```
#################
# Association Rules for TripAdvisor
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# Team: droptable
# Project 2
# Version 1.2
#
# Description:
# We explore the TripAdvisor dataset using association rule mining.
#
# File Dependencies:
#   'data/tripadvisor_data.Rdata'
#
# How to run:
#    Source this script (no need to set wd beforehand if directory structure is
#    maintained as downloaded). Alternatively, set the working directory to the
#   data directory manaully.
#
# References
#   1) Set working directory to the file path of a script:
#      http://stackoverflow.com/questions/13672720/r-command-for-setting-working-dire
#   2) Tutorial on association rules in R:
#      http://www.rdatamining.com/examples/association-rules
#   3) Renaming levels of a factor:
#      http://www.cookbook-r.com/Manipulating_data/Renaming_levels_of_a_factor/
#   4) Installing package from a source file:
#      https://cran.r-project.org/web/packages/arules/index.html

require("arules")   # version 2.2 is needed, which required installing from source

## Loading required package:  arules
## Warning:  package 'arules' was built under R version 3.2.2
## Loading required package:  Matrix
##
## Attaching package:  'arules'
##
## The following objects are masked from 'package:base':
##
##    %in%, abbreviate, write
```

```
require("arulesViz")
```

```
## Loading required package:  arulesViz
## Warning:  package 'arulesViz' was built under R version 3.1.3
## Loading required package:  grid
##
## Attaching package:  'arulesViz'
##
## The following object is masked from 'package:arules':
##
##    abbreviate
##
## The following object is masked from 'package:base':
##
##    abbreviate
```

```
require("Hmisc")
```

```
## Loading required package:  Hmisc
## Warning:  package 'Hmisc' was built under R version 3.1.3
## Loading required package:  lattice
## Loading required package:  survival
## Loading required package:  splines
## Loading required package:  Formula
## Warning:  package 'Formula' was built under R version 3.1.3
## Loading required package:  ggplot2
##
## Attaching package:  'Hmisc'
##
## The following objects are masked from 'package:base':
##
##    format.pval, round.POSIXt, trunc.POSIXt, units
```

```
require("data.table")
```

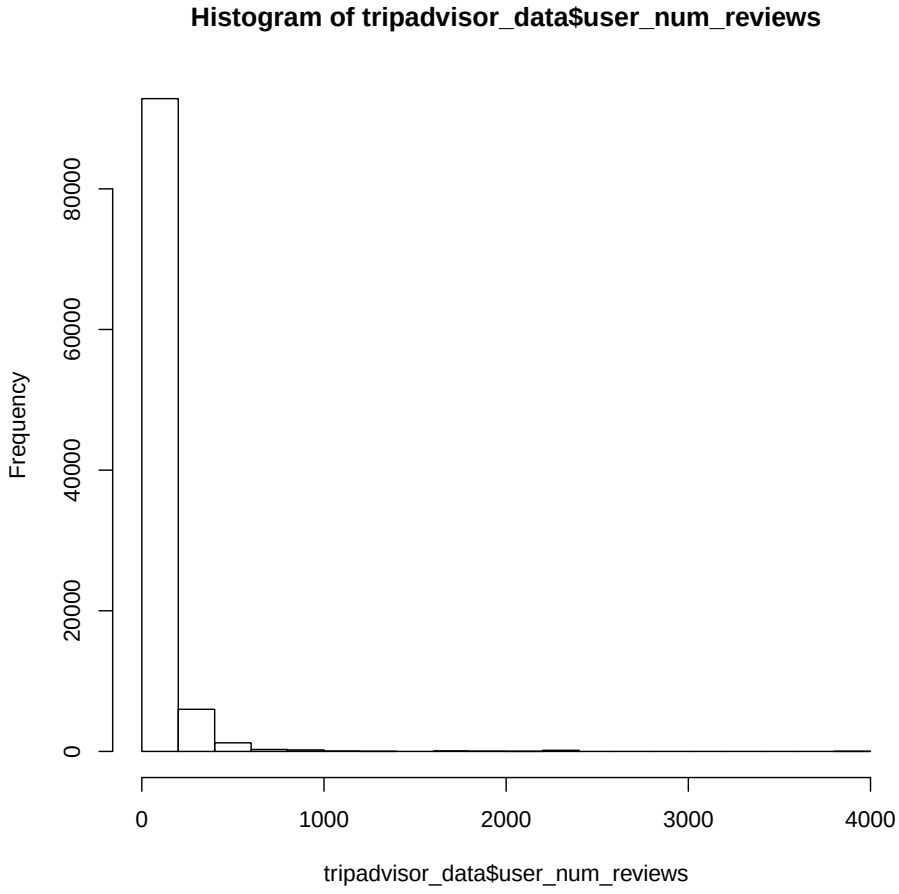
```
## Loading required package:  data.table
## Warning:  package 'data.table' was built under R version 3.1.3
```

```
require("plyr")
```

```
## Loading required package:  plyr
##
```

```
## Attaching package:  'plyr'
##
## The following objects are masked from 'package:Hmisc':
##
##    is.discrete, summarize

#################
# Load in data
#################

load("tripadvisor_data.Rdata")

#################
# Prep data for association rules
#################

# Create a new data.frame for the data set we want to use association rules on.
# We want to create categorical variables for this purpose.

tripadvisor_data_categorical <- data.frame(user_is_local = as.factor(tripadvisor_data

# Now, we bin some continuous variables and add to this new data set.

####################
# user_review_length
# We omit this for TripAdvisor, since the data is incomplete with some of the
# reviews being cut off (e.g. they end with the word "More").

####################
# user_rating

# Explore data
table(tripadvisor_data$user_rating)




# Bin and add to new data set:
# We keep all five categories:
```

```r
tripadvisor_data_categorical$user_rating <- as.factor(tripadvisor_data$user_rating)

####################
# user_num_reviews

# Explore data
summary(tripadvisor_data$user_num_reviews)

##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    1.00   17.00   43.00   80.21   93.00 3834.00

hist(tripadvisor_data$user_num_reviews)
```



```r
# Bin and add to new data set:
# low: [1 to 16)
# medium: [16 to 93)
# high: [83 and up)
tripadvisor_data_categorical$user_num_reviews <- cut2(x=tripadvisor_data$user_num_rev
                                                      cut=c(1, 16, 83))

###################
# Check out the new data set
head(tripadvisor_data_categorical)
```

```
##   user_is_local user_rating user_num_reviews
## 1         FALSE           5      [  16,  83)
## 2         FALSE           5      [  16,  83)
## 3         FALSE           5      [   1,  16)
## 4         FALSE           4      [  16,  83)
## 5          TRUE           2      [   1,  16)
## 6         FALSE           5      [   1,  16)
```

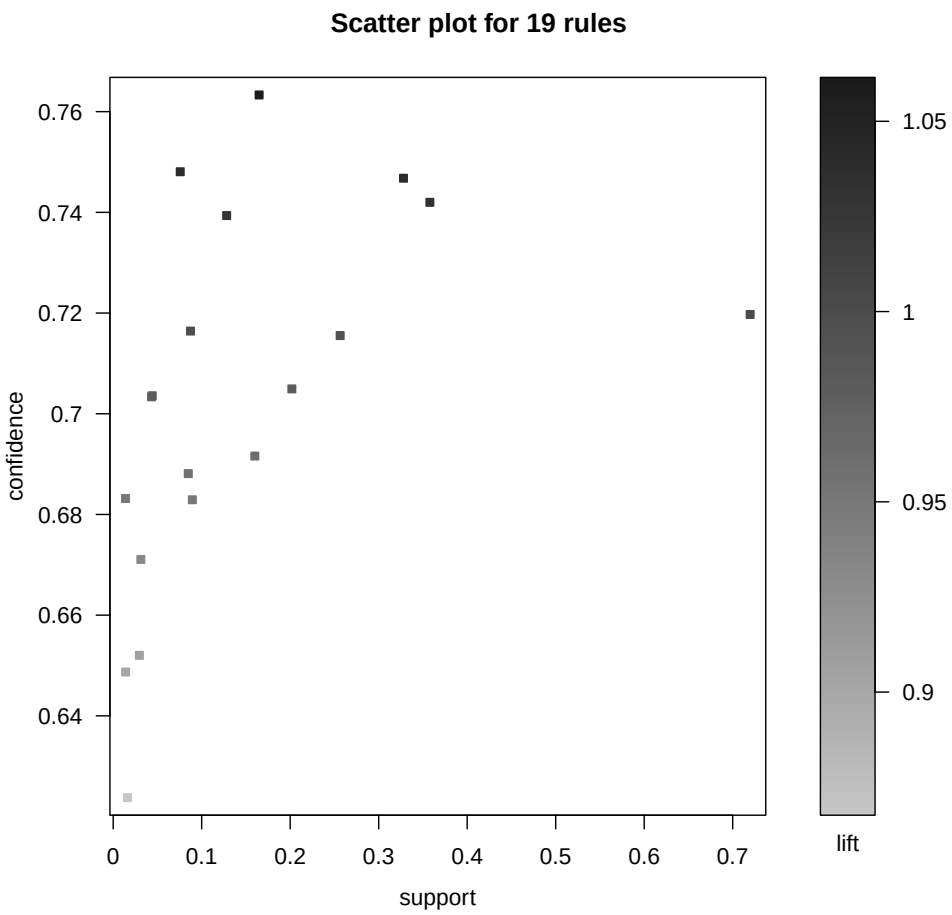
```r
#################
# Start association rules mining for tripadvisor
#################

attach(tripadvisor_data_categorical)

# Since a central question we are asking is whether or not local or non_local
# ratings are higher, we start association rule mining with the binary
# user_is_local on the right, to see if we can find any implications. We
# adjust the minimum support and confidence levels to obtain the most
# meaningful rule set. Just as we did for Yelp.

# A first look shows us that  the higher user ratings 4 and 5 are associated
# with non_local reviews with a higher confidence then with local reviews.

tripadvisor_rules_1 <- apriori(tripadvisor_data_categorical,
                               parameter = list(minlen=1, supp=.01, conf=.5),
                               appearance = list(rhs=c("user_is_local=FALSE", "user_i
                               control = list(verbose=F))
```

```
## Warning in match(x, table, nomatch = 0):  bytecode version mismatch;
using eval
```

```
inspect(tripadvisor_rules_1)
```

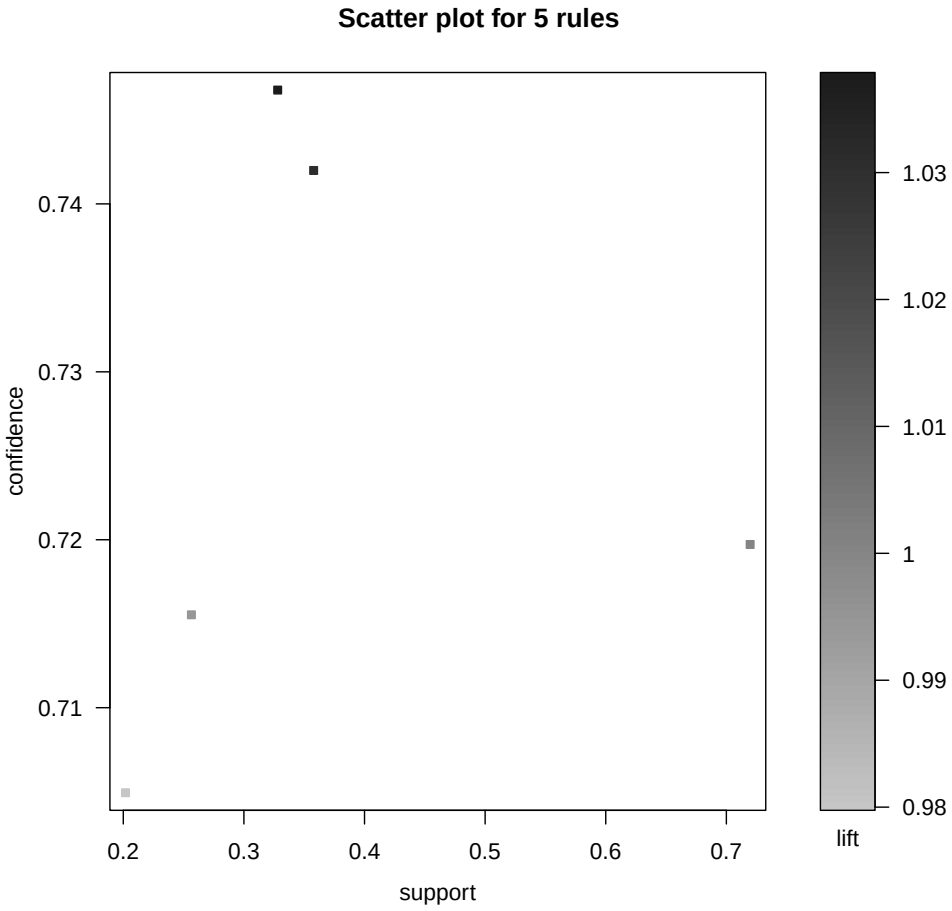
```
##    lhs                                  rhs                        support confidence
## 1  {}                                => {user_is_local=FALSE} 0.71971913  0.7197191 1
## 2  {user_rating=1}                   => {user_is_local=FALSE} 0.01619542  0.6237586 0
## 3  {user_rating=2}                   => {user_is_local=FALSE} 0.02958416  0.6520219 0
## 4  {user_rating=3}                   => {user_is_local=FALSE} 0.08945662  0.6829194 0
## 5  {user_num_reviews=[   1,  16)} => {user_is_local=FALSE} 0.16002023  0.6915988 0
## 6  {user_num_reviews=[  83,3834]} => {user_is_local=FALSE} 0.20187244  0.7049351 0
## 7  {user_rating=4}                   => {user_is_local=FALSE} 0.25646874  0.7155308 0
## 8  {user_rating=5}                   => {user_is_local=FALSE} 0.32801420  0.7467769 1
## 9  {user_num_reviews=[  16,  83)} => {user_is_local=FALSE} 0.35782646  0.7419899 1
## 10 {user_rating=2,
##     user_num_reviews=[  16,  83)} => {user_is_local=FALSE} 0.01396396  0.6831635 0
## 11 {user_rating=3,
##     user_num_reviews=[   1,  16)} => {user_is_local=FALSE} 0.01408297  0.6486980 0
## 12 {user_rating=3,
##     user_num_reviews=[  83,3834]} => {user_is_local=FALSE} 0.03126023  0.6710666 0
## 13 {user_rating=3,
##     user_num_reviews=[  16,  83)} => {user_is_local=FALSE} 0.04411342  0.7035748 0
## 14 {user_rating=4,
##     user_num_reviews=[   1,  16)} => {user_is_local=FALSE} 0.04340927  0.7033585 0
## 15 {user_rating=5,
##     user_num_reviews=[   1,  16)} => {user_is_local=FALSE} 0.08739376  0.7164228 0
## 16 {user_rating=4,
##     user_num_reviews=[  83,3834]} => {user_is_local=FALSE} 0.08485486  0.6881132 0
## 17 {user_rating=5,
##     user_num_reviews=[  83,3834]} => {user_is_local=FALSE} 0.07574060  0.7480654 1
## 18 {user_rating=4,
##     user_num_reviews=[  16,  83)} => {user_is_local=FALSE} 0.12820462  0.7393617 1
## 19 {user_rating=5,
##     user_num_reviews=[  16,  83)} => {user_is_local=FALSE} 0.16487985  0.7633150 1
```

```
plot(tripadvisor_rules_1)
```




```
# Narrowing down by increasing the minimum support shows again that higher
# ratings are associated with non_local reviewers. Of course, the non_local
# reviews are being prioritized with a higher support, due to the class
# imbalance with TripAdvisor data being in favor of non_local.

tripadvisor_rules_2 <- apriori(tripadvisor_data_categorical,
                               parameter = list(minlen=1, supp=.2, conf=.5),
                               appearance = list(rhs=c("user_is_local=FALSE", "user_i
                               control = list(verbose=F))
inspect(tripadvisor_rules_2)

##   lhs                                rhs                    support confidence
```

```
## 1 {}                                => {user_is_local=FALSE} 0.7197191  0.7197191 1.0
## 2 {user_num_reviews=[  83,3834]} => {user_is_local=FALSE} 0.2018724  0.7049351 0.9
## 3 {user_rating=4}                   => {user_is_local=FALSE} 0.2564687  0.7155308 0.9
## 4 {user_rating=5}                   => {user_is_local=FALSE} 0.3280142  0.7467769 1.0
## 5 {user_num_reviews=[  16,  83)} => {user_is_local=FALSE} 0.3578265  0.7419899 1.0

plot(tripadvisor_rules_2)
```

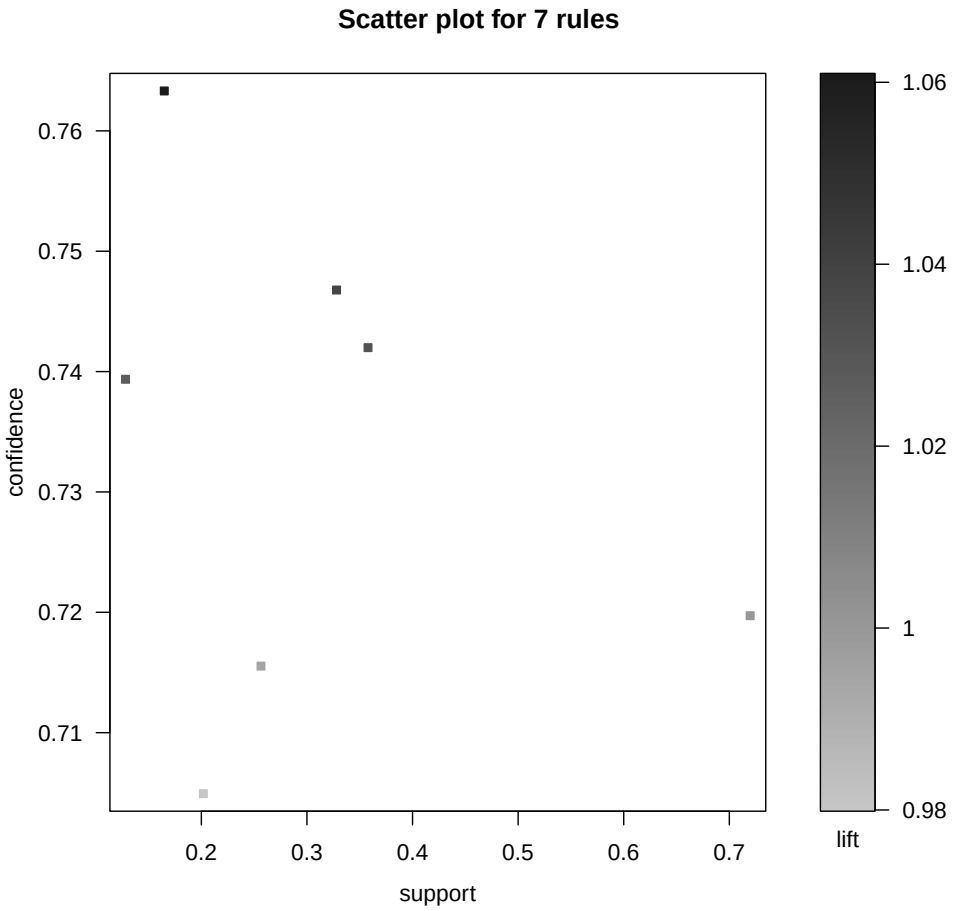



```
# Bringing the support level down to .1, but minimum confidence up to .7, we
# see again that higher ratings imply non_local reviews first. We also see that
# reviewers that have at least 16 reviews on TripAdvisor seem to also imply
# non_local reviews (as opposed to those who have very few reviews).
```

```
tripadvisor_rules_3 <- apriori(tripadvisor_data_categorical,
                               parameter = list(minlen=1, supp=.1, conf=.7),
                               appearance = list(rhs=c("user_is_local=FALSE", "user_i
                               control = list(verbose=F))
inspect(tripadvisor_rules_3)
```

```
##   lhs                                rhs                     support confidence
## 1 {}                              => {user_is_local=FALSE} 0.7197191  0.7197191 1.0
## 2 {user_num_reviews=[  83,3834]} => {user_is_local=FALSE} 0.2018724  0.7049351 0.9
## 3 {user_rating=4}                 => {user_is_local=FALSE} 0.2564687  0.7155308 0.9
## 4 {user_rating=5}                 => {user_is_local=FALSE} 0.3280142  0.7467769 1.0
## 5 {user_num_reviews=[  16,  83)} => {user_is_local=FALSE} 0.3578265  0.7419899 1.0
## 6 {user_rating=4,
##    user_num_reviews=[  16,  83)} => {user_is_local=FALSE} 0.1282046  0.7393617 1.0
## 7 {user_rating=5,
##    user_num_reviews=[  16,  83)} => {user_is_local=FALSE} 0.1648798  0.7633150 1.0
```

```
plot(tripadvisor_rules_3)
```


Scatter plot for 7 rules
confidence
0.76
0.75
0.74
0.73
0.72
0.71
0.2
0.3
0.4
0.5
0.6
0.7
support
1.06
1.04
1.02
1
0.98
lift