

# DMC@ISU: The 2015 Iowa State University Data Mining Cup Team

Creating Feature Matrix Version 0.1

Spring 2015, A Team as Strong as Steel

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Last Day: May 19, 2015

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I am using the following packages:

```
library(magrittr)
library(dplyr)
library(tidyr)
library(lubridate)
library(ggplot2)
library(rCharts)
library(xtable)
library(foreach)
library(gtools)
library(knitr)
library(utils)
source("~/dmc2015/ian/R/renm.R")
```

## 0.1 I am cleaning the original features

There are some things that I realized last night:

- `sim_ftd` and `sim_lnorm` are identical. They are just scaled versions of the same thing and we can drop them.
- We missed several files, either by their location or structure being problematic.
- We would all feel more comfortable if the orderIDs are on the data.

So I am recreating the feature matrices:

### 0.1.1 Universal Features

These are the files that I know contain universal features:

```
path.to.files = "../universal/individual/"
files = list.files(path.to.files)
cat(paste(files, collapse = "\n"))

## basePrice_price_ratio.rds
## basePrice_price_ratio2.rds
## ftd_invmax_similarity.rds
## ftd_ivf_similarity.rds
## ftd_lnorm_similarity.rds
## ftd_pif_similarity.rds
## item_price_basePrice_reward_long.rds
## item_price_basePrice_reward_wide.rds
## jaccard_similarity.rds
## lnorm_invmax_similarity.rds
## lnorm_ivf_similarity.rds
## lnorm_lnorm_similarity.rds
```

```
## lnorm_pif_similarity.rds
## order_match_class.rds
## peteCoupFreq.rds
## user_info.rds
## userTimeFeatures.rds
```

We can read each in as follows:

```
files = list.files("~/dmc2015/features/feature_files/universal/individual/",
  full.name = TRUE)
features = lapply(files, function(x) readRDS(x))
```

Keep in mind that long files have 20,166 rows and wide files have 6722 rows. Wide files should have columns identified as couponCol:

```
wideSet = c()
longSet = c()
noSet = c()
for (i in 1:length(features)) {
  if (nrow(features[[i]]) == 20166) {
    longSet = c(longSet, i)
  } else {
    if (nrow(features[[i]]) == 6722) {
      wideSet = c(wideSet, i)
    } else {
      noSet = c(noSet, i)
    }
  }
}
```

```
## wide format sets:
wideSet
```

```
## [1] 2 3 4 5 6 8 9 10 11 12 13 14 15 16 17
```

```
## long format sets:
longSet
```

```
## [1] 1 7
```

```
## no format sets:
noSet
```

```
## NULL
```

in this case, only the second set /Users/user/dmc2015/features/feature\_files/universal/individual//basePrice\_price\_ratio.rds  
/Users/user/dmc2015/features/feature\_files/universal/individual//item\_price\_basePrice\_reward\_long.rds  
is long, and it is kind of broken:

```
badlong = grep("basePrice_price_ratio.rds", files)
features[[badlong]] %>% head
```

```
##   orderID bPr2pr_ratio1 bPr2pr_ratio2 bPr2pr_ratio3 bPr2pr_approx_ratio1
## 1      1      1.6666667          NA          NA          1.7
## 2      1          NA      0.1098266          NA          NA
## 3      1          NA          NA      1.0000000          NA
## 4      2      0.6853448          NA          NA          0.7
```

```
## 5      2      NA      0.5000000      NA      NA
## 6      2      NA      NA      0.01542416      NA
##   bPr2pr_approx_ratio2 bPr2pr_approx_ratio3
## 1      NA      NA
## 2      0.1      NA
## 3      NA      1
## 4      NA      NA
## 5      0.5      NA
## 6      NA      0
```

so I will just convert the long format.

```
features[[badlong]] = features[[badlong]] %>% gather(columnName, value, -orderID) %>%
  filter(!is.na(value)) %>% mutate(varName = gsub("ratio[0-9]", "ratio", columnName)) %>%
  mutate(couponCol = 1 * grepl("ratio1", columnName) + 2 * grepl("ratio2",
    columnName) + 3 * grepl("ratio3", columnName)) %>% select(-columnName) %>%
  spread(varName, value) %>% arrange(orderID, couponCol)
```

### Combine Wide Sets:

```
wideFrame = features[[wideSet[1]]] %>% select(orderID)
for (x in wideSet) {
  dsn.i = features[[x]]
  dropCols = which(names(dsn.i) %in% names(wideFrame) & names(dsn.i) != "orderID")
  if (length(dropCols) == 0) {
    wideFrame = wideFrame %>% left_join(dsn.i, by = "orderID")
  } else {
    wideFrame = wideFrame %>% left_join(dsn.i[, -dropCols], by = "orderID")
  }
}
names(wideFrame) = gsub("cos\\.sim", "cosSim", names(wideFrame))
names(wideFrame) = gsub("([np])Coup(\\d)(Col\\d)", "\\1times\\3_\\2", names(wideFrame))
names(wideFrame) = gsub("(\\.^[^_0-9])(\\d+)$", "\\1_\\2", names(wideFrame))
wideFrame = wideFrame[, which(!grepl("sim_lnorm_.*_", names(wideFrame)))]
```

### Long Version

We can also convert this set to the long format. Notice that not all of the files are the same “wide” as others, but we would still like to use them:

```
coln = names(wideFrame)
non_numbered_cols = which(!grepl("_\\d+$", coln))
coupon1_cols = c(1, grep("_\\d*1\\d*$", coln))
coupon2_cols = c(1, grep("_\\d*2\\d*$", coln))
coupon3_cols = c(1, grep("_\\d*3\\d*$", coln))

## coupon 1
coupon1 = wideFrame[, coupon1_cols]
names(coupon1) = gsub("_13$", "_to3Col", names(coupon1))
names(coupon1) = gsub("_12$", "_to2Col", names(coupon1))
names(coupon1) = gsub("_1$", "", names(coupon1))
coupon1$couponCol = 1

## coupon 2
coupon2 = wideFrame[, coupon2_cols]
```

```
names(coupon2) = gsub("_23$", "_to3Col", names(coupon2))
names(coupon2) = gsub("_12$", "_to1Col", names(coupon2))
names(coupon2) = gsub("_2$", "", names(coupon2))
coupon2$couponCol = 2

## coupon 3
coupon3 = wideFrame[, coupon3_cols]
names(coupon3) = gsub("_23$", "_to2Col", names(coupon3))
names(coupon3) = gsub("_13$", "_to1Col", names(coupon3))
names(coupon3) = gsub("_3$", "", names(coupon3))
coupon3$couponCol = 3

coupons = bind_rows(coupon1, coupon2, coupon3) %>% arrange(orderID, couponCol)
for (i in grep("_to2Col", names(coupons))) coupons[is.na(coupons[, i]) & coupons$couponCol ==
  2, i] = 1
for (i in grep("_to1Col", names(coupons))) coupons[is.na(coupons[, i]) & coupons$couponCol ==
  1, i] = 1
for (i in grep("_to3Col", names(coupons))) coupons[is.na(coupons[, i]) & coupons$couponCol ==
  3, i] = 1

names(coupons)[grep("_to\\dCol", names(coupons))]

## [1] "sim_ftd_invmax_cosSim_to2Col" "sim_ftd_invmax_cosSim_to3Col"
## [3] "sim_ftd_ivf_cosSim_to2Col"    "sim_ftd_ivf_cosSim_to3Col"
## [5] "sim_ftd_lnorm_cosSim_to2Col"  "sim_ftd_lnorm_cosSim_to3Col"
## [7] "sim_ftd_pif_cosSim_to2Col"    "sim_ftd_pif_cosSim_to3Col"
## [9] "jaccard_to2Col"               "jaccard_to3Col"
## [11] "sim_ftd_invmax_cosSim_to1Col" "sim_ftd_ivf_cosSim_to1Col"
## [13] "sim_ftd_lnorm_cosSim_to1Col"  "sim_ftd_pif_cosSim_to1Col"
## [15] "jaccard_to1Col"

coupons$sim_ftd_invmax_cosSim_mean = apply(coupons[, grep("sim_ftd_invmax",
  names(coupons))], 1, mean)
coupons$sim_ftd_ivf_cosSim_mean = apply(coupons[, grep("sim_ftd_ivf", names(coupons))],
  1, mean)
coupons$sim_ftd_lnorm_cosSim_mean = apply(coupons[, grep("sim_ftd_lnorm", names(coupons))],
  1, mean)
coupons$sim_ftd_pif_cosSim_mean = apply(coupons[, grep("sim_ftd_pif", names(coupons))],
  1, mean)
coupons$sim_jaccard_mean = apply(coupons[, grep("jaccard", names(coupons))],
  1, mean)

longFrame = wideFrame[, non_numbered_cols] %>% left_join(coupons, by = "orderID") %>%
  arrange(orderID, couponCol)

and we can add a few nice variables to the matrices:

wideFrame[, "sim_ftd_ivf_mean"] = rowMeans(wideFrame[, grep("sim_ftd_ivf", names(wideFrame))])
wideFrame[, "sim_ftd_lnorm_mean"] = rowMeans(wideFrame[, grep("sim_ftd_lnorm",
  names(wideFrame))])
wideFrame[, "sim_ftd_pif_mean"] = rowMeans(wideFrame[, grep("sim_ftd_pif", names(wideFrame))])
wideFrame[, "sim_ftd_invmax_mean"] = rowMeans(wideFrame[, grep("sim_ftd_invmax",
  names(wideFrame))])

names(longFrame)[sapply(1:ncol(longFrame), function(i) sum(is.na(longFrame[,
  i])) > 0)]
```

```
## [1] "time_lastVisit" "avgTime_visit" "var_visit"
## [4] "medianTime_visit" "maxTime_visit" "minTime_visit"
```

### Check Universal Features

We can check the final results:

```
dim(wideFrame)

## [1] 6722 176

dim(longFrame)

## [1] 20166 106
```

### Save Universal

These are our universal features:

```
saveRDS(wideFrame, file = "../universal/combined/universalFeaturesCombined_wide.rds")
saveRDS(longFrame, file = "../universal/combined/universalFeaturesCombined_long.rds")
```

## 0.2 Feature Matrix for Set 1

Again we need to read in the files. In addition to the llrs we have:

```
path.to.files = "../set1/individual/"
files = list.files(path.to.files, full.name = TRUE)
cat(paste(files, collapse = "\n"))

## ../set1/individual//clean_coupon_used_wide.rds
## ../set1/individual//HTVmelt1_Combn_UniqueUser.rds
## ../set1/individual//llrs
```

We repeat the process of creating the wide set and then the long set: We can read each in as follows:

```
path.to.files = "../set1/individual/"
path.to.llrs = "../set1/individual/llrs/"
files = c(list.files(path.to.files, pattern = ".rds", full.name = TRUE), list.files(path.to.llrs,
  pattern = "wide", full.name = TRUE))
features = lapply(files, function(x) readRDS(x))

# make one set of adjustments
features[[2]] = do.call("rbind", features[[2]])
```

Keep in mind that long files have 20,166 rows and wide files have 6722 rows. Wide files should have columns identified as couponCol:

```
wideSet = c()
longSet = c()
noSet = c()
for (i in 1:length(features)) {
  if (nrow(features[[i]]) == 20166) {
    longSet = c(longSet, i)
  } else {
    if (nrow(features[[i]]) == 6722) {
      wideSet = c(wideSet, i)
    }
  }
}
```

```

    } else {
      noSet = c(noSet, i)
    }
  }
}

## wide format sets:
wideSet

## [1] 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
## [18] 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
## [35] 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
## [52] 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70
## [69] 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87
## [86] 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104
## [103] 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121
## [120] 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138
## [137] 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155
## [154] 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172
## [171] 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189
## [188] 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206
## [205] 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223
## [222] 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240
## [239] 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257
## [256] 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274
## [273] 275 276 277 278

## long format sets:
longSet

## NULL

## no format sets:
noSet

## [1] 1 2

```

in this case, sets ../set1/individual//clean\_coupon\_used\_wide.rds, ../set1/individual//HTVmelt1\_Combn\_UniqueUser.rds have no proper place. We can figure out why this is by doing the following:

```

features[[noSet[1]]] %>% names

## [1] "orderID"          "nCoupon1Used"    "pCoupon1Used"    "nCoup1Col1Used"
## [5] "nCoup1Col2Used"   "nCoup1Col3Used"   "pCoup1Col1Used"   "pCoup1Col2Used"
## [9] "pCoup1Col3Used"   "pCoupon1in1"      "nCoupon2Used"     "pCoupon2Used"
## [13] "nCoup2Col1Used"   "nCoup2Col2Used"   "nCoup2Col3Used"   "pCoup2Col1Used"
## [17] "pCoup2Col2Used"   "pCoup2Col3Used"   "pCoupon2in2"       "nCoupon3Used"
## [21] "pCoupon3Used"     "nCoup3Col1Used"   "nCoup3Col2Used"   "nCoup3Col3Used"
## [25] "pCoup3Col1Used"   "pCoup3Col2Used"   "pCoup3Col3Used"   "pCoupon3in3"

```

The first set appears to be wide and should join well. All of the NAs would be in the historical rows and wouldn't make their way to our feature matrix.

```

features[[noSet[2]]] %>% names

```

```
## [1] "orderID"
## [2] "orderTime"
## [3] "userID"
## [4] "couponsReceived"
## [5] "basketValue"
## [6] "couponsReceivedDate"
## [7] "couponsReceivedTime"
## [8] "couponsReceivedDoW"
## [9] "couponsReceivedWeekend"
## [10] "couponsReceivedFriSat"
## [11] "orderTimeDate"
## [12] "orderTimeTime"
## [13] "orderTimeDoW"
## [14] "orderTimeWeekend"
## [15] "orderTimeFriSat"
## [16] "batchID"
## [17] "couponsExpire"
## [18] "couponsSent"
## [19] "TimeBtwnSentRec"
## [20] "TimeBtwnRecExpire"
## [21] "TimeBtwnRecOrder"
## [22] "TimeBtwnOrderExpire"
## [23] "couponID"
## [24] "price"
## [25] "basePrice"
## [26] "reward"
## [27] "premiumProduct"
## [28] "brand"
## [29] "productGroup"
## [30] "categoryIDs"
## [31] "couponUsed"
## [32] "couponCol"
## [33] "TimeBtwnRecOrder_disc"
## [34] "ratio_bp_p"
## [35] "ratio_bp_p_round"
## [36] "couponID_nUser"
## [37] "couponID_nUserUsed"
## [38] "couponID_Twice"
## [39] "couponID_prob"
## [40] "couponsReceivedTime_nUser"
## [41] "couponsReceivedTime_nUserUsed"
## [42] "couponsReceivedTime_Twice"
## [43] "couponsReceivedTime_prob"
## [44] "couponsReceivedDoW_nUser"
## [45] "couponsReceivedDoW_nUserUsed"
## [46] "couponsReceivedDoW_prob"
## [47] "orderTimeTime_nUser"
## [48] "orderTimeTime_nUserUsed"
## [49] "orderTimeTime_Twice"
## [50] "orderTimeTime_prob"
## [51] "orderTimeDoW_nUser"
## [52] "orderTimeDoW_nUserUsed"
## [53] "orderTimeDoW_prob"
## [54] "TimeBtwnRecOrder_disc_nUser"
```

```
## [55] "TimeBtwnRecOrder_disc_nUserUsed"
## [56] "TimeBtwnRecOrder_disc_Twice"
## [57] "TimeBtwnRecOrder_disc_prob"
## [58] "price_nUser"
## [59] "price_nUserUsed"
## [60] "price_Twice"
## [61] "price_prob"
## [62] "basePrice_nUser"
## [63] "basePrice_nUserUsed"
## [64] "basePrice_Twice"
## [65] "basePrice_prob"
## [66] "productGroup_nUser"
## [67] "productGroup_nUserUsed"
## [68] "productGroup_Twice"
## [69] "productGroup_prob"
## [70] "categoryIDs_nUser"
## [71] "categoryIDs_nUserUsed"
## [72] "categoryIDs_Twice"
## [73] "categoryIDs_prob"
## [74] "ratio_bp_p_round_nUser"
## [75] "ratio_bp_p_round_nUserUsed"
## [76] "ratio_bp_p_round_Twice"
## [77] "ratio_bp_p_round_prob"
## [78] "reward_couponsReceivedTime_nUser"
## [79] "reward_couponsReceivedTime_nUserUsed"
## [80] "reward_couponsReceivedTime_Twice"
## [81] "reward_couponsReceivedTime_prob"
## [82] "reward_couponsReceivedDoW_nUser"
## [83] "reward_couponsReceivedDoW_nUserUsed"
## [84] "reward_couponsReceivedDoW_Twice"
## [85] "reward_couponsReceivedDoW_prob"
## [86] "reward_orderTimeTime_nUser"
## [87] "reward_orderTimeTime_nUserUsed"
## [88] "reward_orderTimeTime_Twice"
## [89] "reward_orderTimeTime_prob"
## [90] "reward_orderTimeDoW_nUser"
## [91] "reward_orderTimeDoW_nUserUsed"
## [92] "reward_orderTimeDoW_Twice"
## [93] "reward_orderTimeDoW_prob"
## [94] "reward_TimeBtwnRecOrder_disc_nUser"
## [95] "reward_TimeBtwnRecOrder_disc_nUserUsed"
## [96] "reward_TimeBtwnRecOrder_disc_Twice"
## [97] "reward_TimeBtwnRecOrder_disc_prob"
## [98] "reward_price_nUser"
## [99] "reward_price_nUserUsed"
## [100] "reward_price_Twice"
## [101] "reward_price_prob"
## [102] "reward_basePrice_nUser"
## [103] "reward_basePrice_nUserUsed"
## [104] "reward_basePrice_Twice"
## [105] "reward_basePrice_prob"
## [106] "reward_productGroup_nUser"
## [107] "reward_productGroup_nUserUsed"
## [108] "reward_productGroup_Twice"
```



```
## [109] "reward_productGroup_prob"
## [110] "reward_categoryIDs_nUser"
## [111] "reward_categoryIDs_nUserUsed"
## [112] "reward_categoryIDs_Twice"
## [113] "reward_categoryIDs_prob"
## [114] "reward_ratio_bp_p_round_nUser"
## [115] "reward_ratio_bp_p_round_nUserUsed"
## [116] "reward_ratio_bp_p_round_Twice"
## [117] "reward_ratio_bp_p_round_prob"
## [118] "reward_brand_nUser"
## [119] "reward_brand_nUserUsed"
## [120] "reward_brand_Twice"
## [121] "reward_brand_prob"
## [122] "reward_premiumProduct_nUser"
## [123] "reward_premiumProduct_nUserUsed"
## [124] "reward_premiumProduct_Twice"
## [125] "reward_premiumProduct_prob"
## [126] "couponID_couponsReceivedTime_nUserUsed"
## [127] "couponID_couponsReceivedTime_Twice"
## [128] "couponID_couponsReceivedTime_prob"
## [129] "couponID_couponsReceivedDoW_nUser"
## [130] "couponID_couponsReceivedDoW_nUserUsed"
## [131] "couponID_couponsReceivedDoW_Twice"
## [132] "couponID_couponsReceivedDoW_prob"
## [133] "couponID_orderTimeTime_nUserUsed"
## [134] "couponID_orderTimeTime_prob"
## [135] "couponID_orderTimeDoW_nUser"
## [136] "couponID_orderTimeDoW_nUserUsed"
## [137] "couponID_orderTimeDoW_Twice"
## [138] "couponID_orderTimeDoW_prob"
## [139] "couponID_TimeBtwnRecOrder_disc_nUser"
## [140] "couponID_TimeBtwnRecOrder_disc_nUserUsed"
## [141] "couponID_TimeBtwnRecOrder_disc_Twice"
## [142] "couponID_TimeBtwnRecOrder_disc_prob"
## [143] "couponsReceivedTime_couponsReceivedDoW_nUser"
## [144] "couponsReceivedTime_couponsReceivedDoW_nUserUsed"
## [145] "couponsReceivedTime_couponsReceivedDoW_Twice"
## [146] "couponsReceivedTime_couponsReceivedDoW_prob"
## [147] "couponsReceivedTime_orderTimeTime_nUserUsed"
## [148] "couponsReceivedTime_orderTimeTime_Twice"
## [149] "couponsReceivedTime_orderTimeTime_prob"
## [150] "couponsReceivedTime_orderTimeDoW_nUser"
## [151] "couponsReceivedTime_orderTimeDoW_nUserUsed"
## [152] "couponsReceivedTime_orderTimeDoW_Twice"
## [153] "couponsReceivedTime_orderTimeDoW_prob"
## [154] "couponsReceivedTime_TimeBtwnRecOrder_disc_nUser"
## [155] "couponsReceivedTime_TimeBtwnRecOrder_disc_nUserUsed"
## [156] "couponsReceivedTime_TimeBtwnRecOrder_disc_Twice"
## [157] "couponsReceivedTime_TimeBtwnRecOrder_disc_prob"
## [158] "couponsReceivedTime_price_nUser"
## [159] "couponsReceivedTime_price_nUserUsed"
## [160] "couponsReceivedTime_price_Twice"
## [161] "couponsReceivedTime_price_prob"
## [162] "couponsReceivedTime_basePrice_nUser"
```

```
## [163] "couponsReceivedTime_basePrice_nUserUsed"
## [164] "couponsReceivedTime_basePrice_Twice"
## [165] "couponsReceivedTime_basePrice_prob"
## [166] "couponsReceivedTime_productGroup_nUser"
## [167] "couponsReceivedTime_productGroup_nUserUsed"
## [168] "couponsReceivedTime_productGroup_Twice"
## [169] "couponsReceivedTime_productGroup_prob"
## [170] "couponsReceivedTime_categoryIDs_nUser"
## [171] "couponsReceivedTime_categoryIDs_nUserUsed"
## [172] "couponsReceivedTime_categoryIDs_Twice"
## [173] "couponsReceivedTime_categoryIDs_prob"
## [174] "couponsReceivedTime_ratio_bp_p_round_nUser"
## [175] "couponsReceivedTime_ratio_bp_p_round_nUserUsed"
## [176] "couponsReceivedTime_ratio_bp_p_round_Twice"
## [177] "couponsReceivedTime_ratio_bp_p_round_prob"
## [178] "couponsReceivedTime_brand_nUser"
## [179] "couponsReceivedTime_brand_nUserUsed"
## [180] "couponsReceivedTime_brand_Twice"
## [181] "couponsReceivedTime_brand_prob"
## [182] "couponsReceivedTime_premiumProduct_nUser"
## [183] "couponsReceivedTime_premiumProduct_nUserUsed"
## [184] "couponsReceivedTime_premiumProduct_Twice"
## [185] "couponsReceivedTime_premiumProduct_prob"
## [186] "couponsReceivedDoW_orderTimeTime_nUser"
## [187] "couponsReceivedDoW_orderTimeTime_nUserUsed"
## [188] "couponsReceivedDoW_orderTimeTime_Twice"
## [189] "couponsReceivedDoW_orderTimeTime_prob"
## [190] "couponsReceivedDoW_orderTimeDoW_nUser"
## [191] "couponsReceivedDoW_orderTimeDoW_nUserUsed"
## [192] "couponsReceivedDoW_orderTimeDoW_Twice"
## [193] "couponsReceivedDoW_orderTimeDoW_prob"
## [194] "couponsReceivedDoW_TimeBtwnRecOrder_disc_nUser"
## [195] "couponsReceivedDoW_TimeBtwnRecOrder_disc_nUserUsed"
## [196] "couponsReceivedDoW_TimeBtwnRecOrder_disc_Twice"
## [197] "couponsReceivedDoW_TimeBtwnRecOrder_disc_prob"
## [198] "couponsReceivedDoW_price_nUser"
## [199] "couponsReceivedDoW_price_nUserUsed"
## [200] "couponsReceivedDoW_price_Twice"
## [201] "couponsReceivedDoW_price_prob"
## [202] "couponsReceivedDoW_basePrice_nUser"
## [203] "couponsReceivedDoW_basePrice_nUserUsed"
## [204] "couponsReceivedDoW_basePrice_Twice"
## [205] "couponsReceivedDoW_basePrice_prob"
## [206] "couponsReceivedDoW_productGroup_nUser"
## [207] "couponsReceivedDoW_productGroup_nUserUsed"
## [208] "couponsReceivedDoW_productGroup_Twice"
## [209] "couponsReceivedDoW_productGroup_prob"
## [210] "couponsReceivedDoW_categoryIDs_nUser"
## [211] "couponsReceivedDoW_categoryIDs_nUserUsed"
## [212] "couponsReceivedDoW_categoryIDs_Twice"
## [213] "couponsReceivedDoW_categoryIDs_prob"
## [214] "couponsReceivedDoW_ratio_bp_p_round_nUser"
## [215] "couponsReceivedDoW_ratio_bp_p_round_nUserUsed"
## [216] "couponsReceivedDoW_ratio_bp_p_round_Twice"
```

```
## [217] "couponsReceivedDoW_ratio_bp_p_round_prob"
## [218] "couponsReceivedDoW_brand_nUser"
## [219] "couponsReceivedDoW_brand_nUserUsed"
## [220] "couponsReceivedDoW_brand_Twice"
## [221] "couponsReceivedDoW_brand_prob"
## [222] "couponsReceivedDoW_premiumProduct_nUser"
## [223] "couponsReceivedDoW_premiumProduct_nUserUsed"
## [224] "couponsReceivedDoW_premiumProduct_prob"
## [225] "orderTimeTime_orderTimeDoW_nUser"
## [226] "orderTimeTime_orderTimeDoW_nUserUsed"
## [227] "orderTimeTime_orderTimeDoW_Twice"
## [228] "orderTimeTime_orderTimeDoW_prob"
## [229] "orderTimeTime_TimeBtwnRecOrder_disc_nUser"
## [230] "orderTimeTime_TimeBtwnRecOrder_disc_nUserUsed"
## [231] "orderTimeTime_TimeBtwnRecOrder_disc_Twice"
## [232] "orderTimeTime_TimeBtwnRecOrder_disc_prob"
## [233] "orderTimeTime_price_nUser"
## [234] "orderTimeTime_price_nUserUsed"
## [235] "orderTimeTime_price_Twice"
## [236] "orderTimeTime_price_prob"
## [237] "orderTimeTime_basePrice_nUser"
## [238] "orderTimeTime_basePrice_nUserUsed"
## [239] "orderTimeTime_basePrice_Twice"
## [240] "orderTimeTime_basePrice_prob"
## [241] "orderTimeTime_productGroup_nUser"
## [242] "orderTimeTime_productGroup_nUserUsed"
## [243] "orderTimeTime_productGroup_Twice"
## [244] "orderTimeTime_productGroup_prob"
## [245] "orderTimeTime_categoryIDs_nUser"
## [246] "orderTimeTime_categoryIDs_nUserUsed"
## [247] "orderTimeTime_categoryIDs_Twice"
## [248] "orderTimeTime_categoryIDs_prob"
## [249] "orderTimeTime_ratio_bp_p_round_nUser"
## [250] "orderTimeTime_ratio_bp_p_round_nUserUsed"
## [251] "orderTimeTime_ratio_bp_p_round_Twice"
## [252] "orderTimeTime_ratio_bp_p_round_prob"
## [253] "orderTimeTime_brand_nUser"
## [254] "orderTimeTime_brand_nUserUsed"
## [255] "orderTimeTime_brand_Twice"
## [256] "orderTimeTime_brand_prob"
## [257] "orderTimeTime_premiumProduct_nUser"
## [258] "orderTimeTime_premiumProduct_nUserUsed"
## [259] "orderTimeTime_premiumProduct_Twice"
## [260] "orderTimeTime_premiumProduct_prob"
## [261] "orderTimeDoW_TimeBtwnRecOrder_disc_nUser"
## [262] "orderTimeDoW_TimeBtwnRecOrder_disc_nUserUsed"
## [263] "orderTimeDoW_TimeBtwnRecOrder_disc_Twice"
## [264] "orderTimeDoW_TimeBtwnRecOrder_disc_prob"
## [265] "orderTimeDoW_price_nUser"
## [266] "orderTimeDoW_price_nUserUsed"
## [267] "orderTimeDoW_price_Twice"
## [268] "orderTimeDoW_price_prob"
## [269] "orderTimeDoW_basePrice_nUser"
## [270] "orderTimeDoW_basePrice_nUserUsed"
```

```
## [271] "orderTimeDoW_basePrice_Twice"
## [272] "orderTimeDoW_basePrice_prob"
## [273] "orderTimeDoW_productGroup_nUser"
## [274] "orderTimeDoW_productGroup_nUserUsed"
## [275] "orderTimeDoW_productGroup_Twice"
## [276] "orderTimeDoW_productGroup_prob"
## [277] "orderTimeDoW_categoryIDs_nUser"
## [278] "orderTimeDoW_categoryIDs_nUserUsed"
## [279] "orderTimeDoW_categoryIDs_Twice"
## [280] "orderTimeDoW_categoryIDs_prob"
## [281] "orderTimeDoW_ratio_bp_p_round_nUser"
## [282] "orderTimeDoW_ratio_bp_p_round_nUserUsed"
## [283] "orderTimeDoW_ratio_bp_p_round_Twice"
## [284] "orderTimeDoW_ratio_bp_p_round_prob"
## [285] "orderTimeDoW_brand_nUser"
## [286] "orderTimeDoW_brand_nUserUsed"
## [287] "orderTimeDoW_brand_Twice"
## [288] "orderTimeDoW_brand_prob"
## [289] "orderTimeDoW_premiumProduct_nUser"
## [290] "orderTimeDoW_premiumProduct_nUserUsed"
## [291] "orderTimeDoW_premiumProduct_prob"
## [292] "TimeBtwnRecOrder_disc_price_nUser"
## [293] "TimeBtwnRecOrder_disc_price_nUserUsed"
## [294] "TimeBtwnRecOrder_disc_price_Twice"
## [295] "TimeBtwnRecOrder_disc_price_prob"
## [296] "TimeBtwnRecOrder_disc_basePrice_nUser"
## [297] "TimeBtwnRecOrder_disc_basePrice_nUserUsed"
## [298] "TimeBtwnRecOrder_disc_basePrice_Twice"
## [299] "TimeBtwnRecOrder_disc_basePrice_prob"
## [300] "TimeBtwnRecOrder_disc_productGroup_nUser"
## [301] "TimeBtwnRecOrder_disc_productGroup_nUserUsed"
## [302] "TimeBtwnRecOrder_disc_productGroup_Twice"
## [303] "TimeBtwnRecOrder_disc_productGroup_prob"
## [304] "TimeBtwnRecOrder_disc_categoryIDs_nUser"
## [305] "TimeBtwnRecOrder_disc_categoryIDs_nUserUsed"
## [306] "TimeBtwnRecOrder_disc_categoryIDs_Twice"
## [307] "TimeBtwnRecOrder_disc_categoryIDs_prob"
## [308] "TimeBtwnRecOrder_disc_ratio_bp_p_round_nUser"
## [309] "TimeBtwnRecOrder_disc_ratio_bp_p_round_nUserUsed"
## [310] "TimeBtwnRecOrder_disc_ratio_bp_p_round_Twice"
## [311] "TimeBtwnRecOrder_disc_ratio_bp_p_round_prob"
## [312] "TimeBtwnRecOrder_disc_brand_nUser"
## [313] "TimeBtwnRecOrder_disc_brand_nUserUsed"
## [314] "TimeBtwnRecOrder_disc_brand_Twice"
## [315] "TimeBtwnRecOrder_disc_brand_prob"
## [316] "TimeBtwnRecOrder_disc_premiumProduct_nUser"
## [317] "TimeBtwnRecOrder_disc_premiumProduct_nUserUsed"
## [318] "TimeBtwnRecOrder_disc_premiumProduct_Twice"
## [319] "TimeBtwnRecOrder_disc_premiumProduct_prob"
## [320] "price_basePrice_nUser"
## [321] "price_basePrice_nUserUsed"
## [322] "price_basePrice_Twice"
## [323] "price_basePrice_prob"
## [324] "price_productGroup_nUser"
```

```
## [325] "price_productGroup_nUserUsed"
## [326] "price_productGroup_Twice"
## [327] "price_productGroup_prob"
## [328] "price_categoryIDs_nUser"
## [329] "price_categoryIDs_nUserUsed"
## [330] "price_categoryIDs_Twice"
## [331] "price_categoryIDs_prob"
## [332] "price_ratio_bp_p_round_nUser"
## [333] "price_ratio_bp_p_round_nUserUsed"
## [334] "price_ratio_bp_p_round_Twice"
## [335] "price_ratio_bp_p_round_prob"
## [336] "price_brand_nUser"
## [337] "price_brand_nUserUsed"
## [338] "price_brand_Twice"
## [339] "price_brand_prob"
## [340] "price_premiumProduct_nUser"
## [341] "price_premiumProduct_nUserUsed"
## [342] "price_premiumProduct_Twice"
## [343] "price_premiumProduct_prob"
## [344] "basePrice_productGroup_nUser"
## [345] "basePrice_productGroup_nUserUsed"
## [346] "basePrice_productGroup_Twice"
## [347] "basePrice_productGroup_prob"
## [348] "basePrice_categoryIDs_nUser"
## [349] "basePrice_categoryIDs_nUserUsed"
## [350] "basePrice_categoryIDs_Twice"
## [351] "basePrice_categoryIDs_prob"
## [352] "basePrice_ratio_bp_p_round_nUser"
## [353] "basePrice_ratio_bp_p_round_nUserUsed"
## [354] "basePrice_ratio_bp_p_round_Twice"
## [355] "basePrice_ratio_bp_p_round_prob"
## [356] "basePrice_brand_nUser"
## [357] "basePrice_brand_nUserUsed"
## [358] "basePrice_brand_Twice"
## [359] "basePrice_brand_prob"
## [360] "basePrice_premiumProduct_nUser"
## [361] "basePrice_premiumProduct_nUserUsed"
## [362] "basePrice_premiumProduct_Twice"
## [363] "basePrice_premiumProduct_prob"
## [364] "productGroup_categoryIDs_nUser"
## [365] "productGroup_categoryIDs_nUserUsed"
## [366] "productGroup_categoryIDs_Twice"
## [367] "productGroup_categoryIDs_prob"
## [368] "productGroup_ratio_bp_p_round_nUser"
## [369] "productGroup_ratio_bp_p_round_nUserUsed"
## [370] "productGroup_ratio_bp_p_round_Twice"
## [371] "productGroup_ratio_bp_p_round_prob"
## [372] "productGroup_brand_nUser"
## [373] "productGroup_brand_nUserUsed"
## [374] "productGroup_brand_Twice"
## [375] "productGroup_brand_prob"
## [376] "productGroup_premiumProduct_nUser"
## [377] "productGroup_premiumProduct_nUserUsed"
## [378] "productGroup_premiumProduct_Twice"
```

```
## [379] "productGroup_premiumProduct_prob"
## [380] "categoryIDs_ratio_bp_p_round_nUser"
## [381] "categoryIDs_ratio_bp_p_round_nUserUsed"
## [382] "categoryIDs_ratio_bp_p_round_Twice"
## [383] "categoryIDs_ratio_bp_p_round_prob"
## [384] "categoryIDs_brand_nUser"
## [385] "categoryIDs_brand_nUserUsed"
## [386] "categoryIDs_brand_Twice"
## [387] "categoryIDs_brand_prob"
## [388] "categoryIDs_premiumProduct_nUser"
## [389] "categoryIDs_premiumProduct_nUserUsed"
## [390] "categoryIDs_premiumProduct_Twice"
## [391] "categoryIDs_premiumProduct_prob"
## [392] "ratio_bp_p_round_brand_nUser"
## [393] "ratio_bp_p_round_brand_nUserUsed"
## [394] "ratio_bp_p_round_brand_Twice"
## [395] "ratio_bp_p_round_brand_prob"
## [396] "ratio_bp_p_round_premiumProduct_nUser"
## [397] "ratio_bp_p_round_premiumProduct_nUserUsed"
## [398] "ratio_bp_p_round_premiumProduct_Twice"
## [399] "ratio_bp_p_round_premiumProduct_prob"
## [400] "brand_premiumProduct_nUser"
## [401] "brand_premiumProduct_nUserUsed"
## [402] "brand_premiumProduct_Twice"
## [403] "brand_premiumProduct_prob"
```

The second set appears to be long, so I will just convert the long format.

```
badlong = noSet[2]
features[[badlong]] = features[[badlong]][, -(2:31)] %>% gather(columnName,
  value, -orderID, -couponCol) %>% mutate(varName = paste0(columnName, "_",
  couponCol)) %>% select(orderID, varName, value) %>% spread(varName, value) %>%
  arrange(orderID)
```

### Combine Wide Sets:

```
wideFrame = features[[badlong]]
for (x in wideSet) {
  dsn.i = features[[x]]
  dropCols = which(names(dsn.i) %in% names(wideFrame) & names(dsn.i) != "orderID")
  if (length(dropCols) == 0) {
    wideFrame = wideFrame %>% full_join(dsn.i, by = "orderID")
  } else {
    wideFrame = wideFrame %>% full_join(dsn.i[, -dropCols], by = "orderID")
  }
}
names(wideFrame) = gsub("_[Cc]ol(\\d+)$", "_\\1", names(wideFrame))
names(wideFrame) = gsub("(^.*[^_0-9])(\\d+)$", "\\1_\\2", names(wideFrame))
wideFrame = wideFrame[, which(!grepl("times(N*o*t*)Used*_", names(wideFrame)))]
```

### Long Version

We can also convert this set to the long format. Notice that not all of the files are the same “wide” as others, but we would still like to use them:

```
coln = names(wideFrame)
non_numbered_cols = which(!grepl("_\\d+$", coln))
coupon1_cols = c(1, grep("_(\\d*)1(\\d*)$", coln))
coupon2_cols = c(1, grep("_(\\d*)2(\\d*)$", coln))
coupon3_cols = c(1, grep("_(\\d*)3(\\d*)$", coln))

## coupon 1
coupon1 = wideFrame[, coupon1_cols]
names(coupon1) = gsub("_13$", "_to3Col", names(coupon1))
names(coupon1) = gsub("_12$", "_to2Col", names(coupon1))
names(coupon1) = gsub("_1$", "", names(coupon1))
coupon1$couponCol = 1

## coupon 2
coupon2 = wideFrame[, coupon2_cols]
names(coupon2) = gsub("_23$", "_to3Col", names(coupon2))
names(coupon2) = gsub("_12$", "_to1Col", names(coupon2))
names(coupon2) = gsub("_2$", "", names(coupon2))
coupon2$couponCol = 2

## coupon 3
coupon3 = wideFrame[, coupon3_cols]
names(coupon3) = gsub("_23$", "_to2Col", names(coupon3))
names(coupon3) = gsub("_13$", "_to3Col", names(coupon3))
names(coupon3) = gsub("_3$", "", names(coupon3))
coupon3$couponCol = 3

coupons = bind_rows(coupon1, coupon2, coupon3)

longFrame = coupons %>% arrange(orderID, couponCol)
```

### Check Universal Features

We can check the final results:

```
dim(wideFrame)

## [1] 6722 3598

dim(longFrame)

## [1] 20166 1201

names(wideFrame)[colSums(is.na(wideFrame)) > 0]

## [1] "basePrice_brand_nUser_1"
## [2] "basePrice_brand_nUser_2"
## [3] "basePrice_brand_nUser_3"
## [4] "basePrice_brand_nUserUsed_1"
## [5] "basePrice_brand_nUserUsed_2"
## [6] "basePrice_brand_nUserUsed_3"
## [7] "basePrice_brand_prob_1"
## [8] "basePrice_brand_prob_2"
## [9] "basePrice_brand_prob_3"
## [10] "basePrice_brand_Twice_1"
## [11] "basePrice_brand_Twice_2"
```

```
## [12] "basePrice_brand_Twice_3"
## [13] "basePrice_categoryIDs_nUser_1"
## [14] "basePrice_categoryIDs_nUser_2"
## [15] "basePrice_categoryIDs_nUser_3"
## [16] "basePrice_categoryIDs_nUserUsed_1"
## [17] "basePrice_categoryIDs_nUserUsed_2"
## [18] "basePrice_categoryIDs_nUserUsed_3"
## [19] "basePrice_categoryIDs_prob_1"
## [20] "basePrice_categoryIDs_prob_2"
## [21] "basePrice_categoryIDs_prob_3"
## [22] "basePrice_categoryIDs_Twice_1"
## [23] "basePrice_categoryIDs_Twice_2"
## [24] "basePrice_categoryIDs_Twice_3"
## [25] "basePrice_nUser_1"
## [26] "basePrice_nUser_2"
## [27] "basePrice_nUser_3"
## [28] "basePrice_nUserUsed_1"
## [29] "basePrice_nUserUsed_2"
## [30] "basePrice_nUserUsed_3"
## [31] "basePrice_premiumProduct_nUser_1"
## [32] "basePrice_premiumProduct_nUser_2"
## [33] "basePrice_premiumProduct_nUser_3"
## [34] "basePrice_premiumProduct_nUserUsed_1"
## [35] "basePrice_premiumProduct_nUserUsed_2"
## [36] "basePrice_premiumProduct_nUserUsed_3"
## [37] "basePrice_premiumProduct_prob_1"
## [38] "basePrice_premiumProduct_prob_2"
## [39] "basePrice_premiumProduct_prob_3"
## [40] "basePrice_premiumProduct_Twice_1"
## [41] "basePrice_premiumProduct_Twice_2"
## [42] "basePrice_premiumProduct_Twice_3"
## [43] "basePrice_prob_1"
## [44] "basePrice_prob_2"
## [45] "basePrice_prob_3"
## [46] "basePrice_productGroup_nUser_1"
## [47] "basePrice_productGroup_nUser_2"
## [48] "basePrice_productGroup_nUser_3"
## [49] "basePrice_productGroup_nUserUsed_1"
## [50] "basePrice_productGroup_nUserUsed_2"
## [51] "basePrice_productGroup_nUserUsed_3"
## [52] "basePrice_productGroup_prob_1"
## [53] "basePrice_productGroup_prob_2"
## [54] "basePrice_productGroup_prob_3"
## [55] "basePrice_productGroup_Twice_1"
## [56] "basePrice_productGroup_Twice_2"
## [57] "basePrice_productGroup_Twice_3"
## [58] "basePrice_ratio_bp_p_round_nUser_1"
## [59] "basePrice_ratio_bp_p_round_nUser_2"
## [60] "basePrice_ratio_bp_p_round_nUser_3"
## [61] "basePrice_ratio_bp_p_round_nUserUsed_1"
## [62] "basePrice_ratio_bp_p_round_nUserUsed_2"
## [63] "basePrice_ratio_bp_p_round_nUserUsed_3"
## [64] "basePrice_ratio_bp_p_round_prob_1"
## [65] "basePrice_ratio_bp_p_round_prob_2"
```



```
## [66] "basePrice_ratio_bp_p_round_prob_3"
## [67] "basePrice_ratio_bp_p_round_Twice_1"
## [68] "basePrice_ratio_bp_p_round_Twice_2"
## [69] "basePrice_ratio_bp_p_round_Twice_3"
## [70] "basePrice_Twice_1"
## [71] "basePrice_Twice_2"
## [72] "basePrice_Twice_3"
## [73] "brand_premiumProduct_nUser_1"
## [74] "brand_premiumProduct_nUser_2"
## [75] "brand_premiumProduct_nUser_3"
## [76] "brand_premiumProduct_nUserUsed_1"
## [77] "brand_premiumProduct_nUserUsed_2"
## [78] "brand_premiumProduct_nUserUsed_3"
## [79] "brand_premiumProduct_prob_1"
## [80] "brand_premiumProduct_prob_2"
## [81] "brand_premiumProduct_prob_3"
## [82] "brand_premiumProduct_Twice_1"
## [83] "brand_premiumProduct_Twice_2"
## [84] "brand_premiumProduct_Twice_3"
## [85] "categoryIDs_brand_nUser_1"
## [86] "categoryIDs_brand_nUser_2"
## [87] "categoryIDs_brand_nUser_3"
## [88] "categoryIDs_brand_nUserUsed_1"
## [89] "categoryIDs_brand_nUserUsed_2"
## [90] "categoryIDs_brand_nUserUsed_3"
## [91] "categoryIDs_brand_prob_1"
## [92] "categoryIDs_brand_prob_2"
## [93] "categoryIDs_brand_prob_3"
## [94] "categoryIDs_brand_Twice_1"
## [95] "categoryIDs_brand_Twice_2"
## [96] "categoryIDs_brand_Twice_3"
## [97] "categoryIDs_nUser_1"
## [98] "categoryIDs_nUser_2"
## [99] "categoryIDs_nUser_3"
## [100] "categoryIDs_nUserUsed_1"
## [101] "categoryIDs_nUserUsed_2"
## [102] "categoryIDs_nUserUsed_3"
## [103] "categoryIDs_premiumProduct_nUser_1"
## [104] "categoryIDs_premiumProduct_nUser_2"
## [105] "categoryIDs_premiumProduct_nUser_3"
## [106] "categoryIDs_premiumProduct_nUserUsed_1"
## [107] "categoryIDs_premiumProduct_nUserUsed_2"
## [108] "categoryIDs_premiumProduct_nUserUsed_3"
## [109] "categoryIDs_premiumProduct_prob_1"
## [110] "categoryIDs_premiumProduct_prob_2"
## [111] "categoryIDs_premiumProduct_prob_3"
## [112] "categoryIDs_premiumProduct_Twice_1"
## [113] "categoryIDs_premiumProduct_Twice_2"
## [114] "categoryIDs_premiumProduct_Twice_3"
## [115] "categoryIDs_prob_1"
## [116] "categoryIDs_prob_2"
## [117] "categoryIDs_prob_3"
## [118] "categoryIDs_ratio_bp_p_round_nUser_1"
## [119] "categoryIDs_ratio_bp_p_round_nUser_2"
```

```
## [120] "categoryIDs_ratio_bp_p_round_nUser_3"
## [121] "categoryIDs_ratio_bp_p_round_nUserUsed_1"
## [122] "categoryIDs_ratio_bp_p_round_nUserUsed_2"
## [123] "categoryIDs_ratio_bp_p_round_nUserUsed_3"
## [124] "categoryIDs_ratio_bp_p_round_prob_1"
## [125] "categoryIDs_ratio_bp_p_round_prob_2"
## [126] "categoryIDs_ratio_bp_p_round_prob_3"
## [127] "categoryIDs_ratio_bp_p_round_Twice_1"
## [128] "categoryIDs_ratio_bp_p_round_Twice_2"
## [129] "categoryIDs_ratio_bp_p_round_Twice_3"
## [130] "categoryIDs_Twice_1"
## [131] "categoryIDs_Twice_2"
## [132] "categoryIDs_Twice_3"
## [133] "couponID_couponsReceivedDoW_nUser_1"
## [134] "couponID_couponsReceivedDoW_nUser_2"
## [135] "couponID_couponsReceivedDoW_nUser_3"
## [136] "couponID_couponsReceivedDoW_nUserUsed_1"
## [137] "couponID_couponsReceivedDoW_nUserUsed_2"
## [138] "couponID_couponsReceivedDoW_nUserUsed_3"
## [139] "couponID_couponsReceivedDoW_prob_1"
## [140] "couponID_couponsReceivedDoW_prob_2"
## [141] "couponID_couponsReceivedDoW_prob_3"
## [142] "couponID_couponsReceivedDoW_Twice_1"
## [143] "couponID_couponsReceivedDoW_Twice_2"
## [144] "couponID_couponsReceivedDoW_Twice_3"
## [145] "couponID_couponsReceivedTime_nUserUsed_1"
## [146] "couponID_couponsReceivedTime_nUserUsed_2"
## [147] "couponID_couponsReceivedTime_nUserUsed_3"
## [148] "couponID_couponsReceivedTime_prob_1"
## [149] "couponID_couponsReceivedTime_prob_2"
## [150] "couponID_couponsReceivedTime_prob_3"
## [151] "couponID_couponsReceivedTime_Twice_1"
## [152] "couponID_couponsReceivedTime_Twice_2"
## [153] "couponID_couponsReceivedTime_Twice_3"
## [154] "couponID_nUser_1"
## [155] "couponID_nUser_2"
## [156] "couponID_nUser_3"
## [157] "couponID_nUserUsed_1"
## [158] "couponID_nUserUsed_2"
## [159] "couponID_nUserUsed_3"
## [160] "couponID_orderTimeDoW_nUser_1"
## [161] "couponID_orderTimeDoW_nUser_2"
## [162] "couponID_orderTimeDoW_nUser_3"
## [163] "couponID_orderTimeDoW_nUserUsed_1"
## [164] "couponID_orderTimeDoW_nUserUsed_2"
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## [220] "orderTimeTime_ratio_bp_p_round_nUser"
## [221] "orderTimeTime_ratio_bp_p_round_nUserUsed"
## [222] "orderTimeTime_ratio_bp_p_round_prob"
## [223] "orderTimeTime_ratio_bp_p_round_Twice"
## [224] "orderTimeTime_TimeBtwnRecOrder_disc_nUser"
## [225] "orderTimeTime_TimeBtwnRecOrder_disc_nUserUsed"
## [226] "orderTimeTime_TimeBtwnRecOrder_disc_prob"
## [227] "orderTimeTime_TimeBtwnRecOrder_disc_Twice"
## [228] "orderTimeTime_Twice"
## [229] "price_basePrice_nUser"
## [230] "price_basePrice_nUserUsed"
## [231] "price_basePrice_prob"
## [232] "price_basePrice_Twice"
## [233] "price_brand_nUser"
## [234] "price_brand_nUserUsed"
## [235] "price_brand_prob"
## [236] "price_brand_Twice"
## [237] "price_categoryIDs_nUser"
## [238] "price_categoryIDs_nUserUsed"
## [239] "price_categoryIDs_prob"
## [240] "price_categoryIDs_Twice"
## [241] "price_nUser"
## [242] "price_nUserUsed"
## [243] "price_premiumProduct_nUser"
## [244] "price_premiumProduct_nUserUsed"
## [245] "price_premiumProduct_prob"
## [246] "price_premiumProduct_Twice"
```



```
## [247] "price_prob"
## [248] "price_productGroup_nUser"
## [249] "price_productGroup_nUserUsed"
## [250] "price_productGroup_prob"
## [251] "price_productGroup_Twice"
## [252] "price_ratio_bp_p_round_nUser"
## [253] "price_ratio_bp_p_round_nUserUsed"
## [254] "price_ratio_bp_p_round_prob"
## [255] "price_ratio_bp_p_round_Twice"
## [256] "price_Twice"
## [257] "productGroup_brand_nUser"
## [258] "productGroup_brand_nUserUsed"
## [259] "productGroup_brand_prob"
## [260] "productGroup_brand_Twice"
## [261] "productGroup_categoryIDs_nUser"
## [262] "productGroup_categoryIDs_nUserUsed"
## [263] "productGroup_categoryIDs_prob"
## [264] "productGroup_categoryIDs_Twice"
## [265] "productGroup_nUser"
## [266] "productGroup_nUserUsed"
## [267] "productGroup_premiumProduct_nUser"
## [268] "productGroup_premiumProduct_nUserUsed"
## [269] "productGroup_premiumProduct_prob"
## [270] "productGroup_premiumProduct_Twice"
## [271] "productGroup_prob"
## [272] "productGroup_ratio_bp_p_round_nUser"
## [273] "productGroup_ratio_bp_p_round_nUserUsed"
## [274] "productGroup_ratio_bp_p_round_prob"
## [275] "productGroup_ratio_bp_p_round_Twice"
## [276] "productGroup_Twice"
## [277] "ratio_bp_p"
## [278] "ratio_bp_p_round"
## [279] "ratio_bp_p_round_brand_nUser"
## [280] "ratio_bp_p_round_brand_nUserUsed"
## [281] "ratio_bp_p_round_brand_prob"
## [282] "ratio_bp_p_round_brand_Twice"
## [283] "ratio_bp_p_round_nUser"
## [284] "ratio_bp_p_round_nUserUsed"
## [285] "ratio_bp_p_round_premiumProduct_nUser"
## [286] "ratio_bp_p_round_premiumProduct_nUserUsed"
## [287] "ratio_bp_p_round_premiumProduct_prob"
## [288] "ratio_bp_p_round_premiumProduct_Twice"
## [289] "ratio_bp_p_round_prob"
## [290] "ratio_bp_p_round_Twice"
## [291] "reward_basePrice_nUser"
## [292] "reward_basePrice_nUserUsed"
## [293] "reward_basePrice_prob"
## [294] "reward_basePrice_Twice"
## [295] "reward_brand_nUser"
## [296] "reward_brand_nUserUsed"
## [297] "reward_brand_prob"
## [298] "reward_brand_Twice"
## [299] "reward_categoryIDs_nUser"
## [300] "reward_categoryIDs_nUserUsed"
```

```
## [301] "reward_categoryIDs_prob"
## [302] "reward_categoryIDs_Twice"
## [303] "reward_couponsReceivedDoW_nUser"
## [304] "reward_couponsReceivedDoW_nUserUsed"
## [305] "reward_couponsReceivedDoW_prob"
## [306] "reward_couponsReceivedDoW_Twice"
## [307] "reward_couponsReceivedTime_nUser"
## [308] "reward_couponsReceivedTime_nUserUsed"
## [309] "reward_couponsReceivedTime_prob"
## [310] "reward_couponsReceivedTime_Twice"
## [311] "reward_orderTimeDoW_nUser"
## [312] "reward_orderTimeDoW_nUserUsed"
## [313] "reward_orderTimeDoW_prob"
## [314] "reward_orderTimeDoW_Twice"
## [315] "reward_orderTimeTime_nUser"
## [316] "reward_orderTimeTime_nUserUsed"
## [317] "reward_orderTimeTime_prob"
## [318] "reward_orderTimeTime_Twice"
## [319] "reward_premiumProduct_nUser"
## [320] "reward_premiumProduct_nUserUsed"
## [321] "reward_premiumProduct_prob"
## [322] "reward_premiumProduct_Twice"
## [323] "reward_price_nUser"
## [324] "reward_price_nUserUsed"
## [325] "reward_price_prob"
## [326] "reward_price_Twice"
## [327] "reward_productGroup_nUser"
## [328] "reward_productGroup_nUserUsed"
## [329] "reward_productGroup_prob"
## [330] "reward_productGroup_Twice"
## [331] "reward_ratio_bp_p_round_nUser"
## [332] "reward_ratio_bp_p_round_nUserUsed"
## [333] "reward_ratio_bp_p_round_prob"
## [334] "reward_ratio_bp_p_round_Twice"
## [335] "reward_TimeBtwnRecOrder_disc_nUser"
## [336] "reward_TimeBtwnRecOrder_disc_nUserUsed"
## [337] "reward_TimeBtwnRecOrder_disc_prob"
## [338] "reward_TimeBtwnRecOrder_disc_Twice"
## [339] "TimeBtwnRecOrder_disc"
## [340] "TimeBtwnRecOrder_disc_basePrice_nUser"
## [341] "TimeBtwnRecOrder_disc_basePrice_nUserUsed"
## [342] "TimeBtwnRecOrder_disc_basePrice_prob"
## [343] "TimeBtwnRecOrder_disc_basePrice_Twice"
## [344] "TimeBtwnRecOrder_disc_brand_nUser"
## [345] "TimeBtwnRecOrder_disc_brand_nUserUsed"
## [346] "TimeBtwnRecOrder_disc_brand_prob"
## [347] "TimeBtwnRecOrder_disc_brand_Twice"
## [348] "TimeBtwnRecOrder_disc_categoryIDs_nUser"
## [349] "TimeBtwnRecOrder_disc_categoryIDs_nUserUsed"
## [350] "TimeBtwnRecOrder_disc_categoryIDs_prob"
## [351] "TimeBtwnRecOrder_disc_categoryIDs_Twice"
## [352] "TimeBtwnRecOrder_disc_nUser"
## [353] "TimeBtwnRecOrder_disc_nUserUsed"
## [354] "TimeBtwnRecOrder_disc_premiumProduct_nUser"
```

```
## [355] "TimeBtwnRecOrder_disc_premiumProduct_nUserUsed"
## [356] "TimeBtwnRecOrder_disc_premiumProduct_prob"
## [357] "TimeBtwnRecOrder_disc_premiumProduct_Twice"
## [358] "TimeBtwnRecOrder_disc_price_nUser"
## [359] "TimeBtwnRecOrder_disc_price_nUserUsed"
## [360] "TimeBtwnRecOrder_disc_price_prob"
## [361] "TimeBtwnRecOrder_disc_price_Twice"
## [362] "TimeBtwnRecOrder_disc_prob"
## [363] "TimeBtwnRecOrder_disc_productGroup_nUser"
## [364] "TimeBtwnRecOrder_disc_productGroup_nUserUsed"
## [365] "TimeBtwnRecOrder_disc_productGroup_prob"
## [366] "TimeBtwnRecOrder_disc_productGroup_Twice"
## [367] "TimeBtwnRecOrder_disc_ratio_bp_p_round_nUser"
## [368] "TimeBtwnRecOrder_disc_ratio_bp_p_round_nUserUsed"
## [369] "TimeBtwnRecOrder_disc_ratio_bp_p_round_prob"
## [370] "TimeBtwnRecOrder_disc_ratio_bp_p_round_Twice"
## [371] "TimeBtwnRecOrder_disc_Twice"
```

### Save Universal

These are our universal features:

```
saveRDS(wideFrame, file = "../set1/combined/set1FeaturesCombined_wide.rds")
saveRDS(longFrame, file = "../set1/combined/set1FeaturesCombined_long.rds")
```

## 0.3 Feature Matrix for Set 2

Again we need to read in the files. In addition to the llrs we have:

```
path.to.files = "../set2/individual/"
files = list.files(path.to.files, full.name = TRUE)
cat(paste(files, collapse = "\n"))

## ../set2/individual//coupon_usr_info.rds
## ../set2/individual//HTVmelt2_Combn_UniqueUser.rds
## ../set2/individual//llrs
```

We repeat the process of creating the wide set and then the long set: We can read each in as follows:

```
path.to.files = "../set2/individual/"
path.to.llrs = "../set2/individual/llrs/"
files = c(list.files(path.to.files, pattern = ".rds", full.name = TRUE), list.files(path.to.llrs,
  pattern = "wide", full.name = TRUE))
features = lapply(files, function(x) readRDS(x))

# make one set of adjustments
features[[2]] = do.call("rbind", features[[2]])
```

Keep in mind that long files have 20,166 rows and wide files have 6722 rows. Wide files should have columns identified as couponCol:

```
wideSet = c()
longSet = c()
noSet = c()
for (i in 1:length(features)) {
```

```

if (nrow(features[[i]]) == 20166) {
  longSet = c(longSet, i)
} else {
  if (nrow(features[[i]]) == 6722) {
    wideSet = c(wideSet, i)
  } else {
    noSet = c(noSet, i)
  }
}
}

```

```

## wide format sets:
wideSet

```

```

##   [1]   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
## [18]  20  21  22  23  24  25  26  27  28  29  30  31  32  33  34  35  36
## [35]  37  38  39  40  41  42  43  44  45  46  47  48  49  50  51  52  53
## [52]  54  55  56  57  58  59  60  61  62  63  64  65  66  67  68  69  70
## [69]  71  72  73  74  75  76  77  78  79  80  81  82  83  84  85  86  87
## [86]  88  89  90  91  92  93  94  95  96  97  98  99 100 101 102 103 104
## [103] 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121
## [120] 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138
## [137] 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155
## [154] 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172
## [171] 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189
## [188] 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206
## [205] 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223
## [222] 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240
## [239] 241 242

```

```

## long format sets:
longSet

```

```

## NULL

```

```

## no format sets:
noSet

```

```

## [1] 1 2

```

in this case, sets ../set2/individual//coupon\_usr\_info.rds, ../set2/individual//HTVmelt2\_Combn\_UniqueUser.rds have no proper place. We can figure out why this is by doing the following:

```

features[[noSet[1]]] %>% names

```

```

## [1] "couponID" "nUserSent" "nUserUsed" "UsedTwice" "prop" "prob"

```

The first set appears to be long. We can join by couponID:

```

features[[noSet[1]]] = features[[noSet[2]][, -c(2:22, 24:31)] %>% arrange(orderID,
  couponCol) %>% left_join(features[[noSet[1]]], by = "couponID") %>% select(-couponID) %>%
  gather(varname, value, -couponCol, -orderID) %>% mutate(colname = paste0(varname,
  "_", couponCol)) %>% select(orderID, colname, value) %>% spread(colname,
  value)

```

```

features[[noSet[1]]] %>% arrange(orderID) %>% select(orderID) %>% head

```

```
##  orderID
## 1      1
## 2      2
## 3      3
## 4      4
## 5      5
## 6      6
```

### Combine Wide Sets:

```
wideFrame = features[[noSet[1]]]
for (x in wideSet) {
  dsn.i = features[[x]]
  dropCols = which(names(dsn.i) %in% names(wideFrame) & names(dsn.i) != "orderID")
  dropCols = c(dropCols, which(grepl("times(N*o*t*)Used*_", names(dsn.i))))
  if (length(dropCols) == 0) {
    wideFrame = wideFrame %>% full_join(dsn.i, by = "orderID")
  } else {
    wideFrame = wideFrame %>% full_join(dsn.i[, -dropCols], by = "orderID")
  }
}
names(wideFrame) = gsub("_[Cc]ol(\\d+)$", "_\\1", names(wideFrame))
names(wideFrame) = gsub("(^[^_0-9])(\\d+)$", "\\1_\\2", names(wideFrame))
wideFrame = wideFrame[, which(!grepl("times(N*o*t*)Used*_", names(wideFrame)))]
```

### Long Version

We can also convert this set to the long format. Notice that not all of the files are the same “wide” as others, but we would still like to use them:

```
coln = names(wideFrame)
non_numbered_cols = which(!grepl("_\\d+$", coln))
coupon1_cols = c(1, grep("_(\\d*)1(\\d*)$", coln))
coupon2_cols = c(1, grep("_(\\d*)2(\\d*)$", coln))
coupon3_cols = c(1, grep("_(\\d*)3(\\d*)$", coln))

## coupon 1
coupon1 = wideFrame[, coupon1_cols]
names(coupon1) = gsub("_13$", "_to3Col", names(coupon1))
names(coupon1) = gsub("_12$", "_to2Col", names(coupon1))
names(coupon1) = gsub("_1$", "", names(coupon1))
coupon1$couponCol = 1

## coupon 2
coupon2 = wideFrame[, coupon2_cols]
names(coupon2) = gsub("_23$", "_to3Col", names(coupon2))
names(coupon2) = gsub("_12$", "_to1Col", names(coupon2))
names(coupon2) = gsub("_2$", "", names(coupon2))
coupon2$couponCol = 2

## coupon 3
coupon3 = wideFrame[, coupon3_cols]
names(coupon3) = gsub("_23$", "_to2Col", names(coupon3))
names(coupon3) = gsub("_13$", "_to3Col", names(coupon3))
names(coupon3) = gsub("_3$", "", names(coupon3))
```

```
coupon3$couponCol = 3

coupons = bind_rows(coupon1, coupon2, coupon3)

longFrame = coupons %>% arrange(orderID, couponCol)
```

### Check Universal Features

We can check the final results:

```
dim(wideFrame)

## [1] 6722 3286

dim(longFrame)

## [1] 20166 1097

names(wideFrame)[colSums(is.na(wideFrame)) > 0]

## [1] "basePrice_brand_nUser_1"
## [2] "basePrice_brand_nUser_2"
## [3] "basePrice_brand_nUser_3"
## [4] "basePrice_brand_nUserUsed_1"
## [5] "basePrice_brand_nUserUsed_2"
## [6] "basePrice_brand_nUserUsed_3"
## [7] "basePrice_brand_prob_1"
## [8] "basePrice_brand_prob_2"
## [9] "basePrice_brand_prob_3"
## [10] "basePrice_brand_Twice_1"
## [11] "basePrice_brand_Twice_2"
## [12] "basePrice_brand_Twice_3"
## [13] "basePrice_categoryIDs_nUser_1"
## [14] "basePrice_categoryIDs_nUser_2"
## [15] "basePrice_categoryIDs_nUser_3"
## [16] "basePrice_categoryIDs_nUserUsed_1"
## [17] "basePrice_categoryIDs_nUserUsed_2"
## [18] "basePrice_categoryIDs_nUserUsed_3"
## [19] "basePrice_categoryIDs_prob_1"
## [20] "basePrice_categoryIDs_prob_2"
## [21] "basePrice_categoryIDs_prob_3"
## [22] "basePrice_categoryIDs_Twice_1"
## [23] "basePrice_categoryIDs_Twice_2"
## [24] "basePrice_categoryIDs_Twice_3"
## [25] "basePrice_nUser_1"
## [26] "basePrice_nUser_2"
## [27] "basePrice_nUser_3"
## [28] "basePrice_nUserUsed_1"
## [29] "basePrice_nUserUsed_2"
## [30] "basePrice_nUserUsed_3"
## [31] "basePrice_premiumProduct_nUser_1"
## [32] "basePrice_premiumProduct_nUser_2"
## [33] "basePrice_premiumProduct_nUser_3"
## [34] "basePrice_premiumProduct_nUserUsed_1"
## [35] "basePrice_premiumProduct_nUserUsed_2"
## [36] "basePrice_premiumProduct_nUserUsed_3"
```

```
## [37] "basePrice_premiumProduct_prob_1"
## [38] "basePrice_premiumProduct_prob_2"
## [39] "basePrice_premiumProduct_prob_3"
## [40] "basePrice_premiumProduct_Twice_1"
## [41] "basePrice_premiumProduct_Twice_2"
## [42] "basePrice_premiumProduct_Twice_3"
## [43] "basePrice_prob_1"
## [44] "basePrice_prob_2"
## [45] "basePrice_prob_3"
## [46] "basePrice_productGroup_nUser_1"
## [47] "basePrice_productGroup_nUser_2"
## [48] "basePrice_productGroup_nUser_3"
## [49] "basePrice_productGroup_nUserUsed_1"
## [50] "basePrice_productGroup_nUserUsed_2"
## [51] "basePrice_productGroup_nUserUsed_3"
## [52] "basePrice_productGroup_prob_1"
## [53] "basePrice_productGroup_prob_2"
## [54] "basePrice_productGroup_prob_3"
## [55] "basePrice_productGroup_Twice_1"
## [56] "basePrice_productGroup_Twice_2"
## [57] "basePrice_productGroup_Twice_3"
## [58] "basePrice_ratio_bp_p_round_nUser_1"
## [59] "basePrice_ratio_bp_p_round_nUser_2"
## [60] "basePrice_ratio_bp_p_round_nUser_3"
## [61] "basePrice_ratio_bp_p_round_nUserUsed_1"
## [62] "basePrice_ratio_bp_p_round_nUserUsed_2"
## [63] "basePrice_ratio_bp_p_round_nUserUsed_3"
## [64] "basePrice_ratio_bp_p_round_prob_1"
## [65] "basePrice_ratio_bp_p_round_prob_2"
## [66] "basePrice_ratio_bp_p_round_prob_3"
## [67] "basePrice_ratio_bp_p_round_Twice_1"
## [68] "basePrice_ratio_bp_p_round_Twice_2"
## [69] "basePrice_ratio_bp_p_round_Twice_3"
## [70] "basePrice_Twice_1"
## [71] "basePrice_Twice_2"
## [72] "basePrice_Twice_3"
## [73] "brand_premiumProduct_nUser_1"
## [74] "brand_premiumProduct_nUser_2"
## [75] "brand_premiumProduct_nUser_3"
## [76] "brand_premiumProduct_nUserUsed_1"
## [77] "brand_premiumProduct_nUserUsed_2"
## [78] "brand_premiumProduct_nUserUsed_3"
## [79] "brand_premiumProduct_prob_1"
## [80] "brand_premiumProduct_prob_2"
## [81] "brand_premiumProduct_prob_3"
## [82] "brand_premiumProduct_Twice_1"
## [83] "brand_premiumProduct_Twice_2"
## [84] "brand_premiumProduct_Twice_3"
## [85] "categoryIDs_brand_nUser_1"
## [86] "categoryIDs_brand_nUser_2"
## [87] "categoryIDs_brand_nUser_3"
## [88] "categoryIDs_brand_nUserUsed_1"
## [89] "categoryIDs_brand_nUserUsed_2"
## [90] "categoryIDs_brand_nUserUsed_3"
```

```
## [91] "categoryIDs_brand_prob_1"
## [92] "categoryIDs_brand_prob_2"
## [93] "categoryIDs_brand_prob_3"
## [94] "categoryIDs_brand_Twice_1"
## [95] "categoryIDs_brand_Twice_2"
## [96] "categoryIDs_brand_Twice_3"
## [97] "categoryIDs_nUser_1"
## [98] "categoryIDs_nUser_2"
## [99] "categoryIDs_nUser_3"
## [100] "categoryIDs_nUserUsed_1"
## [101] "categoryIDs_nUserUsed_2"
## [102] "categoryIDs_nUserUsed_3"
## [103] "categoryIDs_premiumProduct_nUser_1"
## [104] "categoryIDs_premiumProduct_nUser_2"
## [105] "categoryIDs_premiumProduct_nUser_3"
## [106] "categoryIDs_premiumProduct_nUserUsed_1"
## [107] "categoryIDs_premiumProduct_nUserUsed_2"
## [108] "categoryIDs_premiumProduct_nUserUsed_3"
## [109] "categoryIDs_premiumProduct_prob_1"
## [110] "categoryIDs_premiumProduct_prob_2"
## [111] "categoryIDs_premiumProduct_prob_3"
## [112] "categoryIDs_premiumProduct_Twice_1"
## [113] "categoryIDs_premiumProduct_Twice_2"
## [114] "categoryIDs_premiumProduct_Twice_3"
## [115] "categoryIDs_prob_1"
## [116] "categoryIDs_prob_2"
## [117] "categoryIDs_prob_3"
## [118] "categoryIDs_ratio_bp_p_round_nUser_1"
## [119] "categoryIDs_ratio_bp_p_round_nUser_2"
## [120] "categoryIDs_ratio_bp_p_round_nUser_3"
## [121] "categoryIDs_ratio_bp_p_round_nUserUsed_1"
## [122] "categoryIDs_ratio_bp_p_round_nUserUsed_2"
## [123] "categoryIDs_ratio_bp_p_round_nUserUsed_3"
## [124] "categoryIDs_ratio_bp_p_round_prob_1"
## [125] "categoryIDs_ratio_bp_p_round_prob_2"
## [126] "categoryIDs_ratio_bp_p_round_prob_3"
## [127] "categoryIDs_ratio_bp_p_round_Twice_1"
## [128] "categoryIDs_ratio_bp_p_round_Twice_2"
## [129] "categoryIDs_ratio_bp_p_round_Twice_3"
## [130] "categoryIDs_Twice_1"
## [131] "categoryIDs_Twice_2"
## [132] "categoryIDs_Twice_3"
## [133] "couponID_couponsReceivedDoW_nUser_1"
## [134] "couponID_couponsReceivedDoW_nUser_2"
## [135] "couponID_couponsReceivedDoW_nUser_3"
## [136] "couponID_couponsReceivedDoW_nUserUsed_1"
## [137] "couponID_couponsReceivedDoW_nUserUsed_2"
## [138] "couponID_couponsReceivedDoW_nUserUsed_3"
## [139] "couponID_couponsReceivedDoW_prob_1"
## [140] "couponID_couponsReceivedDoW_prob_2"
## [141] "couponID_couponsReceivedDoW_prob_3"
## [142] "couponID_couponsReceivedDoW_Twice_1"
## [143] "couponID_couponsReceivedDoW_Twice_2"
## [144] "couponID_couponsReceivedDoW_Twice_3"
```



```
## [145] "couponID_couponsReceivedTime_nUser_1"
## [146] "couponID_couponsReceivedTime_nUser_2"
## [147] "couponID_couponsReceivedTime_nUser_3"
## [148] "couponID_couponsReceivedTime_nUserUsed_1"
## [149] "couponID_couponsReceivedTime_nUserUsed_2"
## [150] "couponID_couponsReceivedTime_nUserUsed_3"
## [151] "couponID_couponsReceivedTime_prob_1"
## [152] "couponID_couponsReceivedTime_prob_2"
## [153] "couponID_couponsReceivedTime_prob_3"
## [154] "couponID_couponsReceivedTime_Twice_1"
## [155] "couponID_couponsReceivedTime_Twice_2"
## [156] "couponID_couponsReceivedTime_Twice_3"
## [157] "couponID_nUser_1"
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## [1122] "TimeBtwnRecOrder_disc_ratio_bp_p_round_Twice_3"
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## [1124] "UsedTwice_2"
## [1125] "UsedTwice_3"
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names(longFrame)[colSums(is.na(longFrame)) > 0]
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## [6] "basePrice_categoryIDs_nUserUsed"
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## [12] "basePrice_premiumProduct_nUserUsed"
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## [15] "basePrice_prob"
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## [203] "orderTimeTime_nUser"
## [204] "orderTimeTime_nUserUsed"
## [205] "orderTimeTime_orderTimeDoW_nUser"
```

```
## [206] "orderTimeTime_orderTimeDoW_nUserUsed"
## [207] "orderTimeTime_orderTimeDoW_prob"
## [208] "orderTimeTime_orderTimeDoW_Twice"
## [209] "orderTimeTime_premiumProduct_nUser"
## [210] "orderTimeTime_premiumProduct_nUserUsed"
## [211] "orderTimeTime_premiumProduct_prob"
## [212] "orderTimeTime_premiumProduct_Twice"
## [213] "orderTimeTime_price_nUser"
## [214] "orderTimeTime_price_nUserUsed"
## [215] "orderTimeTime_price_prob"
## [216] "orderTimeTime_price_Twice"
## [217] "orderTimeTime_prob"
## [218] "orderTimeTime_productGroup_nUser"
## [219] "orderTimeTime_productGroup_nUserUsed"
## [220] "orderTimeTime_productGroup_prob"
## [221] "orderTimeTime_productGroup_Twice"
## [222] "orderTimeTime_ratio_bp_p_round_nUser"
## [223] "orderTimeTime_ratio_bp_p_round_nUserUsed"
## [224] "orderTimeTime_ratio_bp_p_round_prob"
## [225] "orderTimeTime_ratio_bp_p_round_Twice"
## [226] "orderTimeTime_TimeBtwnRecOrder_disc_nUser"
## [227] "orderTimeTime_TimeBtwnRecOrder_disc_nUserUsed"
## [228] "orderTimeTime_TimeBtwnRecOrder_disc_prob"
## [229] "orderTimeTime_TimeBtwnRecOrder_disc_Twice"
## [230] "orderTimeTime_Twice"
## [231] "price_basePrice_nUser"
## [232] "price_basePrice_nUserUsed"
## [233] "price_basePrice_prob"
## [234] "price_basePrice_Twice"
## [235] "price_brand_nUser"
## [236] "price_brand_nUserUsed"
## [237] "price_brand_prob"
## [238] "price_brand_Twice"
## [239] "price_categoryIDs_nUser"
## [240] "price_categoryIDs_nUserUsed"
## [241] "price_categoryIDs_prob"
## [242] "price_categoryIDs_Twice"
## [243] "price_nUser"
## [244] "price_nUserUsed"
## [245] "price_premiumProduct_nUser"
## [246] "price_premiumProduct_nUserUsed"
## [247] "price_premiumProduct_prob"
## [248] "price_premiumProduct_Twice"
## [249] "price_prob"
## [250] "price_productGroup_nUser"
## [251] "price_productGroup_nUserUsed"
## [252] "price_productGroup_prob"
## [253] "price_productGroup_Twice"
## [254] "price_ratio_bp_p_round_nUser"
## [255] "price_ratio_bp_p_round_nUserUsed"
## [256] "price_ratio_bp_p_round_prob"
## [257] "price_ratio_bp_p_round_Twice"
## [258] "price_Twice"
## [259] "prob"
```

```
## [260] "productGroup_brand_nUser"
## [261] "productGroup_brand_nUserUsed"
## [262] "productGroup_brand_prob"
## [263] "productGroup_brand_Twice"
## [264] "productGroup_categoryIDs_nUser"
## [265] "productGroup_categoryIDs_nUserUsed"
## [266] "productGroup_categoryIDs_prob"
## [267] "productGroup_categoryIDs_Twice"
## [268] "productGroup_nUser"
## [269] "productGroup_nUserUsed"
## [270] "productGroup_premiumProduct_nUser"
## [271] "productGroup_premiumProduct_nUserUsed"
## [272] "productGroup_premiumProduct_prob"
## [273] "productGroup_premiumProduct_Twice"
## [274] "productGroup_prob"
## [275] "productGroup_ratio_bp_p_round_nUser"
## [276] "productGroup_ratio_bp_p_round_nUserUsed"
## [277] "productGroup_ratio_bp_p_round_prob"
## [278] "productGroup_ratio_bp_p_round_Twice"
## [279] "productGroup_Twice"
## [280] "prop"
## [281] "ratio_bp_p"
## [282] "ratio_bp_p_round"
## [283] "ratio_bp_p_round_brand_nUser"
## [284] "ratio_bp_p_round_brand_nUserUsed"
## [285] "ratio_bp_p_round_brand_prob"
## [286] "ratio_bp_p_round_brand_Twice"
## [287] "ratio_bp_p_round_nUser"
## [288] "ratio_bp_p_round_nUserUsed"
## [289] "ratio_bp_p_round_premiumProduct_nUser"
## [290] "ratio_bp_p_round_premiumProduct_nUserUsed"
## [291] "ratio_bp_p_round_premiumProduct_prob"
## [292] "ratio_bp_p_round_premiumProduct_Twice"
## [293] "ratio_bp_p_round_prob"
## [294] "ratio_bp_p_round_Twice"
## [295] "reward_basePrice_nUser"
## [296] "reward_basePrice_nUserUsed"
## [297] "reward_basePrice_prob"
## [298] "reward_basePrice_Twice"
## [299] "reward_brand_nUser"
## [300] "reward_brand_nUserUsed"
## [301] "reward_brand_prob"
## [302] "reward_brand_Twice"
## [303] "reward_categoryIDs_nUser"
## [304] "reward_categoryIDs_nUserUsed"
## [305] "reward_categoryIDs_prob"
## [306] "reward_categoryIDs_Twice"
## [307] "reward_couponsReceivedDoW_nUser"
## [308] "reward_couponsReceivedDoW_nUserUsed"
## [309] "reward_couponsReceivedDoW_prob"
## [310] "reward_couponsReceivedDoW_Twice"
## [311] "reward_couponsReceivedTime_nUser"
## [312] "reward_couponsReceivedTime_nUserUsed"
## [313] "reward_couponsReceivedTime_prob"
```



```
## [314] "reward_couponsReceivedTime_Twice"
## [315] "reward_orderTimeDoW_nUser"
## [316] "reward_orderTimeDoW_nUserUsed"
## [317] "reward_orderTimeDoW_prob"
## [318] "reward_orderTimeDoW_Twice"
## [319] "reward_orderTimeTime_nUser"
## [320] "reward_orderTimeTime_nUserUsed"
## [321] "reward_orderTimeTime_prob"
## [322] "reward_orderTimeTime_Twice"
## [323] "reward_premiumProduct_nUser"
## [324] "reward_premiumProduct_nUserUsed"
## [325] "reward_premiumProduct_prob"
## [326] "reward_premiumProduct_Twice"
## [327] "reward_price_nUser"
## [328] "reward_price_nUserUsed"
## [329] "reward_price_prob"
## [330] "reward_price_Twice"
## [331] "reward_productGroup_nUser"
## [332] "reward_productGroup_nUserUsed"
## [333] "reward_productGroup_prob"
## [334] "reward_productGroup_Twice"
## [335] "reward_ratio_bp_p_round_nUser"
## [336] "reward_ratio_bp_p_round_nUserUsed"
## [337] "reward_ratio_bp_p_round_prob"
## [338] "reward_ratio_bp_p_round_Twice"
## [339] "reward_TimeBtwnRecOrder_disc_nUser"
## [340] "reward_TimeBtwnRecOrder_disc_nUserUsed"
## [341] "reward_TimeBtwnRecOrder_disc_prob"
## [342] "reward_TimeBtwnRecOrder_disc_Twice"
## [343] "TimeBtwnRecOrder_disc"
## [344] "TimeBtwnRecOrder_disc_basePrice_nUser"
## [345] "TimeBtwnRecOrder_disc_basePrice_nUserUsed"
## [346] "TimeBtwnRecOrder_disc_basePrice_prob"
## [347] "TimeBtwnRecOrder_disc_basePrice_Twice"
## [348] "TimeBtwnRecOrder_disc_brand_nUser"
## [349] "TimeBtwnRecOrder_disc_brand_nUserUsed"
## [350] "TimeBtwnRecOrder_disc_brand_prob"
## [351] "TimeBtwnRecOrder_disc_brand_Twice"
## [352] "TimeBtwnRecOrder_disc_categoryIDs_nUser"
## [353] "TimeBtwnRecOrder_disc_categoryIDs_nUserUsed"
## [354] "TimeBtwnRecOrder_disc_categoryIDs_prob"
## [355] "TimeBtwnRecOrder_disc_categoryIDs_Twice"
## [356] "TimeBtwnRecOrder_disc_nUser"
## [357] "TimeBtwnRecOrder_disc_nUserUsed"
## [358] "TimeBtwnRecOrder_disc_premiumProduct_nUser"
## [359] "TimeBtwnRecOrder_disc_premiumProduct_nUserUsed"
## [360] "TimeBtwnRecOrder_disc_premiumProduct_prob"
## [361] "TimeBtwnRecOrder_disc_premiumProduct_Twice"
## [362] "TimeBtwnRecOrder_disc_price_nUser"
## [363] "TimeBtwnRecOrder_disc_price_nUserUsed"
## [364] "TimeBtwnRecOrder_disc_price_prob"
## [365] "TimeBtwnRecOrder_disc_price_Twice"
## [366] "TimeBtwnRecOrder_disc_prob"
## [367] "TimeBtwnRecOrder_disc_productGroup_nUser"
```

```
## [368] "TimeBtwnRecOrder_disc_productGroup_nUserUsed"
## [369] "TimeBtwnRecOrder_disc_productGroup_prob"
## [370] "TimeBtwnRecOrder_disc_productGroup_Twice"
## [371] "TimeBtwnRecOrder_disc_ratio_bp_p_round_nUser"
## [372] "TimeBtwnRecOrder_disc_ratio_bp_p_round_nUserUsed"
## [373] "TimeBtwnRecOrder_disc_ratio_bp_p_round_prob"
## [374] "TimeBtwnRecOrder_disc_ratio_bp_p_round_Twice"
## [375] "UsedTwice"
```

### Save Universal

These are our universal features:

```
saveRDS(wideFrame, file = "../set2/combined/set2FeaturesCombined_wide.rds")
saveRDS(longFrame, file = "../set2/combined/set2FeaturesCombined_long.rds")
```

## 0.4 Feature Matrix for Set 3

Again we need to read in the files. In addition to the llrs we have:

```
path.to.files = "../set3/individual/"
files = list.files(path.to.files, full.name = TRUE)
cat(paste(files, collapse = "\n"))

## ../set3/individual//HTVmelt3_Combn_UniqueUser.rds
## ../set3/individual//llrs
```

We repeat the process of creating the wide set and then the long set: We can read each in as follows:

```
path.to.files = "../set3/individual/"
path.to.llrs = "../set3/individual/llrs/"
files = c(list.files(path.to.files, pattern = ".rds", full.name = TRUE), list.files(path.to.llrs,
  pattern = "wide", full.name = TRUE))
features = lapply(files, function(x) readRDS(x))

# make one set of adjustments
features[[1]] = do.call("rbind", features[[1]])
```

Keep in mind that long files have 20,166 rows and wide files have 6722 rows. Wide files should have columns identified as couponCol:

```
wideSet = c()
longSet = c()
noSet = c()
for (i in 1:length(features)) {
  if (nrow(features[[i]]) == 20166) {
    longSet = c(longSet, i)
  } else {
    if (nrow(features[[i]]) == 6722) {
      wideSet = c(wideSet, i)
    } else {
      noSet = c(noSet, i)
    }
  }
}
```

```
## wide format sets:
```

```
wideSet
```

```
## [1] 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
## [18] 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35
## [35] 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52
## [52] 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69
## [69] 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86
## [86] 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103
## [103] 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120
## [120] 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137
## [137] 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154
## [154] 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171
## [171] 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188
## [188] 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205
## [205] 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222
## [222] 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239
## [239] 240 241
```

```
## long format sets:
```

```
longSet
```

```
## NULL
```

```
## no format sets:
```

```
noSet
```

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

in this case, sets `../set3/individual//HTVmelt3_Combn_UniqueUser.rds` have no proper place. We can figure out why this is by doing the following:

```
features[[noSet[1]]] %>% select(orderID) %>% arrange(orderID) %>% head
```

```
## orderID
## 1      1
## 2      1
## 3      1
## 4      2
## 5      2
## 6      2
```

The first set appears to be long. We can join by couponID:

```
features[[noSet[1]]] = features[[noSet[1]][, -c(2:22, 24:31)] %>% arrange(orderID,
  couponCol) %>% select(-couponID) %>% gather(varname, value, -couponCol,
  -orderID) %>% mutate(colname = paste0(varname, "_", couponCol)) %>% select(orderID,
  colname, value) %>% spread(colname, value)
```

```
features[[noSet[1]]] %>% arrange(orderID) %>% select(orderID) %>% head
```

```
## orderID
## 1      1
## 2      2
## 3      3
## 4      4
## 5      5
## 6      6
```

### Combine Wide Sets:

```
wideFrame = features[[noSet[1]]]
for (x in wideSet) {
  dsn.i = features[[x]]
  dropCols = which(names(dsn.i) %in% names(wideFrame) & names(dsn.i) != "orderID")
  dropCols = c(dropCols, which(grepl("times(N*o*t*)Used*_", names(dsn.i))))
  if (length(dropCols) == 0) {
    wideFrame = wideFrame %>% full_join(dsn.i, by = "orderID")
  } else {
    wideFrame = wideFrame %>% full_join(dsn.i[, -dropCols], by = "orderID")
  }
}
names(wideFrame) = gsub("_[Cc]ol(\\d+)$", "_\\1", names(wideFrame))
names(wideFrame) = gsub("(^[^_0-9])(\\d+)$", "\\1_\\2", names(wideFrame))
wideFrame = wideFrame[, which(!grepl("times(N*o*t*)Used*_", names(wideFrame)))]
```

### Long Version

We can also convert this set to the long format. Notice that not all of the files are the same “wide” as others, but we would still like to use them:

```
coln = names(wideFrame)
non_numbered_cols = which(!grepl("_\\d+$", coln))
coupon1_cols = c(1, grep("_(\\d*)1(\\d*)$", coln))
coupon2_cols = c(1, grep("_(\\d*)2(\\d*)$", coln))
coupon3_cols = c(1, grep("_(\\d*)3(\\d*)$", coln))

## coupon 1
coupon1 = wideFrame[, coupon1_cols]
names(coupon1) = gsub("_13$", "_to3Col", names(coupon1))
names(coupon1) = gsub("_12$", "_to2Col", names(coupon1))
names(coupon1) = gsub("_1$", "", names(coupon1))
coupon1$couponCol = 1

## coupon 2
coupon2 = wideFrame[, coupon2_cols]
names(coupon2) = gsub("_23$", "_to3Col", names(coupon2))
names(coupon2) = gsub("_12$", "_to1Col", names(coupon2))
names(coupon2) = gsub("_2$", "", names(coupon2))
coupon2$couponCol = 2

## coupon 3
coupon3 = wideFrame[, coupon3_cols]
names(coupon3) = gsub("_23$", "_to2Col", names(coupon3))
names(coupon3) = gsub("_13$", "_to3Col", names(coupon3))
names(coupon3) = gsub("_3$", "", names(coupon3))
coupon3$couponCol = 3

coupons = bind_rows(coupon1, coupon2, coupon3)

longFrame = coupons %>% arrange(orderID, couponCol)
```

### Check Universal Features

We can check the final results:

```
dim(wideFrame)

## [1] 6722 3277

dim(longFrame)

## [1] 20166 1094

names(wideFrame)[colSums(is.na(wideFrame)) > 0]

## [1] "basePrice_brand_nUser_1"
## [2] "basePrice_brand_nUser_2"
## [3] "basePrice_brand_nUser_3"
## [4] "basePrice_brand_nUserUsed_1"
## [5] "basePrice_brand_nUserUsed_2"
## [6] "basePrice_brand_nUserUsed_3"
## [7] "basePrice_brand_prob_1"
## [8] "basePrice_brand_prob_2"
## [9] "basePrice_brand_prob_3"
## [10] "basePrice_brand_Twice_1"
## [11] "basePrice_brand_Twice_2"
## [12] "basePrice_brand_Twice_3"
## [13] "basePrice_categoryIDs_nUser_1"
## [14] "basePrice_categoryIDs_nUser_2"
## [15] "basePrice_categoryIDs_nUser_3"
## [16] "basePrice_categoryIDs_nUserUsed_1"
## [17] "basePrice_categoryIDs_nUserUsed_2"
## [18] "basePrice_categoryIDs_nUserUsed_3"
## [19] "basePrice_categoryIDs_prob_1"
## [20] "basePrice_categoryIDs_prob_2"
## [21] "basePrice_categoryIDs_prob_3"
## [22] "basePrice_categoryIDs_Twice_1"
## [23] "basePrice_categoryIDs_Twice_2"
## [24] "basePrice_categoryIDs_Twice_3"
## [25] "basePrice_nUser_1"
## [26] "basePrice_nUser_2"
## [27] "basePrice_nUser_3"
## [28] "basePrice_nUserUsed_1"
## [29] "basePrice_nUserUsed_2"
## [30] "basePrice_nUserUsed_3"
## [31] "basePrice_premiumProduct_nUser_1"
## [32] "basePrice_premiumProduct_nUser_2"
## [33] "basePrice_premiumProduct_nUser_3"
## [34] "basePrice_premiumProduct_nUserUsed_1"
## [35] "basePrice_premiumProduct_nUserUsed_2"
## [36] "basePrice_premiumProduct_nUserUsed_3"
## [37] "basePrice_premiumProduct_prob_1"
## [38] "basePrice_premiumProduct_prob_2"
## [39] "basePrice_premiumProduct_prob_3"
## [40] "basePrice_premiumProduct_Twice_1"
## [41] "basePrice_premiumProduct_Twice_2"
## [42] "basePrice_premiumProduct_Twice_3"
## [43] "basePrice_prob_1"
## [44] "basePrice_prob_2"
## [45] "basePrice_prob_3"
```

```
## [46] "basePrice_productGroup_nUser_1"
## [47] "basePrice_productGroup_nUser_2"
## [48] "basePrice_productGroup_nUser_3"
## [49] "basePrice_productGroup_nUserUsed_1"
## [50] "basePrice_productGroup_nUserUsed_2"
## [51] "basePrice_productGroup_nUserUsed_3"
## [52] "basePrice_productGroup_prob_1"
## [53] "basePrice_productGroup_prob_2"
## [54] "basePrice_productGroup_prob_3"
## [55] "basePrice_productGroup_Twice_1"
## [56] "basePrice_productGroup_Twice_2"
## [57] "basePrice_productGroup_Twice_3"
## [58] "basePrice_ratio_bp_p_round_nUser_1"
## [59] "basePrice_ratio_bp_p_round_nUser_2"
## [60] "basePrice_ratio_bp_p_round_nUser_3"
## [61] "basePrice_ratio_bp_p_round_nUserUsed_1"
## [62] "basePrice_ratio_bp_p_round_nUserUsed_2"
## [63] "basePrice_ratio_bp_p_round_nUserUsed_3"
## [64] "basePrice_ratio_bp_p_round_prob_1"
## [65] "basePrice_ratio_bp_p_round_prob_2"
## [66] "basePrice_ratio_bp_p_round_prob_3"
## [67] "basePrice_ratio_bp_p_round_Twice_1"
## [68] "basePrice_ratio_bp_p_round_Twice_2"
## [69] "basePrice_ratio_bp_p_round_Twice_3"
## [70] "basePrice_Twice_1"
## [71] "basePrice_Twice_2"
## [72] "basePrice_Twice_3"
## [73] "brand_premiumProduct_nUser_1"
## [74] "brand_premiumProduct_nUser_2"
## [75] "brand_premiumProduct_nUser_3"
## [76] "brand_premiumProduct_nUserUsed_1"
## [77] "brand_premiumProduct_nUserUsed_2"
## [78] "brand_premiumProduct_nUserUsed_3"
## [79] "brand_premiumProduct_prob_1"
## [80] "brand_premiumProduct_prob_2"
## [81] "brand_premiumProduct_prob_3"
## [82] "brand_premiumProduct_Twice_1"
## [83] "brand_premiumProduct_Twice_2"
## [84] "brand_premiumProduct_Twice_3"
## [85] "categoryIDs_brand_nUser_1"
## [86] "categoryIDs_brand_nUser_2"
## [87] "categoryIDs_brand_nUser_3"
## [88] "categoryIDs_brand_nUserUsed_1"
## [89] "categoryIDs_brand_nUserUsed_2"
## [90] "categoryIDs_brand_nUserUsed_3"
## [91] "categoryIDs_brand_prob_1"
## [92] "categoryIDs_brand_prob_2"
## [93] "categoryIDs_brand_prob_3"
## [94] "categoryIDs_brand_Twice_1"
## [95] "categoryIDs_brand_Twice_2"
## [96] "categoryIDs_brand_Twice_3"
## [97] "categoryIDs_nUser_1"
## [98] "categoryIDs_nUser_2"
## [99] "categoryIDs_nUser_3"
```

```
## [100] "categoryIDs_nUserUsed_1"
## [101] "categoryIDs_nUserUsed_2"
## [102] "categoryIDs_nUserUsed_3"
## [103] "categoryIDs_premiumProduct_nUser_1"
## [104] "categoryIDs_premiumProduct_nUser_2"
## [105] "categoryIDs_premiumProduct_nUser_3"
## [106] "categoryIDs_premiumProduct_nUserUsed_1"
## [107] "categoryIDs_premiumProduct_nUserUsed_2"
## [108] "categoryIDs_premiumProduct_nUserUsed_3"
## [109] "categoryIDs_premiumProduct_prob_1"
## [110] "categoryIDs_premiumProduct_prob_2"
## [111] "categoryIDs_premiumProduct_prob_3"
## [112] "categoryIDs_premiumProduct_Twice_1"
## [113] "categoryIDs_premiumProduct_Twice_2"
## [114] "categoryIDs_premiumProduct_Twice_3"
## [115] "categoryIDs_prob_1"
## [116] "categoryIDs_prob_2"
## [117] "categoryIDs_prob_3"
## [118] "categoryIDs_ratio_bp_p_round_nUser_1"
## [119] "categoryIDs_ratio_bp_p_round_nUser_2"
## [120] "categoryIDs_ratio_bp_p_round_nUser_3"
## [121] "categoryIDs_ratio_bp_p_round_nUserUsed_1"
## [122] "categoryIDs_ratio_bp_p_round_nUserUsed_2"
## [123] "categoryIDs_ratio_bp_p_round_nUserUsed_3"
## [124] "categoryIDs_ratio_bp_p_round_prob_1"
## [125] "categoryIDs_ratio_bp_p_round_prob_2"
## [126] "categoryIDs_ratio_bp_p_round_prob_3"
## [127] "categoryIDs_ratio_bp_p_round_Twice_1"
## [128] "categoryIDs_ratio_bp_p_round_Twice_2"
## [129] "categoryIDs_ratio_bp_p_round_Twice_3"
## [130] "categoryIDs_Twice_1"
## [131] "categoryIDs_Twice_2"
## [132] "categoryIDs_Twice_3"
## [133] "couponID_couponsReceivedDoW_nUser_1"
## [134] "couponID_couponsReceivedDoW_nUser_2"
## [135] "couponID_couponsReceivedDoW_nUser_3"
## [136] "couponID_couponsReceivedDoW_nUserUsed_1"
## [137] "couponID_couponsReceivedDoW_nUserUsed_2"
## [138] "couponID_couponsReceivedDoW_nUserUsed_3"
## [139] "couponID_couponsReceivedDoW_prob_1"
## [140] "couponID_couponsReceivedDoW_prob_2"
## [141] "couponID_couponsReceivedDoW_prob_3"
## [142] "couponID_couponsReceivedDoW_Twice_1"
## [143] "couponID_couponsReceivedDoW_Twice_2"
## [144] "couponID_couponsReceivedDoW_Twice_3"
## [145] "couponID_couponsReceivedTime_nUser_1"
## [146] "couponID_couponsReceivedTime_nUser_2"
## [147] "couponID_couponsReceivedTime_nUser_3"
## [148] "couponID_couponsReceivedTime_nUserUsed_1"
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## [196] "orderTimeTime_brand_nUserUsed"
## [197] "orderTimeTime_brand_prob"
## [198] "orderTimeTime_brand_Twice"
## [199] "orderTimeTime_categoryIDs_nUser"
## [200] "orderTimeTime_categoryIDs_nUserUsed"
## [201] "orderTimeTime_categoryIDs_prob"
## [202] "orderTimeTime_categoryIDs_Twice"
## [203] "orderTimeTime_nUser"
## [204] "orderTimeTime_nUserUsed"
## [205] "orderTimeTime_orderTimeDoW_nUser"
## [206] "orderTimeTime_orderTimeDoW_nUserUsed"
## [207] "orderTimeTime_orderTimeDoW_prob"
## [208] "orderTimeTime_orderTimeDoW_Twice"
## [209] "orderTimeTime_premiumProduct_nUser"
## [210] "orderTimeTime_premiumProduct_nUserUsed"
## [211] "orderTimeTime_premiumProduct_prob"
## [212] "orderTimeTime_premiumProduct_Twice"
## [213] "orderTimeTime_price_nUser"
## [214] "orderTimeTime_price_nUserUsed"
## [215] "orderTimeTime_price_prob"
## [216] "orderTimeTime_price_Twice"
## [217] "orderTimeTime_prob"
## [218] "orderTimeTime_productGroup_nUser"
## [219] "orderTimeTime_productGroup_nUserUsed"
## [220] "orderTimeTime_productGroup_prob"
## [221] "orderTimeTime_productGroup_Twice"
## [222] "orderTimeTime_ratio_bp_p_round_nUser"
## [223] "orderTimeTime_ratio_bp_p_round_nUserUsed"
```

```
## [224] "orderTimeTime_ratio_bp_p_round_prob"
## [225] "orderTimeTime_ratio_bp_p_round_Twice"
## [226] "orderTimeTime_TimeBtwnRecOrder_disc_nUser"
## [227] "orderTimeTime_TimeBtwnRecOrder_disc_nUserUsed"
## [228] "orderTimeTime_TimeBtwnRecOrder_disc_prob"
## [229] "orderTimeTime_TimeBtwnRecOrder_disc_Twice"
## [230] "orderTimeTime_Twice"
## [231] "price_basePrice_nUser"
## [232] "price_basePrice_nUserUsed"
## [233] "price_basePrice_prob"
## [234] "price_basePrice_Twice"
## [235] "price_brand_nUser"
## [236] "price_brand_nUserUsed"
## [237] "price_brand_prob"
## [238] "price_brand_Twice"
## [239] "price_categoryIDs_nUser"
## [240] "price_categoryIDs_nUserUsed"
## [241] "price_categoryIDs_prob"
## [242] "price_categoryIDs_Twice"
## [243] "price_nUser"
## [244] "price_nUserUsed"
## [245] "price_premiumProduct_nUser"
## [246] "price_premiumProduct_nUserUsed"
## [247] "price_premiumProduct_prob"
## [248] "price_premiumProduct_Twice"
## [249] "price_prob"
## [250] "price_productGroup_nUser"
## [251] "price_productGroup_nUserUsed"
## [252] "price_productGroup_prob"
## [253] "price_productGroup_Twice"
## [254] "price_ratio_bp_p_round_nUser"
## [255] "price_ratio_bp_p_round_nUserUsed"
## [256] "price_ratio_bp_p_round_prob"
## [257] "price_ratio_bp_p_round_Twice"
## [258] "price_Twice"
## [259] "productGroup_brand_nUser"
## [260] "productGroup_brand_nUserUsed"
## [261] "productGroup_brand_prob"
## [262] "productGroup_brand_Twice"
## [263] "productGroup_categoryIDs_nUser"
## [264] "productGroup_categoryIDs_nUserUsed"
## [265] "productGroup_categoryIDs_prob"
## [266] "productGroup_categoryIDs_Twice"
## [267] "productGroup_nUser"
## [268] "productGroup_nUserUsed"
## [269] "productGroup_premiumProduct_nUser"
## [270] "productGroup_premiumProduct_nUserUsed"
## [271] "productGroup_premiumProduct_prob"
## [272] "productGroup_premiumProduct_Twice"
## [273] "productGroup_prob"
## [274] "productGroup_ratio_bp_p_round_nUser"
## [275] "productGroup_ratio_bp_p_round_nUserUsed"
## [276] "productGroup_ratio_bp_p_round_prob"
## [277] "productGroup_ratio_bp_p_round_Twice"
```

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## [278] "productGroup_Twice"
## [279] "ratio_bp_p"
## [280] "ratio_bp_p_round"
## [281] "ratio_bp_p_round_brand_nUser"
## [282] "ratio_bp_p_round_brand_nUserUsed"
## [283] "ratio_bp_p_round_brand_prob"
## [284] "ratio_bp_p_round_brand_Twice"
## [285] "ratio_bp_p_round_nUser"
## [286] "ratio_bp_p_round_nUserUsed"
## [287] "ratio_bp_p_round_premiumProduct_nUser"
## [288] "ratio_bp_p_round_premiumProduct_nUserUsed"
## [289] "ratio_bp_p_round_premiumProduct_prob"
## [290] "ratio_bp_p_round_premiumProduct_Twice"
## [291] "ratio_bp_p_round_prob"
## [292] "ratio_bp_p_round_Twice"
## [293] "reward_basePrice_nUser"
## [294] "reward_basePrice_nUserUsed"
## [295] "reward_basePrice_prob"
## [296] "reward_basePrice_Twice"
## [297] "reward_brand_nUser"
## [298] "reward_brand_nUserUsed"
## [299] "reward_brand_prob"
## [300] "reward_brand_Twice"
## [301] "reward_categoryIDs_nUser"
## [302] "reward_categoryIDs_nUserUsed"
## [303] "reward_categoryIDs_prob"
## [304] "reward_categoryIDs_Twice"
## [305] "reward_couponsReceivedDoW_nUser"
## [306] "reward_couponsReceivedDoW_nUserUsed"
## [307] "reward_couponsReceivedDoW_prob"
## [308] "reward_couponsReceivedDoW_Twice"
## [309] "reward_couponsReceivedTime_nUser"
## [310] "reward_couponsReceivedTime_nUserUsed"
## [311] "reward_couponsReceivedTime_prob"
## [312] "reward_couponsReceivedTime_Twice"
## [313] "reward_orderTimeDoW_nUser"
## [314] "reward_orderTimeDoW_nUserUsed"
## [315] "reward_orderTimeDoW_prob"
## [316] "reward_orderTimeDoW_Twice"
## [317] "reward_orderTimeTime_nUser"
## [318] "reward_orderTimeTime_nUserUsed"
## [319] "reward_orderTimeTime_prob"
## [320] "reward_orderTimeTime_Twice"
## [321] "reward_premiumProduct_nUser"
## [322] "reward_premiumProduct_nUserUsed"
## [323] "reward_premiumProduct_prob"
## [324] "reward_premiumProduct_Twice"
## [325] "reward_price_nUser"
## [326] "reward_price_nUserUsed"
## [327] "reward_price_prob"
## [328] "reward_price_Twice"
## [329] "reward_productGroup_nUser"
## [330] "reward_productGroup_nUserUsed"
## [331] "reward_productGroup_prob"
```

```
## [332] "reward_productGroup_Twice"
## [333] "reward_ratio_bp_p_round_nUser"
## [334] "reward_ratio_bp_p_round_nUserUsed"
## [335] "reward_ratio_bp_p_round_prob"
## [336] "reward_ratio_bp_p_round_Twice"
## [337] "reward_TimeBtwnRecOrder_disc_nUser"
## [338] "reward_TimeBtwnRecOrder_disc_nUserUsed"
## [339] "reward_TimeBtwnRecOrder_disc_prob"
## [340] "reward_TimeBtwnRecOrder_disc_Twice"
## [341] "TimeBtwnRecOrder_disc"
## [342] "TimeBtwnRecOrder_disc_basePrice_nUser"
## [343] "TimeBtwnRecOrder_disc_basePrice_nUserUsed"
## [344] "TimeBtwnRecOrder_disc_basePrice_prob"
## [345] "TimeBtwnRecOrder_disc_basePrice_Twice"
## [346] "TimeBtwnRecOrder_disc_brand_nUser"
## [347] "TimeBtwnRecOrder_disc_brand_nUserUsed"
## [348] "TimeBtwnRecOrder_disc_brand_prob"
## [349] "TimeBtwnRecOrder_disc_brand_Twice"
## [350] "TimeBtwnRecOrder_disc_categoryIDs_nUser"
## [351] "TimeBtwnRecOrder_disc_categoryIDs_nUserUsed"
## [352] "TimeBtwnRecOrder_disc_categoryIDs_prob"
## [353] "TimeBtwnRecOrder_disc_categoryIDs_Twice"
## [354] "TimeBtwnRecOrder_disc_nUser"
## [355] "TimeBtwnRecOrder_disc_nUserUsed"
## [356] "TimeBtwnRecOrder_disc_premiumProduct_nUser"
## [357] "TimeBtwnRecOrder_disc_premiumProduct_nUserUsed"
## [358] "TimeBtwnRecOrder_disc_premiumProduct_prob"
## [359] "TimeBtwnRecOrder_disc_premiumProduct_Twice"
## [360] "TimeBtwnRecOrder_disc_price_nUser"
## [361] "TimeBtwnRecOrder_disc_price_nUserUsed"
## [362] "TimeBtwnRecOrder_disc_price_prob"
## [363] "TimeBtwnRecOrder_disc_price_Twice"
## [364] "TimeBtwnRecOrder_disc_prob"
## [365] "TimeBtwnRecOrder_disc_productGroup_nUser"
## [366] "TimeBtwnRecOrder_disc_productGroup_nUserUsed"
## [367] "TimeBtwnRecOrder_disc_productGroup_prob"
## [368] "TimeBtwnRecOrder_disc_productGroup_Twice"
## [369] "TimeBtwnRecOrder_disc_ratio_bp_p_round_nUser"
## [370] "TimeBtwnRecOrder_disc_ratio_bp_p_round_nUserUsed"
## [371] "TimeBtwnRecOrder_disc_ratio_bp_p_round_prob"
## [372] "TimeBtwnRecOrder_disc_ratio_bp_p_round_Twice"
```

## Save Universal

These are our universal features:

```
saveRDS(wideFrame, file = "../set3/combined/set3FeaturesCombined_wide.rds")
saveRDS(longFrame, file = "../set3/combined/set3FeaturesCombined_long.rds")
```