exploring-redhat-data

August 14, 2016

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see http://rmarkdown.rstudio.com.

```r
library(ggplot2)
library(data.table)
library(dplyr)
```

```
## -------------------------------------------------------------------------

## data.table + dplyr code now lives in dtplyr.
## Please library(dtplyr)!

## -------------------------------------------------------------------------

##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:data.table':
##
##     between, last

## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```r
source('../src/data/merge_data_to_disk.R')
```

Functions for rendering HTML and PDF documents

```r
render_pdf <-  function() {
    rmarkdown::render('exploring_redhat_data.Rmd',
                      output_file = 'markdown/exploring_redhat.pdf')
}

render_html <-  function() {
    rmarkdown::render('exploring_redhat_data.Rmd',
                      output_file = 'markdown/exploring_redhat.html')
}
```

Function that removes all r objects from memory

```
clear <- function() {
    rm(list=ls())
}
```

Read data

```
merge_and_write_data_to_disk()
```

```
##
Read 26.4% of 2197291 rows
Read 40.0% of 2197291 rows
Read 60.1% of 2197291 rows
Read 73.7% of 2197291 rows
Read 91.0% of 2197291 rows
Read 2197291 rows and 15 (of 15) columns from 0.131 GB file in 00:00:07
```

```
## [1] "File ../data/processed/merged_data.csv written to disk"
```

```
merged_raw <- fread('../data/processed/merged_data.csv')
```

```
##
Read 0.0% of 2197291 rows
Read 23.2% of 2197291 rows
Read 44.6% of 2197291 rows
Read 63.7% of 2197291 rows
Read 80.6% of 2197291 rows
Read 98.3% of 2197291 rows
Read 2197291 rows and 55 (of 55) columns from 0.746 GB file in 00:00:09
```

Data summary

```
head(merged_raw, 5)
```

```
##    people_id people_char_1 people_group_1 people_char_2 people_date
## 1:   ppl_100        type 2    group 17304        type 2  2021-06-29
## 2:   ppl_100        type 2    group 17304        type 2  2021-06-29
## 3:   ppl_100        type 2    group 17304        type 2  2021-06-29
## 4:   ppl_100        type 2    group 17304        type 2  2021-06-29
## 5:   ppl_100        type 2    group 17304        type 2  2021-06-29
##    people_char_3 people_char_4 people_char_5 people_char_6 people_char_7
## 1:        type 5        type 5        type 5        type 3       type 11
## 2:        type 5        type 5        type 5        type 3       type 11
## 3:        type 5        type 5        type 5        type 3       type 11
## 4:        type 5        type 5        type 5        type 3       type 11
## 5:        type 5        type 5        type 5        type 3       type 11
##    people_char_8 people_char_9 people_char_10 people_char_11
## 1:        type 2        type 2           TRUE          FALSE
## 2:        type 2        type 2           TRUE          FALSE
## 3:        type 2        type 2           TRUE          FALSE
## 4:        type 2        type 2           TRUE          FALSE
## 5:        type 2        type 2           TRUE          FALSE
##    people_char_12 people_char_13 people_char_14 people_char_15
## 1:          FALSE           TRUE           TRUE          FALSE
## 2:          FALSE           TRUE           TRUE          FALSE
## 3:          FALSE           TRUE           TRUE          FALSE
## 4:          FALSE           TRUE           TRUE          FALSE
## 5:          FALSE           TRUE           TRUE          FALSE
##    people_char_16 people_char_17 people_char_18 people_char_19
## 1:           TRUE          FALSE          FALSE          FALSE
## 2:           TRUE          FALSE          FALSE          FALSE
## 3:           TRUE          FALSE          FALSE          FALSE
## 4:           TRUE          FALSE          FALSE          FALSE
## 5:           TRUE          FALSE          FALSE          FALSE
##    people_char_20 people_char_21 people_char_22 people_char_23
## 1:          FALSE           TRUE          FALSE          FALSE
## 2:          FALSE           TRUE          FALSE          FALSE
## 3:          FALSE           TRUE          FALSE          FALSE
## 4:          FALSE           TRUE          FALSE          FALSE
## 5:          FALSE           TRUE          FALSE          FALSE
##    people_char_24 people_char_25 people_char_26 people_char_27
## 1:          FALSE          FALSE          FALSE           TRUE
## 2:          FALSE          FALSE          FALSE           TRUE
## 3:          FALSE          FALSE          FALSE           TRUE
## 4:          FALSE          FALSE          FALSE           TRUE
## 5:          FALSE          FALSE          FALSE           TRUE
##    people_char_28 people_char_29 people_char_30 people_char_31
## 1:           TRUE          FALSE           TRUE           TRUE
## 2:           TRUE          FALSE           TRUE           TRUE
## 3:           TRUE          FALSE           TRUE           TRUE
## 4:           TRUE          FALSE           TRUE           TRUE
## 5:           TRUE          FALSE           TRUE           TRUE
##    people_char_32 people_char_33 people_char_34 people_char_35
## 1:          FALSE          FALSE           TRUE           TRUE
## 2:          FALSE          FALSE           TRUE           TRUE
## 3:          FALSE          FALSE           TRUE           TRUE
## 4:          FALSE          FALSE           TRUE           TRUE
## 5:          FALSE          FALSE           TRUE           TRUE
##    people_char_36 people_char_37 people_char_38  activity_id activity_date
## 1:           TRUE          FALSE             36 act2_1734928    2023-08-26
## 2:           TRUE          FALSE             36 act2_2434093    2022-09-27
## 3:           TRUE          FALSE             36 act2_3404049    2022-09-27
## 4:           TRUE          FALSE             36 act2_3651215    2023-08-04
## 5:           TRUE          FALSE             36 act2_4109017    2023-08-26
##    activity_category activity_char_1 activity_char_2 activity_char_3
## 1:            type 4
## 2:            type 2
## 3:            type 2
## 4:            type 2
## 5:            type 2
##    activity_char_4 activity_char_5 activity_char_6 activity_char_7
## 1:
## 2:
```

```
## 3:
## 4:
## 5:
##    activity_char_8 activity_char_9 activity_char_10 outcome
## 1:                                          type 76       0
## 2:                                           type 1       0
## 3:                                           type 1       0
## 4:                                           type 1       0
## 5:                                           type 1       0
```

```
head(merged_raw[which(merged_raw$activity_char_1 != ''), ])
```

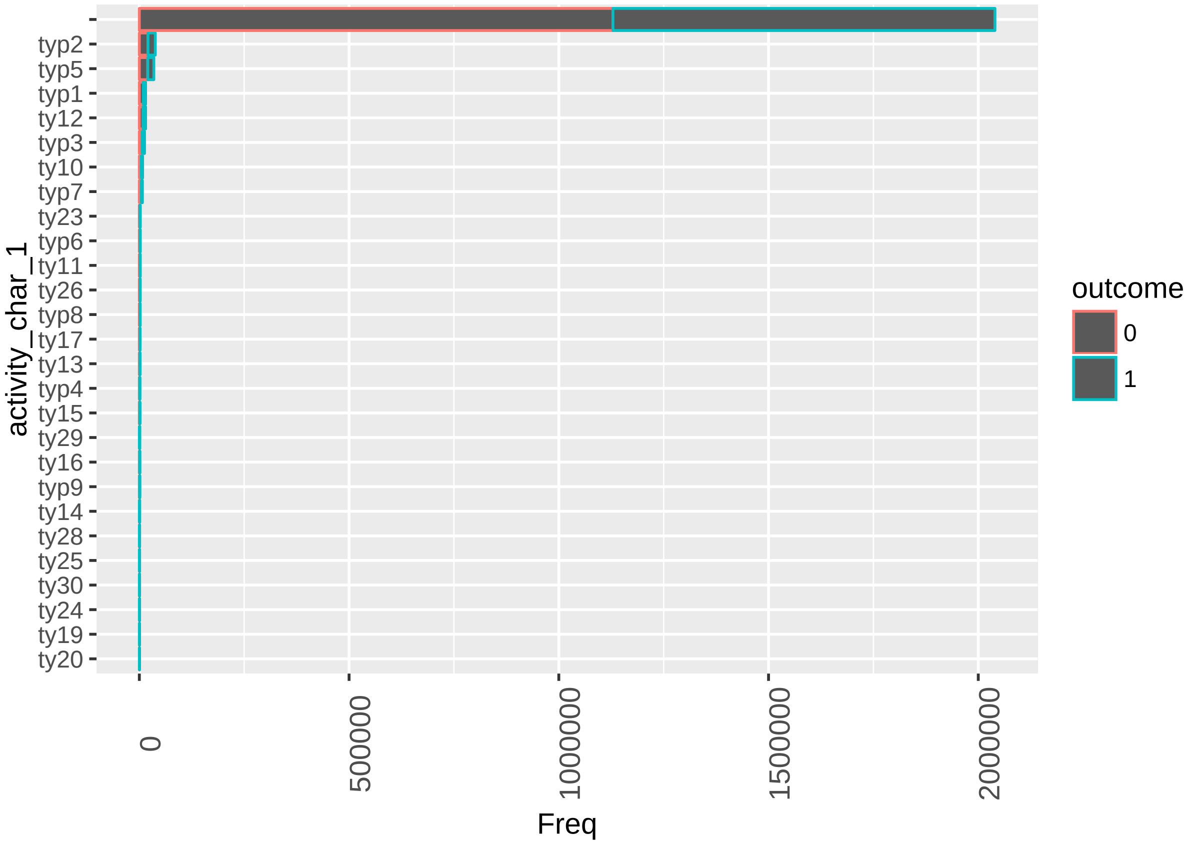
```
##     people_id people_char_1 people_group_1 people_char_2 people_date
## 1: ppl_100025        type 2    group 36096        type 3  2022-08-26
## 2: ppl_100033        type 2    group 17304        type 2  2022-07-26
## 3: ppl_100033        type 2    group 17304        type 2  2022-07-26
## 4: ppl_100033        type 2    group 17304        type 2  2022-07-26
## 5: ppl_100033        type 2    group 17304        type 2  2022-07-26
## 6: ppl_100035        type 2     group 9439        type 3  2022-01-22
##    people_char_3 people_char_4 people_char_5 people_char_6 people_char_7
## 1:       type 14        type 6        type 8        type 3        type 9
## 2:       type 10        type 7        type 6        type 3        type 9
## 3:       type 10        type 7        type 6        type 3        type 9
## 4:       type 10        type 7        type 6        type 3        type 9
## 5:       type 10        type 7        type 6        type 3        type 9
## 6:        type 4       type 10        type 4        type 1       type 23
##    people_char_8 people_char_9 people_char_10 people_char_11
## 1:        type 6        type 6          FALSE          FALSE
## 2:        type 3        type 3          FALSE          FALSE
## 3:        type 3        type 3          FALSE          FALSE
## 4:        type 3        type 3          FALSE          FALSE
## 5:        type 3        type 3          FALSE          FALSE
## 6:        type 2        type 2          FALSE           TRUE
##    people_char_12 people_char_13 people_char_14 people_char_15
## 1:          FALSE          FALSE          FALSE          FALSE
## 2:          FALSE          FALSE          FALSE          FALSE
## 3:          FALSE          FALSE          FALSE          FALSE
## 4:          FALSE          FALSE          FALSE          FALSE
## 5:          FALSE          FALSE          FALSE          FALSE
## 6:          FALSE          FALSE          FALSE          FALSE
##    people_char_16 people_char_17 people_char_18 people_char_19
## 1:          FALSE          FALSE          FALSE          FALSE
## 2:          FALSE          FALSE          FALSE          FALSE
## 3:          FALSE          FALSE          FALSE          FALSE
## 4:          FALSE          FALSE          FALSE          FALSE
## 5:          FALSE          FALSE          FALSE          FALSE
## 6:          FALSE          FALSE          FALSE           TRUE
##    people_char_20 people_char_21 people_char_22 people_char_23
## 1:          FALSE          FALSE          FALSE          FALSE
## 2:          FALSE          FALSE          FALSE          FALSE
## 3:          FALSE          FALSE          FALSE          FALSE
## 4:          FALSE          FALSE          FALSE          FALSE
## 5:          FALSE          FALSE          FALSE          FALSE
## 6:           TRUE           TRUE           TRUE           TRUE
##    people_char_24 people_char_25 people_char_26 people_char_27
## 1:          FALSE          FALSE          FALSE          FALSE
## 2:          FALSE          FALSE          FALSE          FALSE
## 3:          FALSE          FALSE          FALSE          FALSE
## 4:          FALSE          FALSE          FALSE          FALSE
## 5:          FALSE          FALSE          FALSE          FALSE
## 6:           TRUE           TRUE          FALSE          FALSE
##    people_char_28 people_char_29 people_char_30 people_char_31
## 1:          FALSE          FALSE          FALSE          FALSE
## 2:          FALSE          FALSE          FALSE          FALSE
## 3:          FALSE          FALSE          FALSE          FALSE
## 4:          FALSE          FALSE          FALSE          FALSE
## 5:          FALSE          FALSE          FALSE          FALSE
## 6:          FALSE          FALSE          FALSE          FALSE
##    people_char_32 people_char_33 people_char_34 people_char_35
## 1:          FALSE          FALSE          FALSE          FALSE
## 2:          FALSE          FALSE          FALSE          FALSE
## 3:          FALSE          FALSE          FALSE          FALSE
## 4:          FALSE          FALSE          FALSE          FALSE
## 5:          FALSE          FALSE          FALSE          FALSE
## 6:          FALSE          FALSE          FALSE          FALSE
##    people_char_36 people_char_37 people_char_38 activity_id activity_date
## 1:          FALSE          FALSE             76   act1_9923    2022-11-25
## 2:          FALSE          FALSE              0 act1_198174    2022-07-26
## 3:          FALSE          FALSE              0 act1_214090    2023-06-15
## 4:          FALSE          FALSE              0 act1_230588    2023-02-28
## 5:          FALSE          FALSE              0 act1_271874    2022-07-26
## 6:          FALSE           TRUE            100 act1_104259    2023-07-28
##    activity_category activity_char_1 activity_char_2 activity_char_3
## 1:            type 1          type 3          type 5          type 1
## 2:            type 1         type 36         type 11          type 5
## 3:            type 1         type 24          type 6          type 6
## 4:            type 1          type 2          type 2          type 3
## 5:            type 1          type 2          type 5          type 3
## 6:            type 1          type 5          type 2          type 7
##    activity_char_4 activity_char_5 activity_char_6 activity_char_7
## 1:          type 1          type 6          type 3          type 3
## 2:          type 1          type 6          type 1          type 1
## 3:          type 3          type 1          type 3          type 4
## 4:          type 3          type 5          type 2          type 2
## 5:          type 2          type 6          type 1          type 1
## 6:          type 3          type 1          type 3          type 5
##    activity_char_8 activity_char_9 activity_char_10 outcome
## 1:          type 6          type 8                        0
## 2:          type 4          type 1                        0
## 3:          type 5          type 1                        0
## 4:          type 4          type 2                        0
## 5:          type 6          type 8                        0
## 6:          type 4          type 7                        1
```

Inspect outomces for variable activity_char_1

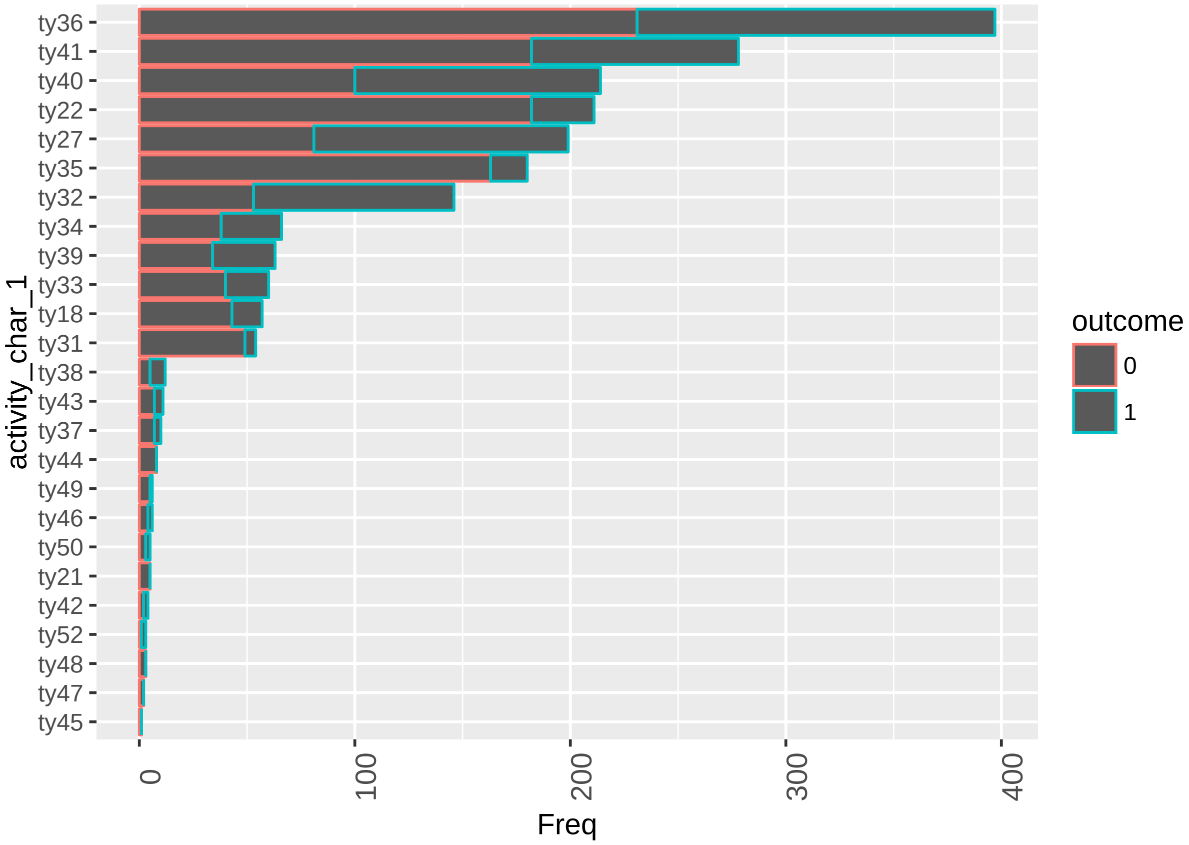
```
counts <- table(merged_raw[, c('activity_char_1', 'outcome'), with=F])

activities_df <- as.data.frame(counts)
activities_df$activity_char_1 <- reorder(activities_df$activity_char_1, activities_df$Freq)
ind_split <- as.integer((length(levels(activities_df$activity_char_1))-1) / 2)
most_frequent_levels <- levels(activities_df$activity_char_1)[
    (ind_split+1): length(levels(activities_df$activity_char_1))]
second_frequent_levels <- levels(activities_df$activity_char_1)[1:ind_split]

ggplot(data=activities_df[activities_df$activity_char_1 %in% most_frequent_levels, ],
       aes(x=activity_char_1, y=Freq,  color=outcome)) +
    geom_bar(stat='identity') +
    theme(axis.text.x=element_text(angle=90, size=11)) +
    scale_x_discrete(labels=abbreviate) +
    coord_flip()
```

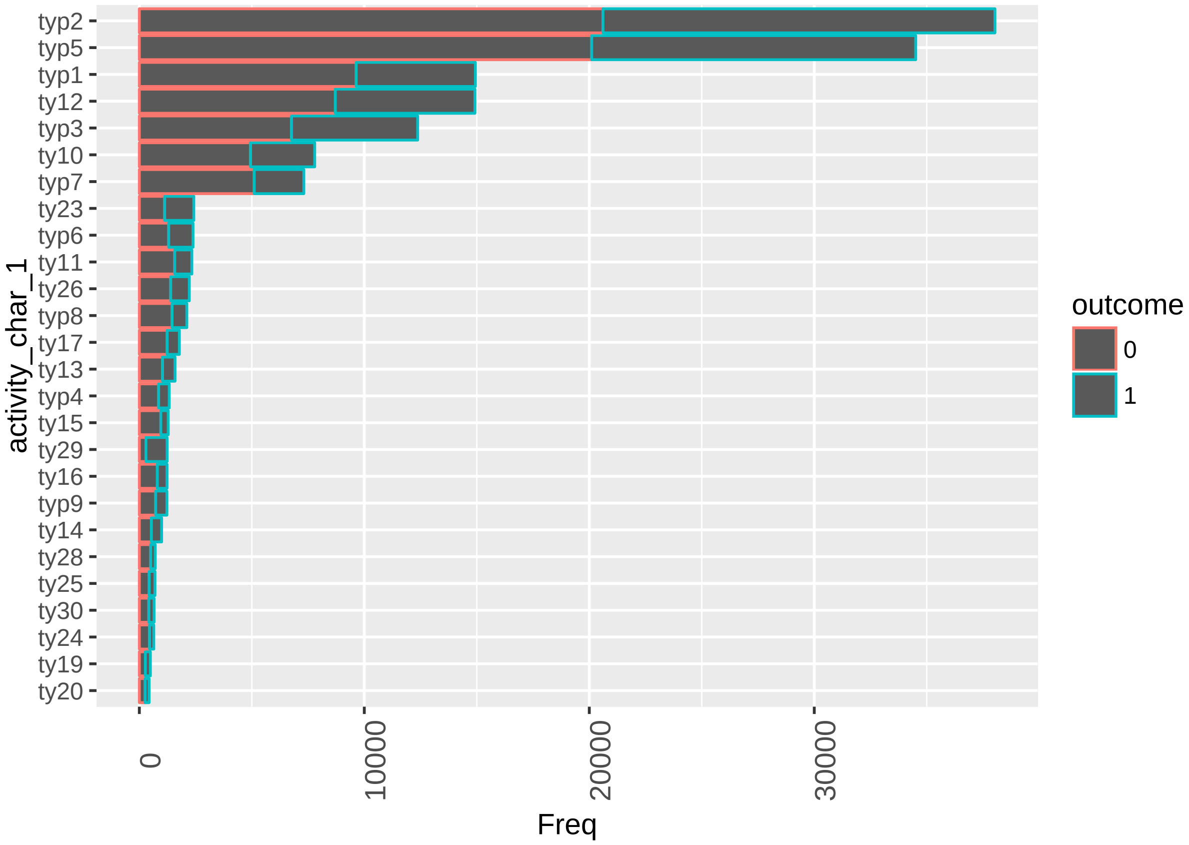


```
ggplot(data=activities_df[activities_df$activity_char_1 %in% second_frequent_levels,],
       aes(x=activity_char_1, y=Freq, color=outcome)) +
    geom_bar(stat='identity') +
    theme(axis.text.x=element_text(angle=90, size=11)) +
    scale_x_discrete(labels=abbreviate) +
    coord_flip()
```

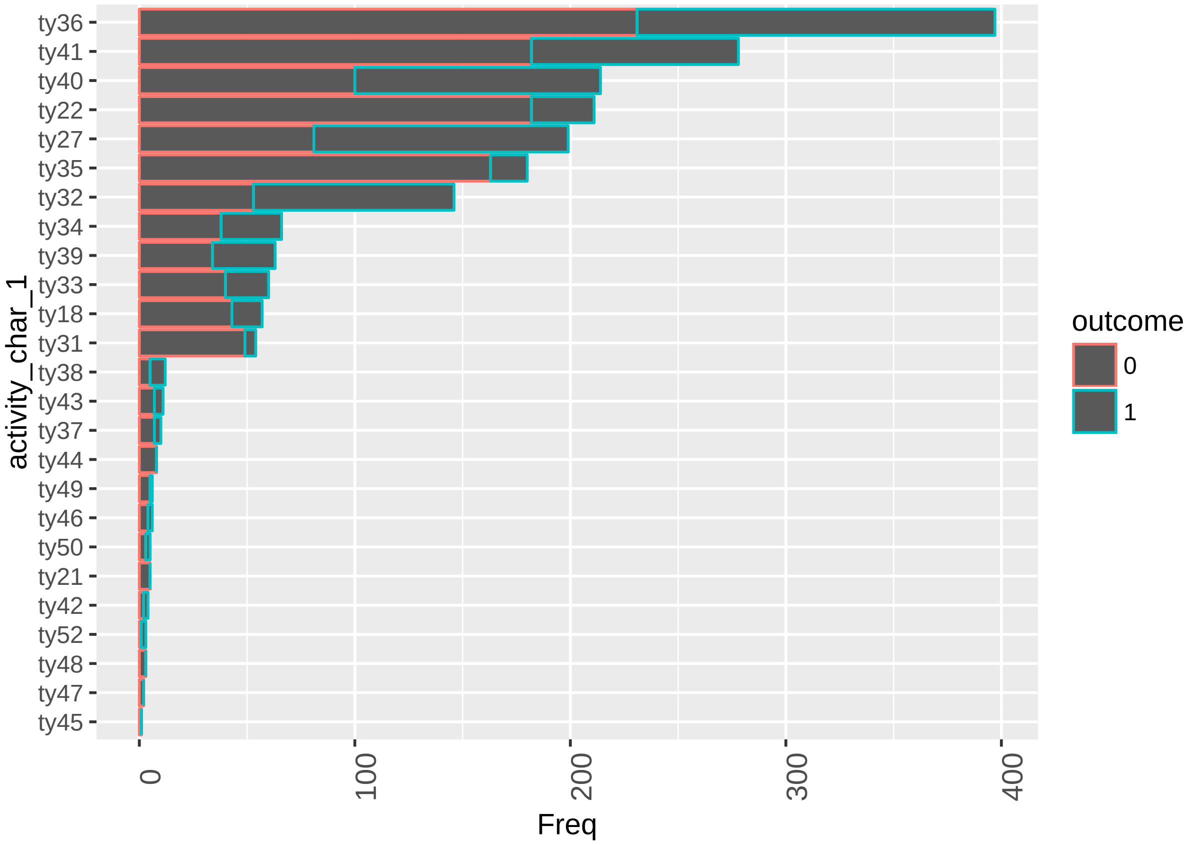


```
df_without_blanks <- activities_df[activities_df$activity_char_1 != '',]
df_without_blanks$activity_char_1 <- as.factor(df_without_blanks$activity_char_1)

ggplot(data=df_without_blanks[df_without_blanks$activity_char_1 %in% most_frequent_levels, ],
       aes(x=activity_char_1, y=Freq, color=outcome)) +
    geom_bar(stat='identity') +
    theme(axis.text.x=element_text(angle=90, size=11)) +
    scale_x_discrete(labels=abbreviate) +
    coord_flip()
```



```
ggplot(
    data=df_without_blanks[df_without_blanks$activity_char_1 %in% second_frequent_levels, ],
       aes(x=activity_char_1, y=Freq, color=outcome)) +
    geom_bar(stat='identity') +
    theme(axis.text.x=element_text(angle=90, size=11)) +
    scale_x_discrete(labels=abbreviate) +
    coord_flip()
```



```
counts <- table(merged_raw$activity_char_1)
counts[order(counts, decreasing=T)]
```

```
##
##           type 2  type 5  type 1 type 12  type 3 type 10  type 7 type 23
## 2039676   38030   34509   14938   14917   12372    7795    7312    2420
##  type 6 type 11 type 26  type 8 type 17 type 13  type 4 type 15 type 29
##    2385    2333    2220    2110    1778    1586    1329    1284    1233
## type 16  type 9 type 14 type 28 type 25 type 30 type 24 type 19 type 20
##    1229    1225     990     706     694     653     641     491     434
## type 36 type 41 type 40 type 22 type 27 type 35 type 32 type 34 type 39
##     397     278     214     211     199     180     146      66      63
## type 33 type 18 type 31 type 38 type 43 type 37 type 44 type 46 type 49
##      60      57      54      12      11      10       8       6       6
## type 21 type 50 type 42 type 48 type 52 type 47 type 45
##       5       5       4       3       3       2       1
```

Most outcomes for variable activity_char_1 are blanks. Counting the number of blanks for each variable is easily done by the colSums function.

```
colSums(merged_raw == '')
```

```
##        people_id    people_char_1   people_group_1    people_char_2
##                0                0                0                0
##      people_date    people_char_3    people_char_4    people_char_5
##                 0                 0                 0                 0
##     people_char_6     people_char_7     people_char_8     people_char_9
##                 0                 0                 0                 0
##    people_char_10    people_char_11    people_char_12    people_char_13
##                 0                 0                 0                 0
##    people_char_14    people_char_15    people_char_16    people_char_17
##                 0                 0                 0                 0
##    people_char_18    people_char_19    people_char_20    people_char_21
##                 0                 0                 0                 0
##    people_char_22    people_char_23    people_char_24    people_char_25
##                 0                 0                 0                 0
##    people_char_26    people_char_27    people_char_28    people_char_29
##                 0                 0                 0                 0
##    people_char_30    people_char_31    people_char_32    people_char_33
##                 0                 0                 0                 0
##    people_char_34    people_char_35    people_char_36    people_char_37
##                 0                 0                 0                 0
##    people_char_38       activity_id     activity_date activity_category
##                 0                 0                 0                 0
##   activity_char_1   activity_char_2   activity_char_3   activity_char_4
##           2039676           2039676           2039676           2039676
##   activity_char_5   activity_char_6   activity_char_7   activity_char_8
##           2039676           2039676           2039676           2039676
##   activity_char_9  activity_char_10           outcome
##           2039676            157615                 0
```

Notice that the number of blanks for variables activity_char_1 up to 9 is constant. This indicates that each record contains data associated to one specific activity.

Number of unqie values for each variable and when grouping over outcome

```
merged_raw[, lapply(.SD, function(x) length(unique(x)))]
```

```
##    people_id people_char_1 people_group_1 people_char_2 people_date
## 1:    151295             2          29899             3        1196
##    people_char_3 people_char_4 people_char_5 people_char_6 people_char_7
## 1:            43            25             9             7            25
##    people_char_8 people_char_9 people_char_10 people_char_11
## 1:             8             9              2              2
##    people_char_12 people_char_13 people_char_14 people_char_15
## 1:              2              2              2              2
##    people_char_16 people_char_17 people_char_18 people_char_19
## 1:              2              2              2              2
##    people_char_20 people_char_21 people_char_22 people_char_23
## 1:              2              2              2              2
##    people_char_24 people_char_25 people_char_26 people_char_27
## 1:              2              2              2              2
##    people_char_28 people_char_29 people_char_30 people_char_31
## 1:              2              2              2              2
##    people_char_32 people_char_33 people_char_34 people_char_35
## 1:              2              2              2              2
##    people_char_36 people_char_37 people_char_38 activity_id activity_date
## 1:              2              2            101     2197291           411
##    activity_category activity_char_1 activity_char_2 activity_char_3
## 1:                 7              52              33              12
##    activity_char_4 activity_char_5 activity_char_6 activity_char_7
## 1:               8               8               6               9
##    activity_char_8 activity_char_9 activity_char_10 outcome
## 1:              19              20             6516       2
```

```
merged_raw[, lapply(.SD, function(x) length(unique(x))), by=outcome]
```

```
##    outcome people_id people_char_1 people_group_1 people_char_2
## 1:       0     89180             2          16850             3
## 2:       1     68771             2          17302             2
##    people_date people_char_3 people_char_4 people_char_5 people_char_6
## 1:        1195            43            25             9             7
## 2:        1173            41            25             9             6
##    people_char_7 people_char_8 people_char_9 people_char_10 people_char_11
## 1:            25             8             9              2              2
## 2:            25             8             9              2              2
##    people_char_12 people_char_13 people_char_14 people_char_15
## 1:              2              2              2              2
## 2:              2              2              2              2
##    people_char_16 people_char_17 people_char_18 people_char_19
## 1:              2              2              2              2
## 2:              2              2              2              2
##    people_char_20 people_char_21 people_char_22 people_char_23
## 1:              2              2              2              2
## 2:              2              2              2              2
##    people_char_24 people_char_25 people_char_26 people_char_27
## 1:              2              2              2              2
## 2:              2              2              2              2
##    people_char_28 people_char_29 people_char_30 people_char_31
## 1:              2              2              2              2
## 2:              2              2              2              2
##    people_char_32 people_char_33 people_char_34 people_char_35
## 1:              2              2              2              2
## 2:              2              2              2              2
##    people_char_36 people_char_37 people_char_38 activity_id activity_date
## 1:              2              2            101     1221794           411
## 2:              2              2             64      975497           410
##    activity_category activity_char_1 activity_char_2 activity_char_3
## 1:                 7              52              33              12
## 2:                 7              47              32              12
##    activity_char_4 activity_char_5 activity_char_6 activity_char_7
## 1:               8               8               6               9
## 2:               8               7               6               9
##    activity_char_8 activity_char_9 activity_char_10
## 1:              19              20             5315
## 2:              19              20             4733
```

Check if non blank activity values are recorded groupvise

```
for (ind in 2:10) {
    colname <- paste0("activity_char_", ind)
    if (sum((merged_raw$activity_char_1 != '') != (merged_raw[, colname, with=F] != '')) != 0) {
        print(paste("Non blank indices for activitiy_char_1 and activity_char", ind, "differ"))
    }
    else {
        print(paste("Non blank indices for activitiy_char_1 and activity_char", ind, "are equal"))
    }
}
```

```
## [1] "Non blank indices for activitiy_char_1 and activity_char 2 are equal"
## [1] "Non blank indices for activitiy_char_1 and activity_char 3 are equal"
## [1] "Non blank indices for activitiy_char_1 and activity_char 4 are equal"
## [1] "Non blank indices for activitiy_char_1 and activity_char 5 are equal"
## [1] "Non blank indices for activitiy_char_1 and activity_char 6 are equal"
## [1] "Non blank indices for activitiy_char_1 and activity_char 7 are equal"
## [1] "Non blank indices for activitiy_char_1 and activity_char 8 are equal"
## [1] "Non blank indices for activitiy_char_1 and activity_char 9 are equal"
## [1] "Non blank indices for activitiy_char_1 and activity_char 10 differ"
```

```
gc()
```

```
##            used  (Mb) gc trigger   (Mb)  max used   (Mb)
## Ncells  2965440 158.4    4555696  243.4   4555696  243.4
## Vcells 94444139 720.6  264901597 2021.1 350476676 2674.0
```

By the data specification it is said that, type 1 activities are different from type 2-7 activities in the sense that there are more known characteristics associated with type 1 activities (nine in total) than type 2-7 activities (which have only one associated characteristic)

Count value distribution for the activity categories

```
table(merged_raw$activity_category)
```

```
##
## type 1 type 2 type 3 type 4 type 5 type 6 type 7
## 157615 904683 429408 207465 490710   4253   3157
```

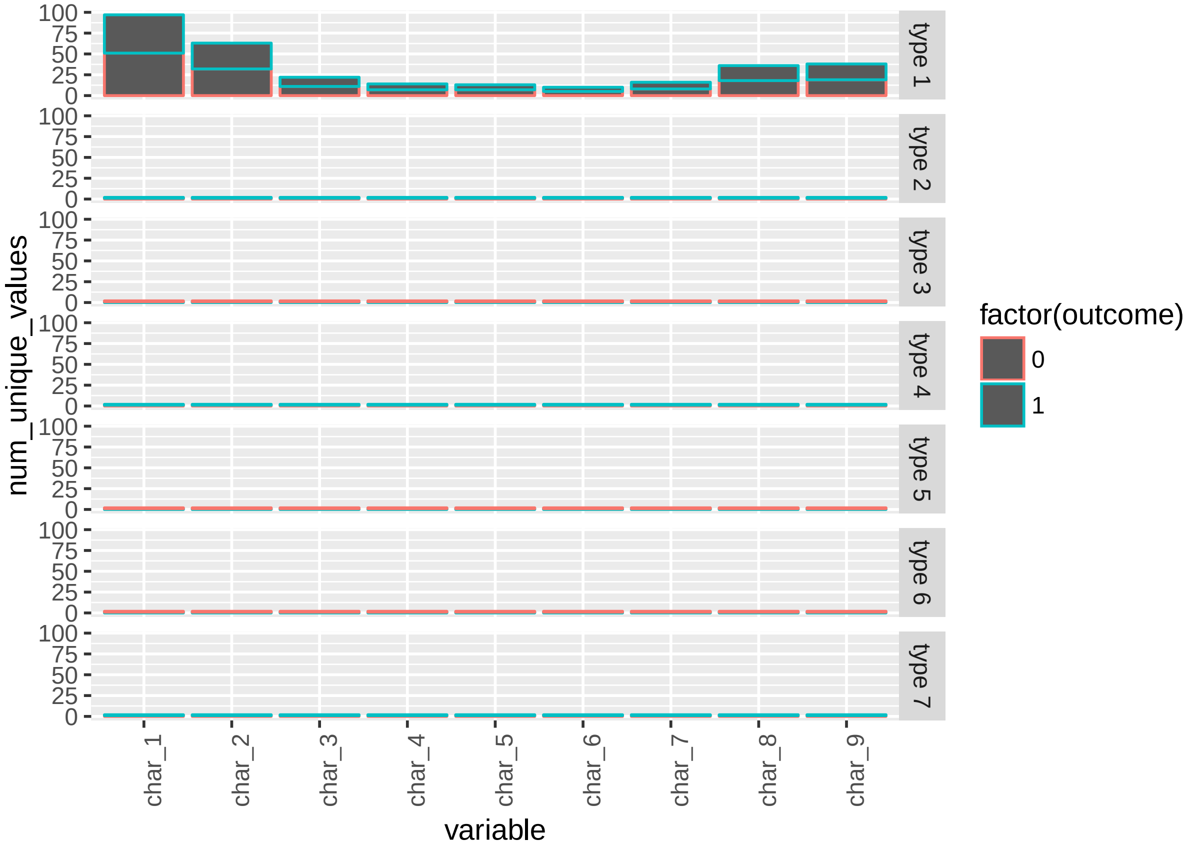
Number of unique values grouped by activity category

```
cols <- c(paste0('activity_char_', 1:9), 'activity_category', 'outcome')

activities_dt <- merged_raw[, cols, with=F]
dt <- activities_dt[
    , lapply(.SD, function(x) length(unique(x))), by=list(activity_category, outcome)]
colnames(dt) <- gsub('activity_', '', colnames(dt))

merge_cols <- colnames(dt)[which(!colnames(dt) %in% c('category', 'outcome'))]
long <- reshape(data=dt, varying=merge_cols,
                v.names='num_unique_values',
                timevar='variable', times=merge_cols, direction='long')

ggplot(data=long, aes(x=variable, y=num_unique_values, colour=factor(outcome))) +
    facet_grid(category ~ .) +
    theme(axis.text.x=element_text(angle=90, size=9)) +
    geom_bar(stat='identity') #+ coord_flip()
```



num_unique_values
100
75
50
25
0
type 1
type 2
type 3
type 4
type 5
type 6
type 7
char_1
char_2
char_3
char_4
char_5
char_6
char_7
char_8
char_9
variable
factor(outcome)
0
1