986486486)
##                                   32727) num_occ_taxi< 1.5 402    29 1 (0.072139303 0.927860697)
##                                     65454) num_vac_taxi< 2.5 313    28 1 (0.089456869 0.910543131)
##                                      130908) occ_avg_speed>=7.9525 90    15 1 (0.166666667 0.833333333)
##                                        261816) occ_avg_speed< 8.55 11     0 0 (1.000000000 0.000000000)
##                                        261817) occ_avg_speed>=8.55 79     4 1 (0.050632911 0.949367089)
##                                      130909) occ_avg_speed< 7.9525 223    13 1 (0.058295964 0.941704036)
##                                     65455) num_vac_taxi>=2.5 89     1 1 (0.011235955 0.988764045) *
##                                  4091) occ_avg_speed< 5.66 557    29 1 (0.052064632 0.947935368)
##                                    8182) vac_avg_speed>=6.167 142    13 1 (0.091549296 0.908450704)
##                                     16364) vac_avg_speed< 9.929917 8     0 0 (1.000000000 0.000000000) *
##                                     16365) vac_avg_speed>=9.929917 134     5 1 (0.037313433 0.962686567) *
##                                    8183) vac_avg_speed< 6.167 415    16 1 (0.038554217 0.961445783)
##                                     16366) num_vac_taxi< 0.5 211    16 1 (0.075829384 0.924170616)
##                                       32732) occ_avg_speed>=4.337 97    14 1 (0.144329897 0.855670103)
##                                         65464) occ_avg_speed< 5.391 9     0 0 (1.000000000 0.000000000) *
##                                         65465) occ_avg_speed>=5.391 88     5 1 (0.056818182 0.943181818) *
##                                       32733) occ_avg_speed< 4.337 114     2 1 (0.017543860 0.982456140) *
##                                     16367) num_vac_taxi>=0.5 204     0 1 (0.000000000 1.000000000) *
##                                1023) occ_avg_speed>=9.001 600    20 1 (0.033333333 0.966666667)
##                                  2046) vac_avg_speed>=4.33925 130    11 1 (0.084615385 0.915384615)
##                                    4092) vac_avg_speed< 11.347 7     0 0 (1.000000000 0.000000000) *
##                                    4093) vac_avg_speed>=11.347 123     4 1 (0.032520325 0.967479675) *
##                                  2047) vac_avg_speed< 4.33925 470     9 1 (0.019148936 0.980851064) *
```

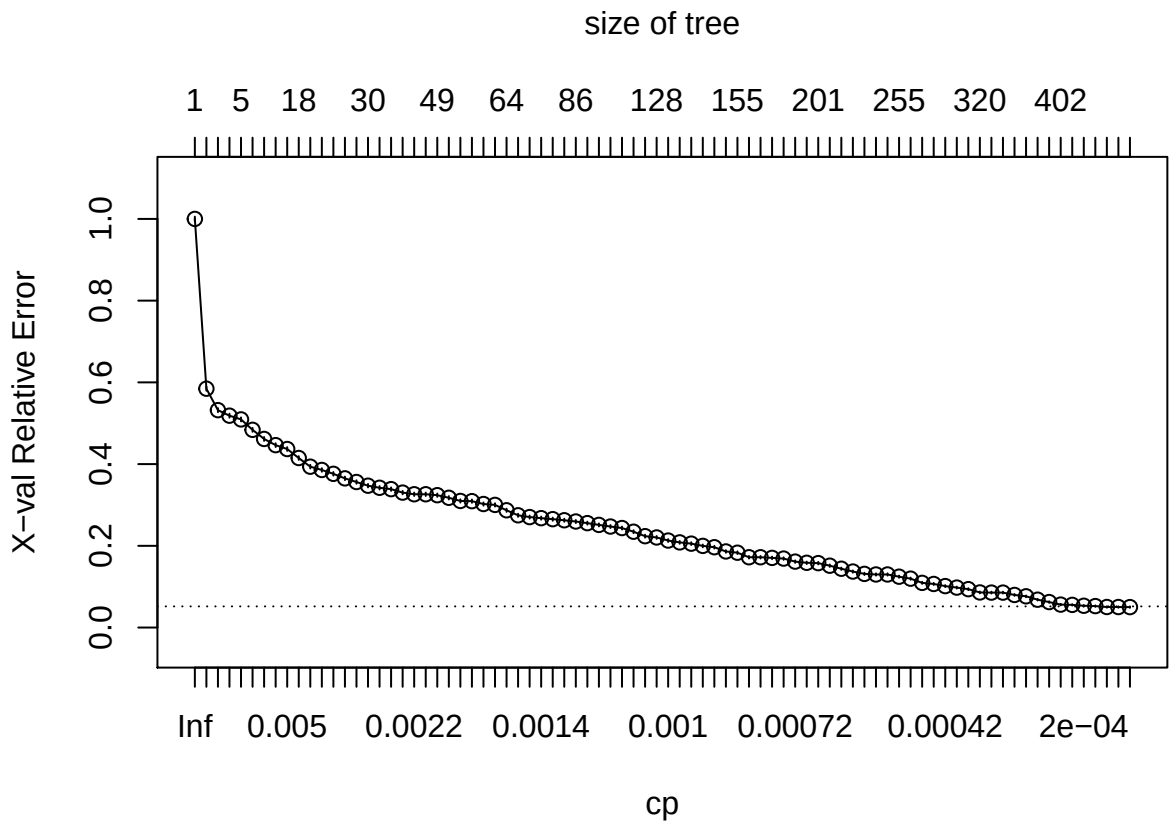
```r
# xerror: error in cross validation
# xstd: standard deviation of error in cross vaidation
printcp(tree)
```

```
##
## Classification tree:
## rpart(formula = "demo ~. -demo", data = train_data, method = "class",
##     control = rpart.control(minsplit = 20, cp = 0))
##
## Variables actually used in tree construction:
## [1] num_occ_taxi  num_vac_taxi  occ_avg_speed rrate         vac_avg_speed
##
## Root node error: 16353/32908 = 0.49693
##
## n= 32908
##
##            CP nsplit rel error   xerror      xstd
## 1  0.41888339      0  1.000000 1.000000 0.0055465
## 2  0.04867608      1  0.581117 0.584541 0.0050361
## 3  0.01816181      2  0.532441 0.532012 0.0048921
## 4  0.01516541      3  0.514279 0.518498 0.0048515
## 5  0.00998797      4  0.499113 0.509387 0.0048233
## 6  0.00721580      7  0.469149 0.483826 0.0047406
## 7  0.00599278      9  0.454718 0.461506 0.0046636
## 8  0.00556473     11  0.442732 0.446401 0.0046089
## 9  0.00443344     14  0.426038 0.436862 0.0045733
## 10 0.00333272     17  0.410873 0.414847 0.0044876
## 11 0.00311869     21  0.394912 0.393689 0.0044005
## 12 0.00295562     22  0.391794 0.385617 0.0043660
## 13 0.00275179     25  0.382927 0.376200 0.0043248
```

```
## 14 0.00256834     26  0.380175 0.365071 0.0042749
## 15 0.00250719     27  0.377607 0.356143 0.0042337
## 16 0.00238488     29  0.372592 0.347153 0.0041912
## 17 0.00236450     30  0.370207 0.342017 0.0041665
## 18 0.00226258     38  0.348927 0.338715 0.0041505
## 19 0.00220143     39  0.346664 0.330215 0.0041085
## 20 0.00218105     40  0.344463 0.326179 0.0040882
## 21 0.00217086     43  0.337920 0.326179 0.0040882
## 22 0.00214028     48  0.321287 0.323916 0.0040767
## 23 0.00204855     50  0.317006 0.317556 0.0040441
## 24 0.00201798     52  0.312909 0.309790 0.0040035
## 25 0.00195683     54  0.308873 0.309301 0.0040009
## 26 0.00183453     56  0.304959 0.302269 0.0039633
## 27 0.00180395     57  0.303125 0.300128 0.0039517
## 28 0.00152877     63  0.287776 0.286981 0.0038790
## 29 0.00143705     64  0.286247 0.274690 0.0038085
## 30 0.00142685     69  0.278970 0.270348 0.0037830
## 31 0.00140647     73  0.272916 0.267718 0.0037674
## 32 0.00139628     75  0.270103 0.265211 0.0037524
## 33 0.00134532     81  0.261726 0.262582 0.0037366
## 34 0.00130455     85  0.256344 0.259463 0.0037176
## 35 0.00125359     88  0.252431 0.255488 0.0036932
## 36 0.00122302     90  0.249924 0.251208 0.0036666
## 37 0.00119244     95  0.243808 0.247233 0.0036416
## 38 0.00116187     97  0.241424 0.243503 0.0036178
## 39 0.00110072    106  0.230967 0.234514 0.0035594
## 40 0.00107014    113  0.221978 0.223568 0.0034860
## 41 0.00103956    127  0.206384 0.220449 0.0034647
## 42 0.00100899    129  0.204305 0.212927 0.0034122
## 43 0.00097841    134  0.198312 0.208402 0.0033800
## 44 0.00094784    136  0.196355 0.205345 0.0033579
## 45 0.00091726    138  0.194460 0.199841 0.0033177
## 46 0.00085611    140  0.192625 0.196600 0.0032936
## 47 0.00082554    151  0.181068 0.186204 0.0032145
## 48 0.00081942    154  0.178561 0.183147 0.0031907
## 49 0.00081025    159  0.174463 0.172017 0.0031016
## 50 0.00079496    171  0.163762 0.172017 0.0031016
## 51 0.00078273    173  0.162172 0.170489 0.0030891
## 52 0.00073381    188  0.146273 0.168776 0.0030749
## 53 0.00071343    190  0.144805 0.161316 0.0030123
## 54 0.00070323    198  0.139057 0.158442 0.0029876
## 55 0.00067266    200  0.137651 0.157647 0.0029808
## 56 0.00064208    205  0.134287 0.151348 0.0029256
## 57 0.00061151    207  0.133003 0.143888 0.0028583
## 58 0.00058093    223  0.120528 0.137039 0.0027945
## 59 0.00057074    231  0.115331 0.131352 0.0027401
## 60 0.00055036    234  0.113618 0.129884 0.0027258
## 61 0.00054017    247  0.106464 0.129884 0.0027258
## 62 0.00051978    254  0.102428 0.124442 0.0026719
## 63 0.00048921    260  0.099309 0.119611 0.0026229
## 64 0.00045863    279  0.089953 0.109338 0.0025145
## 65 0.00042806    281  0.089036 0.106647 0.0024851
## 66 0.00040767    296  0.082370 0.101449 0.0024271
## 67 0.00039748    307  0.076194 0.097780 0.0023851
```

```
## 68 0.00036691    317  0.072219 0.093928 0.0023400
## 69 0.00035671    319  0.071485 0.085917 0.0022427
## 70 0.00035162    327  0.068428 0.085489 0.0022373
## 71 0.00033633    333  0.066104 0.085489 0.0022373
## 72 0.00032614    346  0.060784 0.079741 0.0021640
## 73 0.00030575    351  0.059072 0.076439 0.0021206
## 74 0.00027518    369  0.052712 0.068122 0.0020062
## 75 0.00024460    379  0.049960 0.062374 0.0019225
## 76 0.00022422    401  0.043906 0.056136 0.0018268
## 77 0.00021403    407  0.042561 0.055464 0.0018161
## 78 0.00018345    441  0.034856 0.053324 0.0017817
## 79 0.00016307    450  0.033205 0.052467 0.0017677
## 80 0.00014269    463  0.030759 0.050266 0.0017312
## 81 0.00010701    473  0.028680 0.050205 0.0017302
## 82 0.00000000    481  0.027824 0.050021 0.0017271
```

```
# let's have a look at complexity parameter against xerror
plotcp(tree)
```




```
 # optimal cp
cptable <- as.data.frame(tree$cptable)
opt_cp <- cptable[with(cptable, min(which((xerror - xstd) < min(xerror)))), "CP"]
```

```
opt_tree <- prune(tree = tree, cp = opt_cp)
```

```
# use it on test data
est_prob <- predict(object = opt_tree, newdata = test_data)
```

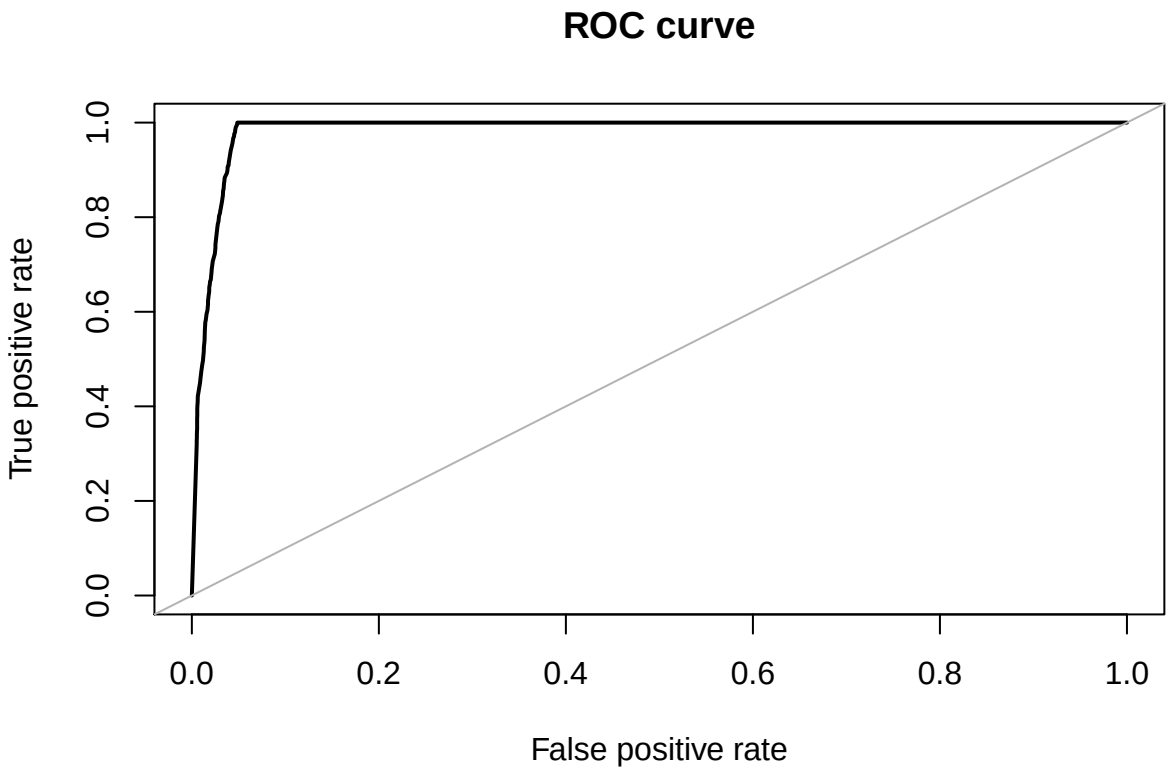
```r
library(ROSE)
```

```
## Loaded ROSE 0.0-3
```

```r
accuracy.meas(response = test_data$demo, predicted = est_prob[,2], threshold = 0.5)
```

```
##
## Call:
## accuracy.meas(response = test_data$demo, predicted = est_prob[,
##     2], threshold = 0.5)
##
## Examples are labelled as positive when predicted is greater than 0.5
##
## precision: 0.954
## recall: 1.000
## F: 0.488
```

```r
# let's look at roc, auc
roc.curve(response = test_data$demo, predicted = est_prob[,2], plotit = T)
```




```
## Area under the curve (AUC): 0.984
```