Predicting the household composition from TV viewing

ETH DAS applied statistics workshop

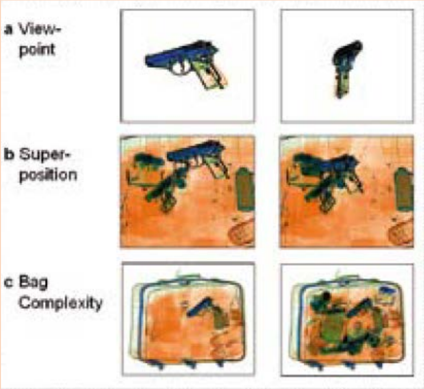
Rafael Lüchinger / 2018-09-10

mediapulse

About Me

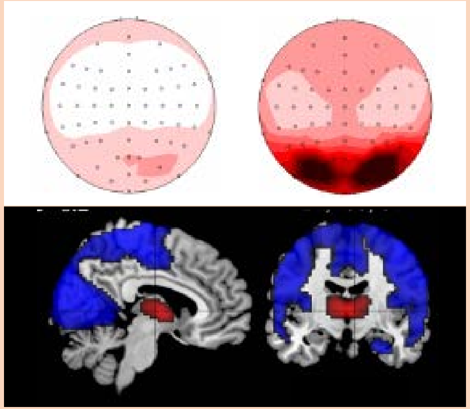
Master Psychology, UZH

Visual Cognition



PhD Neuropsychology, UZH

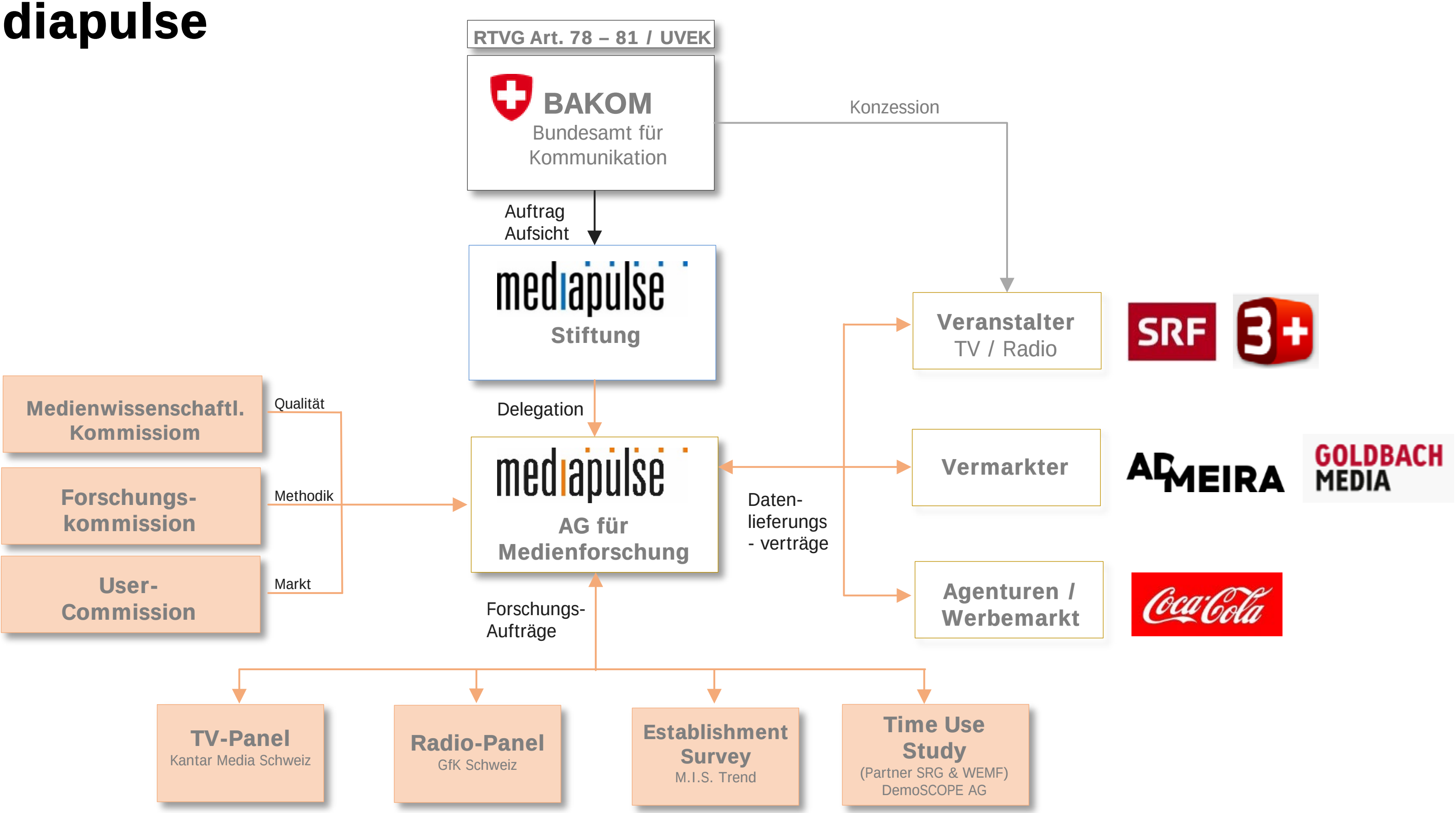
Thalamocortical Interaction



Data Scientist, Mediapulse AG

Radio & TV Nutzung

Mediapulse



RTVG Art. 78 – 81 / UVEK

BAKOM
Bundesamt für Kommunikation

Konzession

Auftrag
Aufsicht

mediapulse
Stiftung

Delegation

mediapulse
AG für Medienforschung

Medienwissenschaftl. Kommission

Forschungs-kommission

User-Commission

Qualität

Methodik

Markt

Daten-lieferungs - verträge

Veranstalter
TV / Radio

SRF

3+

Vermarkter

ADMEIRA

GOLDBACH MEDIA

Agenturen / Werbemarkt

Coca-Cola

Forschungs-Aufträge

TV-Panel
Kantar Media Schweiz

Radio-Panel
GfK Schweiz

Establishment Survey
M.I.S. Trend

Time Use Study
(Partner SRG & WEMF)
DemoSCOPE AG

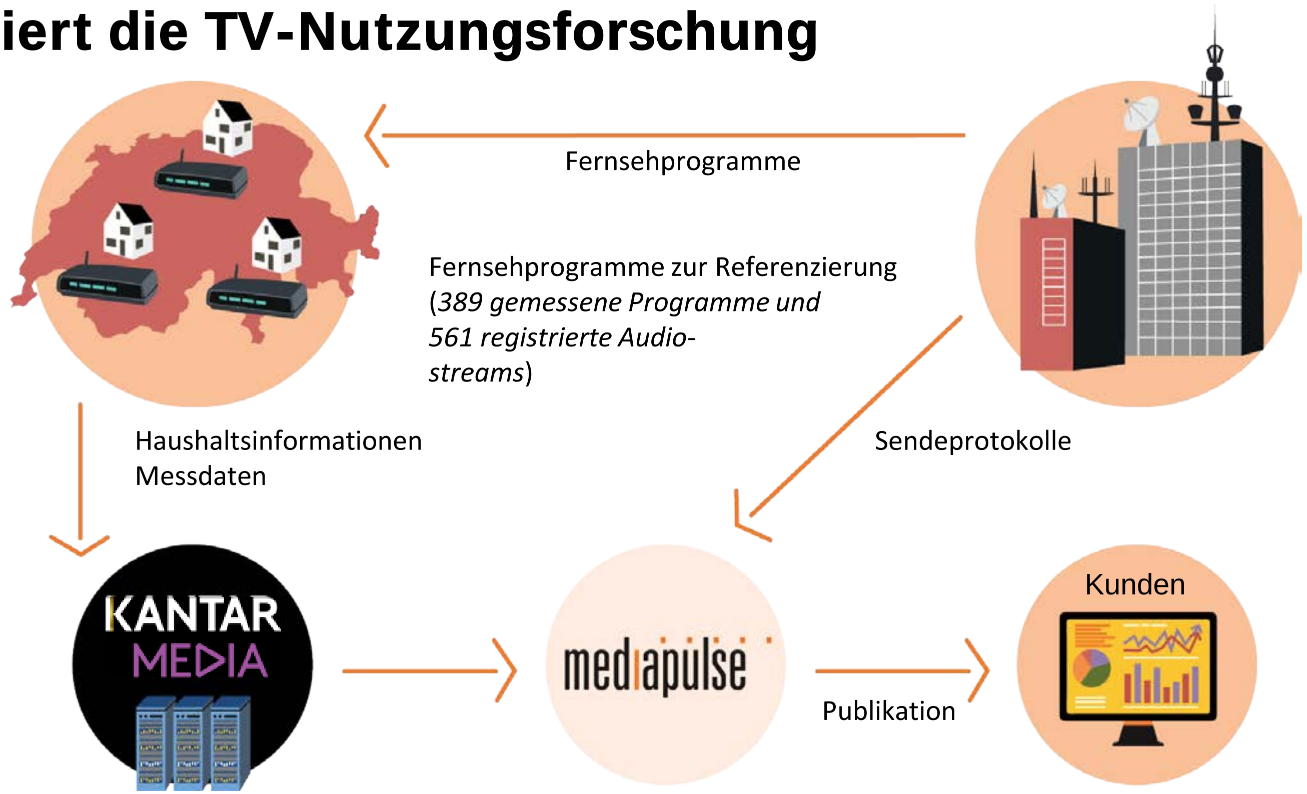
[Die Zahlen gelten für das Jahr 2017]

So funktioniert die TV-Nutzungsforschung

Universum
(*3’335’000 TV-HH in CH*)

Stichprobe
(*2008 HH im Panel im Ø*)
(4505 Personen mit G im *im Ø*)

Messung
(*People Meter in HH*)



Fernsehprogramme

Fernsehprogramme zur Referenzierung
(*389 gemessene Programme und 561 registrierte Audiostreams*)

Haushaltsinformationen
Messdaten

Sendeprotokolle

Publikation

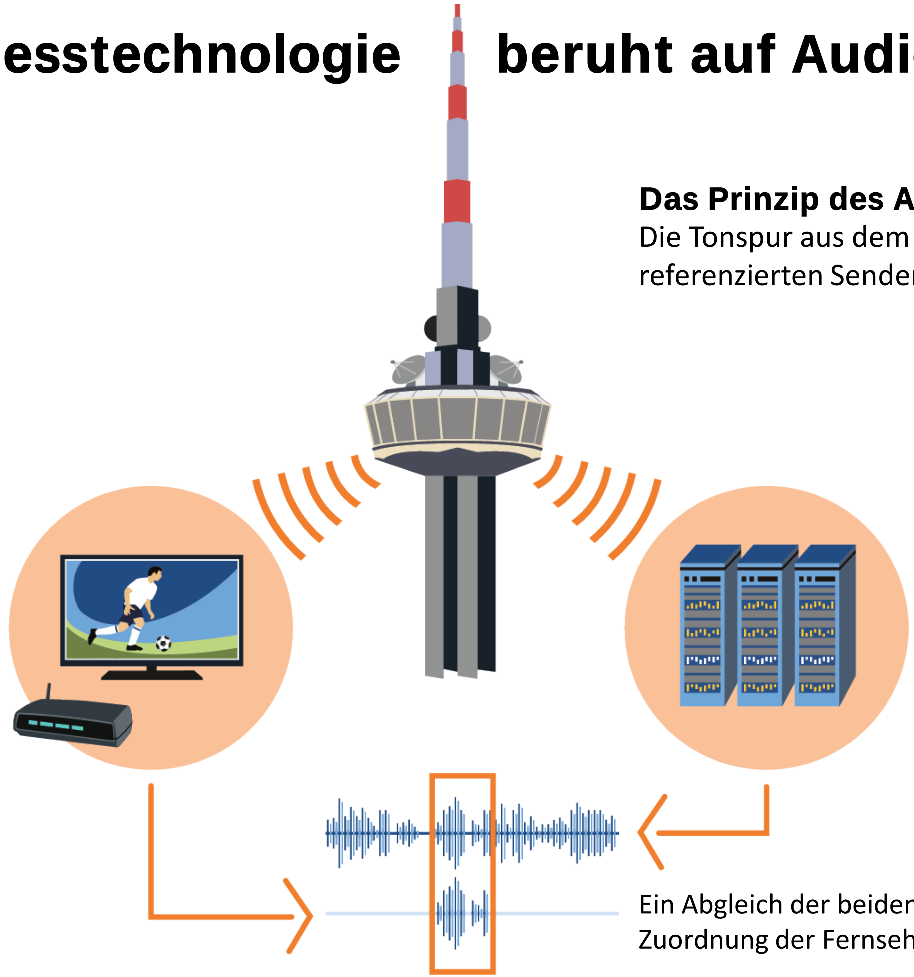
Referenzierung
(*2 Aufzeichnungsstationen*)
Audiomatching/Hochrechnung/
Datenkontrollen

Datenkontrollen
Datenveredelung
(*72 Sendeprotokolle*)

Auswertung der Daten
mit «Instar Analytics»

Die Messtechnologie beruht auf Audiomatching

Das Prinzip des Audiomatching (= Audioabgleich):
Die Tonspur aus dem Panel-Haushalt wird mit den Tonspuren aller referenzierten Sender abgeglichen und zugeordnet.

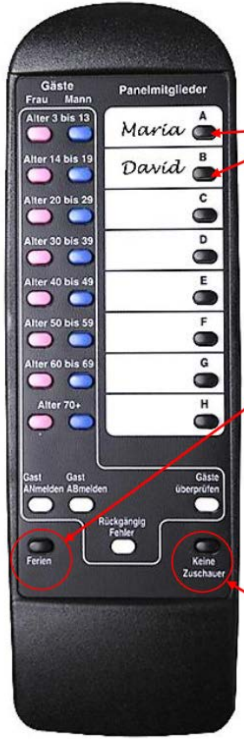


Im Haushalt wird die Tonspur des Fernsehkonsums registriert

In der Zentrale werden alle Tonspuren der relevanten Sender registriert

Ein Abgleich der beiden Quellen ermöglicht die Zuordnung der Fernsehnutzung im Haushalt

Personen Messung



Panelmitglieder anmelden:
Sobald der Fernseher eingeschaltet wird, erscheint im Display „Wer ist anwesend“. Bitte drücken Sie darauf Ihre Personen-Taste.
Dies gilt für alle anwesenden Personen.

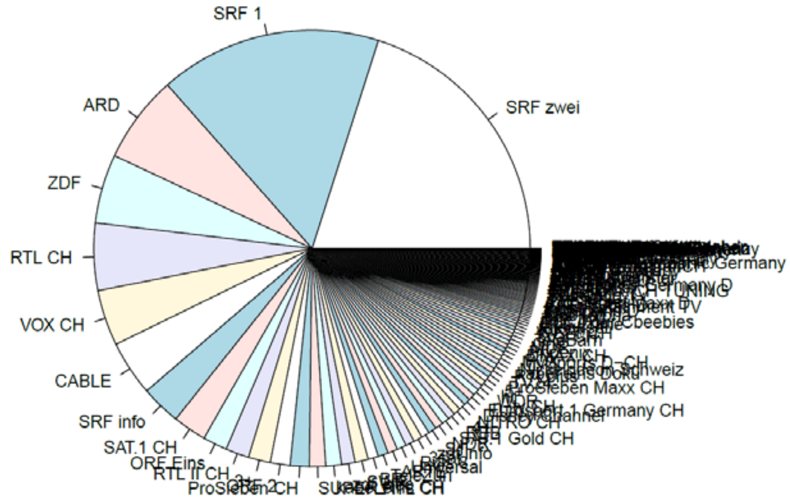
Bevor Sie in die Ferien gehen:
Drücken Sie bitte kurz nach der letzten Nutzung des TV-Gerätes die „Ferien“-Taste. Sobald auf dem Display „Urlaub bestätigen“ erscheint, drücken Sie nochmals die Taste „Ferien“.

Keine Zuschauer:
Falls das TV-Gerät im Betrieb ist, aber niemand zuschaut, drücken Sie bitte die Taste „Keine Zuschauer“. Dies gilt auch dann, wenn Sie das TV-Gerät zum Radio/CD hören benutzen.

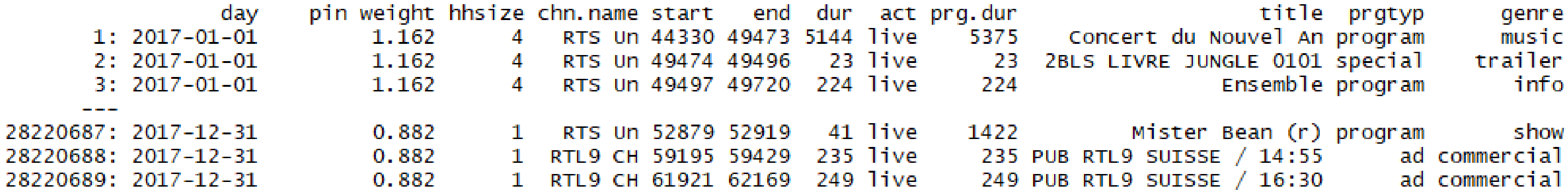
Grenze des Stichprobenansatzes

- Es kommt vor, dass ein Sender zu einer bestimmten Zeit keinen Kontakt aufweist (0-Rating).
- In Wirklichkeit schaut wahrscheinlich irgend jemand das Programm.
- Das TV-Panel ist zu klein um Nutzung mit geringer Reichweite zuverlässig zu erfassen.
- Eine Aufstockung des Panels ist sehr teuer und ineffektiv.
- Das TV Panel ist im internationalen Vergleich relativ gross. Der Schweizer TV Markt ist aber stark fragmentiert.

- Statistische Modellierung
- Anreicherung durch Set-Top-Box Daten (hunderttausende Schweizer Haushalte)


Schweizer TV Markt

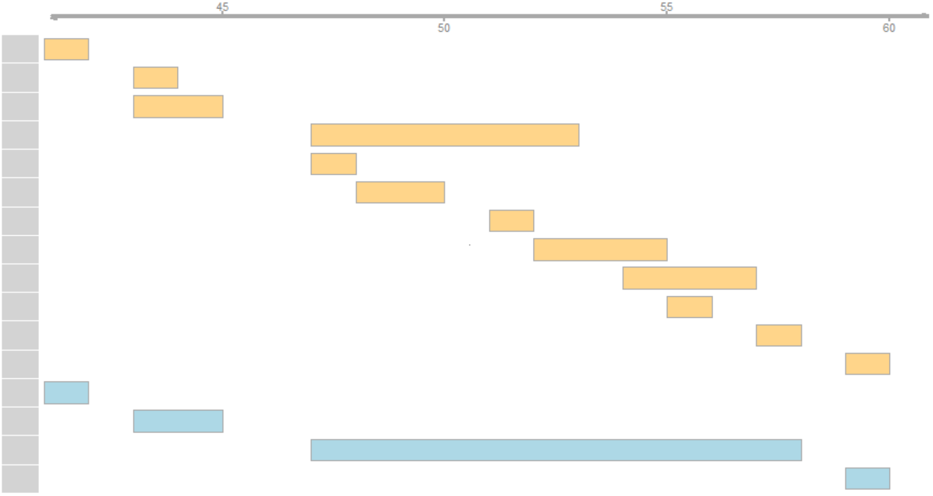
TV Viewing Data



```
                day     pin weight hhsize chn.name start   end  dur  act prg.dur                    title  prgtyp      genre
       1: 2017-01-01          1.162      4   RTS Un 44330 49473 5144 live    5375     Concert du Nouvel An program      music
       2: 2017-01-01          1.162      4   RTS Un 49474 49496   23 live      23   2BLS LIVRE JUNGLE 0101 special    trailer
       3: 2017-01-01          1.162      4   RTS Un 49497 49720  224 live     224                 Ensemble program       info
      ---
28220687: 2017-12-31          0.882      1   RTS Un 52879 52919   41 live    1422          Mister Bean (r) program       show
28220688: 2017-12-31          0.882      1  RTL9 CH 59195 59429  235 live     235  PUB RTL9 SUISSE / 14:55      ad commercial
28220689: 2017-12-31          0.882      1  RTL9 CH 61921 62169  249 live     249  PUB RTL9 SUISSE / 16:30      ad commercial
```

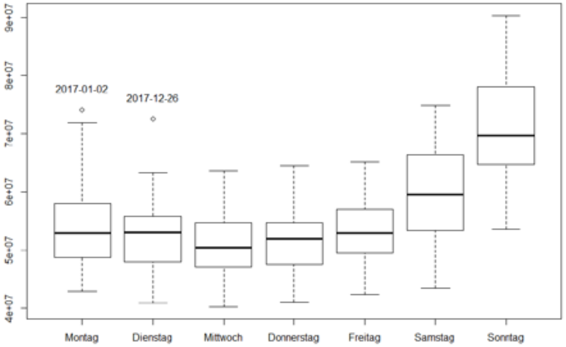
Individual level

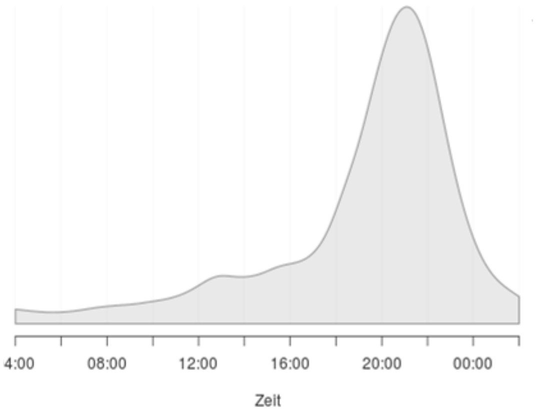
household level



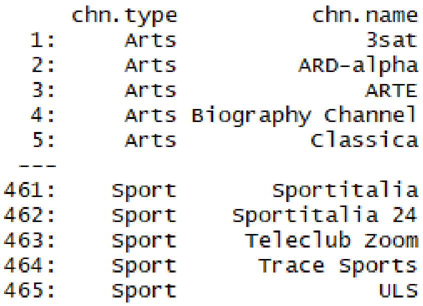
Features Selection

A. Viewing Time



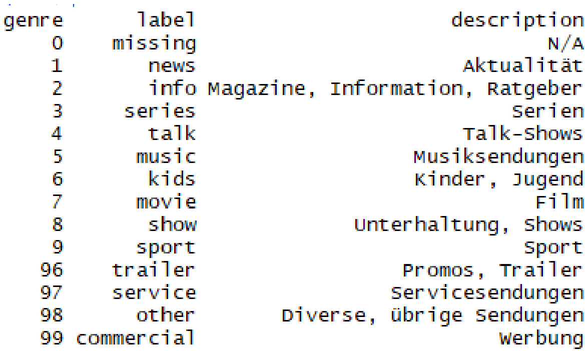


B. Channel Groups



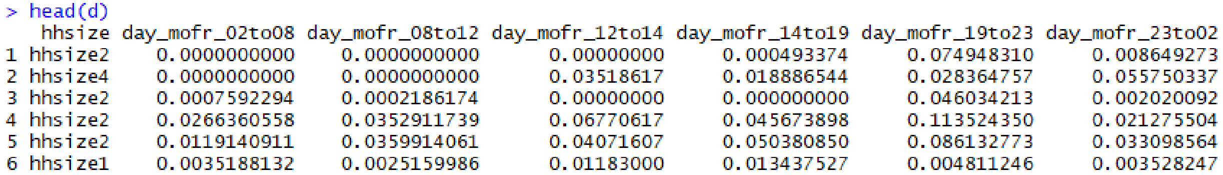
```
        chn.type          chn.name
  1:        Arts              3sat
  2:        Arts         ARD-alpha
  3:        Arts              ARTE
  4:        Arts Biography Channel
  5:        Arts          Classica
 ---
461:       Sport        Sportitalia
462:       Sport     Sportitalia 24
463:       Sport      Teleclub Zoom
464:       Sport       Trace Sports
465:       Sport                ULS
```

C. Program Genre

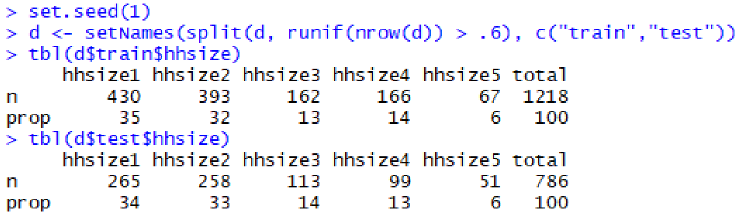


```
genre      label                    description
    0    missing                            N/A
    1       news                     Aktualität
    2       info Magazine, Information, Ratgeber
    3     series                         Serien
    4       talk                     Talk-Shows
    5      music                Musiksendungen
    6       kids                 Kinder, Jugend
    7      movie                           Film
    8       show             Unterhaltung, Shows
    9      sport                          Sport
   96    trailer                Promos, Trailer
   97    service               Servicesendungen
   98      other      Diverse, übrige Sendungen
   99 commercial                        Werbung
```

Train & Test Data

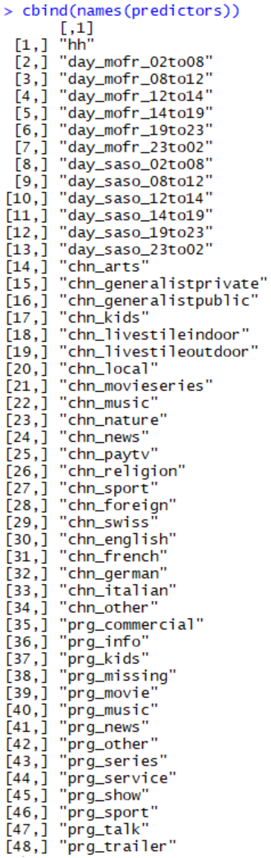


```
> head(d)
  hhsize day_mofr_02to08 day_mofr_08to12 day_mofr_12to14 day_mofr_14to19 day_mofr_19to23 day_mofr_23to02
1 hhsize2    0.0000000000    0.0000000000      0.00000000     0.000493374     0.074948310     0.008649273
2 hhsize4    0.0000000000    0.0000000000      0.03518617     0.018886544     0.028364757     0.055750337
3 hhsize2    0.0007592294    0.0002186174      0.00000000     0.000000000     0.046034213     0.002020092
4 hhsize2    0.0266360558    0.0352911739      0.06770617     0.045673898     0.113524350     0.021275504
5 hhsize2    0.0119140911    0.0359914061      0.04071607     0.050380850     0.086132773     0.033098564
6 hhsize1    0.0035188132    0.0025159986      0.01183000     0.013437527     0.004811246     0.003528247
```



```
> set.seed(1)
> d <- setNames(split(d, runif(nrow(d)) > .6), c("train","test"))
> tbl(d$train$hhsize)
     hhsize1 hhsize2 hhsize3 hhsize4 hhsize5 total
n        430     393     162     166      67  1218
prop      35      32      13      14       6   100
> tbl(d$test$hhsize)
     hhsize1 hhsize2 hhsize3 hhsize4 hhsize5 total
n        265     258     113      99      51   786
prop      34      33      14      13       6   100
```

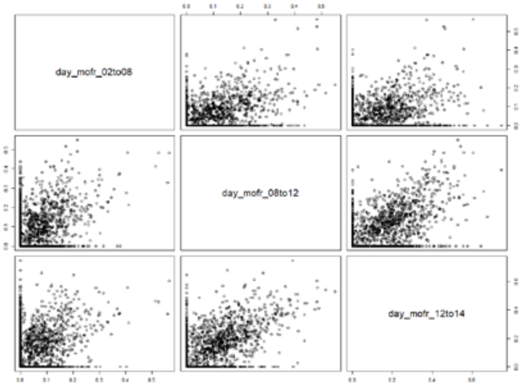
# chance is 1/5



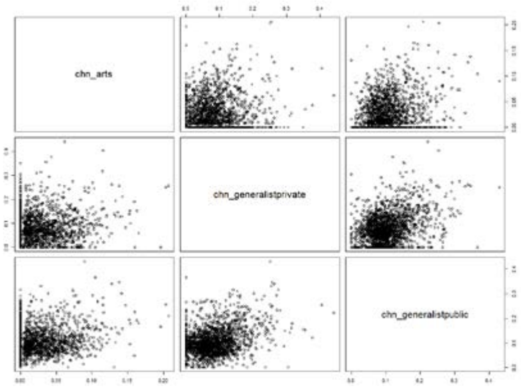
```
> cbind(names(predictors))
      [,1]
 [1,] "hh"
 [2,] "day_mofr_02to08"
 [3,] "day_mofr_08to12"
 [4,] "day_mofr_12to14"
 [5,] "day_mofr_14to19"
 [6,] "day_mofr_19to23"
 [7,] "day_mofr_23to02"
 [8,] "day_saso_02to08"
 [9,] "day_saso_08to12"
[10,] "day_saso_12to14"
[11,] "day_saso_14to19"
[12,] "day_saso_19to23"
[13,] "day_saso_23to02"
[14,] "chn_arts"
[15,] "chn_generalistprivate"
[16,] "chn_generalistpublic"
[17,] "chn_kids"
[18,] "chn_livestileindoor"
[19,] "chn_livestileoutdoor"
[20,] "chn_local"
[21,] "chn_movieseries"
[22,] "chn_music"
[23,] "chn_nature"
[24,] "chn_news"
[25,] "chn_paytv"
[26,] "chn_religion"
[27,] "chn_sport"
[28,] "chn_foreign"
[29,] "chn_swiss"
[30,] "chn_english"
[31,] "chn_french"
[32,] "chn_german"
[33,] "chn_italian"
[34,] "chn_other"
[35,] "prg_commercial"
[36,] "prg_info"
[37,] "prg_kids"
[38,] "prg_missing"
[39,] "prg_movie"
[40,] "prg_music"
[41,] "prg_news"
[42,] "prg_other"
[43,] "prg_series"
[44,] "prg_service"
[45,] "prg_show"
[46,] "prg_sport"
[47,] "prg_talk"
[48,] "prg_trailer"
```

Between features

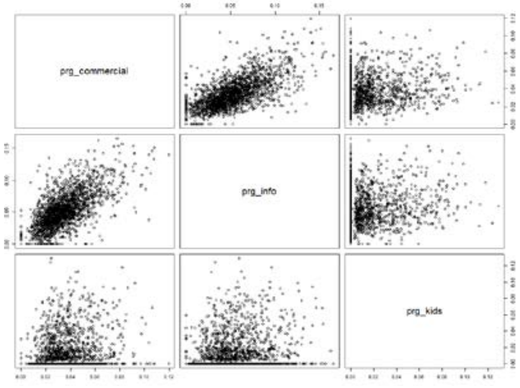
A. Viewing Time

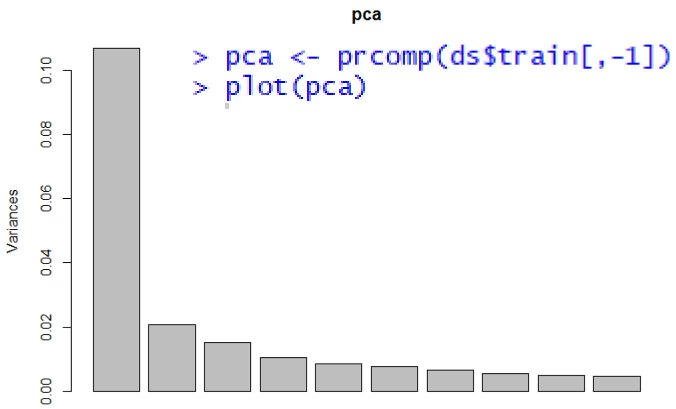


B. Channel Groups

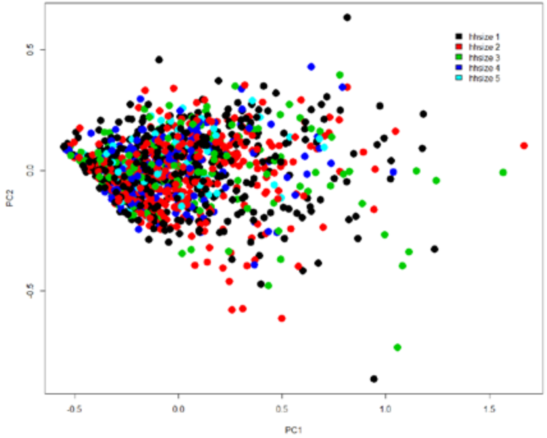


C. Program Genre

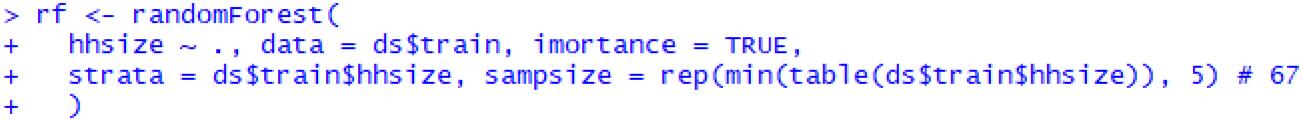




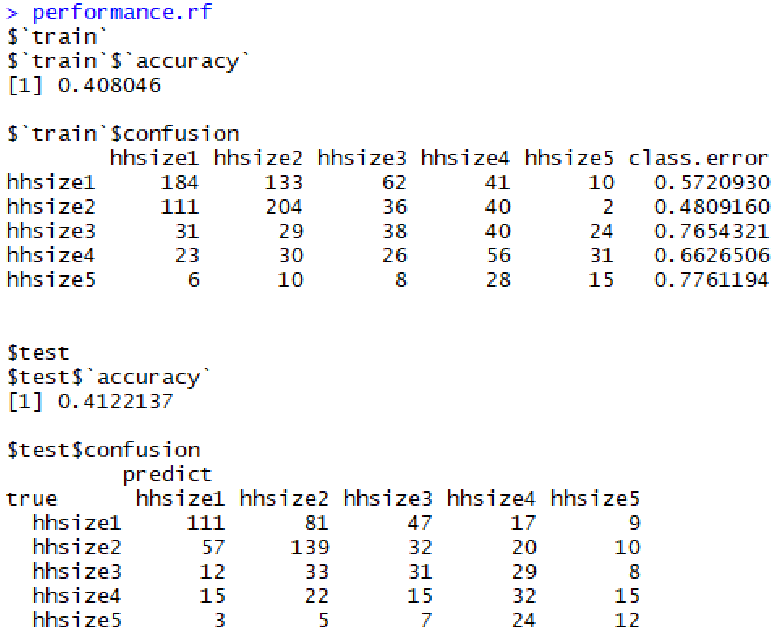
```
> pca <- prcomp(ds$train[,-1])
> plot(pca)
```



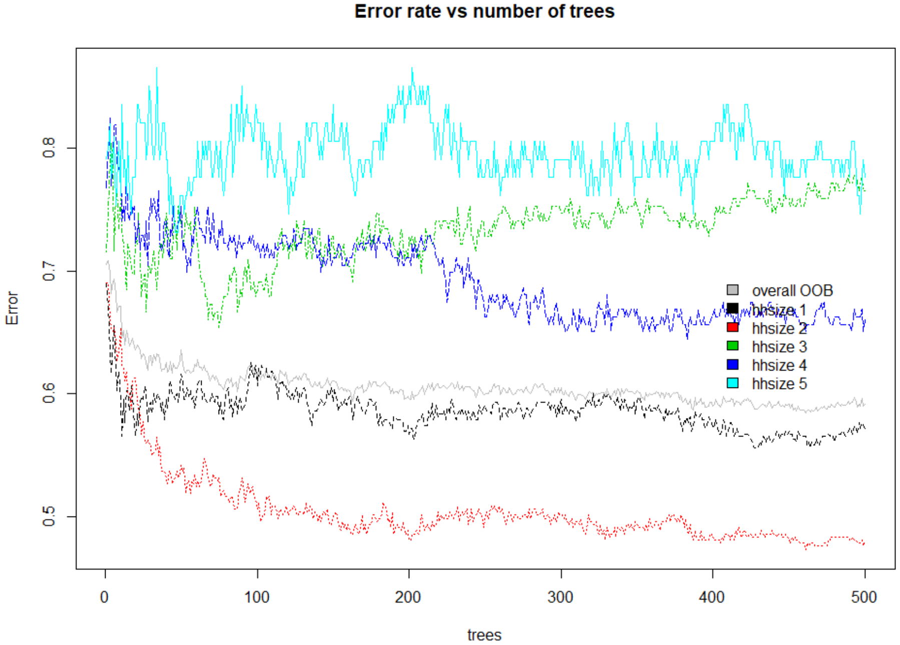
Random Forest



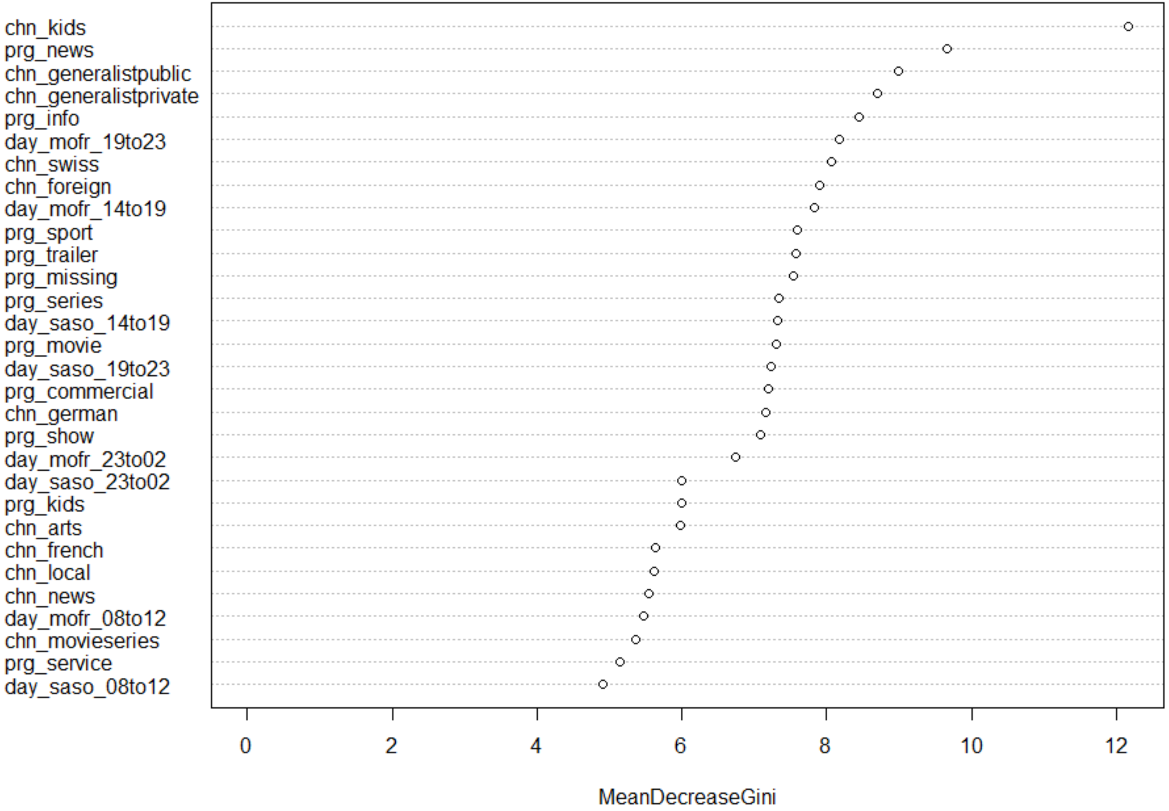
```
> rf <- randomForest(
+   hhsize ~ ., data = ds$train, imortance = TRUE,
+   strata = ds$train$hhsize, sampsize = rep(min(table(ds$train$hhsize)), 5) # 67
+   )
```



```
> performance.rf
$`train`
$`train`$`accuracy`
[1] 0.408046

$`train`$confusion
        hhsize1 hhsize2 hhsize3 hhsize4 hhsize5 class.error
hhsize1     184     133      62      41      10   0.5720930
hhsize2     111     204      36      40       2   0.4809160
hhsize3      31      29      38      40      24   0.7654321
hhsize4      23      30      26      56      31   0.6626506
hhsize5       6      10       8      28      15   0.7761194


$test
$test$`accuracy`
[1] 0.4122137

$test$confusion
         predict
true      hhsize1 hhsize2 hhsize3 hhsize4 hhsize5
  hhsize1     111      81      47      17       9
  hhsize2      57     139      32      20      10
  hhsize3      12      33      31      29       8
  hhsize4      15      22      15      32      15
  hhsize5       3       5       7      24      12
```

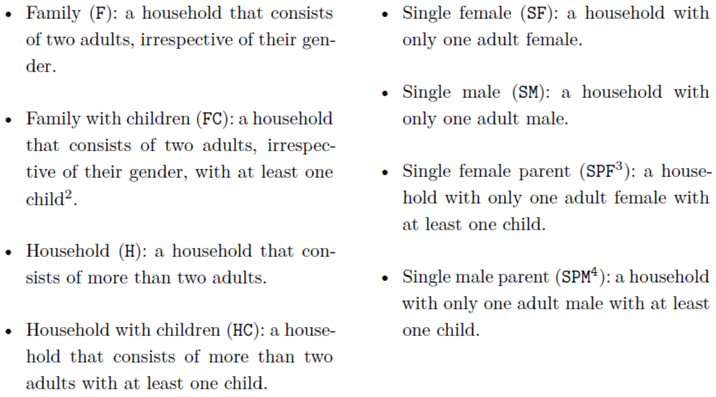


Variable Importance



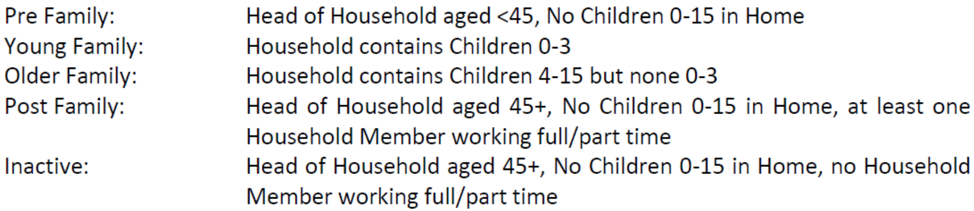
Outlook

- More & better features, based on longer period, e.g. year
- Other Classifier (Multinomial Logistic Model, Linear Discriminant Analysis, Stochastic Gradient Boosting, Support Vector Machine)
- Could we use priors for hh composition by region based on FSO data
- From household size to individual level with age / sex
- Change household size for household composition



- Family (F): a household that consists of two adults, irrespective of their gender.
- Family with children (FC): a household that consists of two adults, irrespective of their gender, with at least one child[2].
- Household (H): a household that consists of more than two adults.
- Household with children (HC): a household that consists of more than two adults with at least one child.
- Single female (SF): a household with only one adult female.
- Single male (SM): a household with only one adult male.
- Single female parent (SPF[3]): a household with only one adult female with at least one child.
- Single male parent (SPM[4]): a household with only one adult male with at least one child.

Man, 2016, Statistical Learning of Household Composition from Television Viewing Behaviour



Pre Family: Head of Household aged <45, No Children 0-15 in Home

Young Family: Household contains Children 0-3

Older Family: Household contains Children 4-15 but none 0-3

Post Family: Head of Household aged 45+, No Children 0-15 in Home, at least one Household Member working full/part time

Inactive: Head of Household aged 45+, No Children 0-15 in Home, no Household Member working full/part time

RSNB 2014, Panel Control Review 2014 for BARB