Datenanalyse

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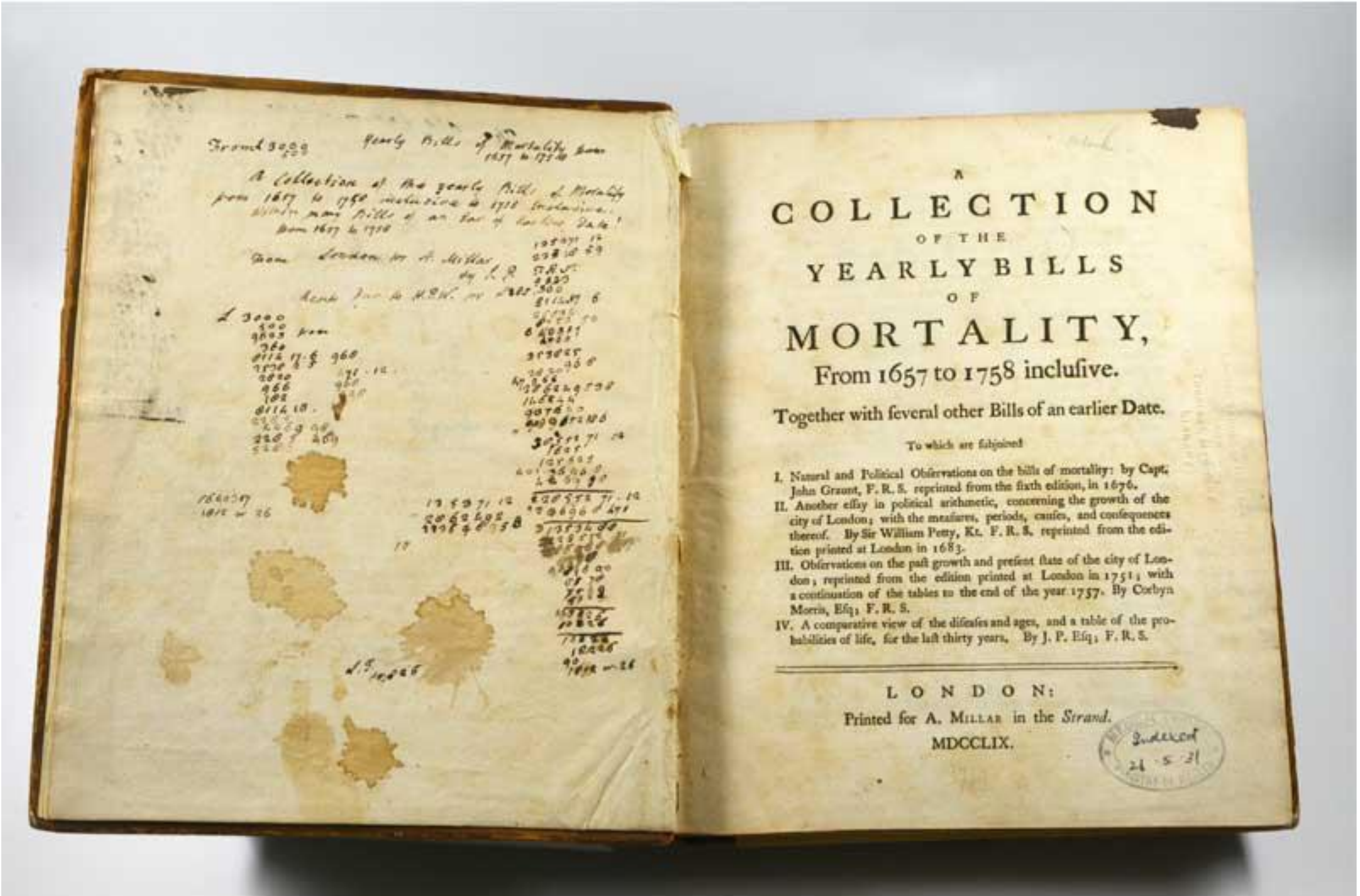
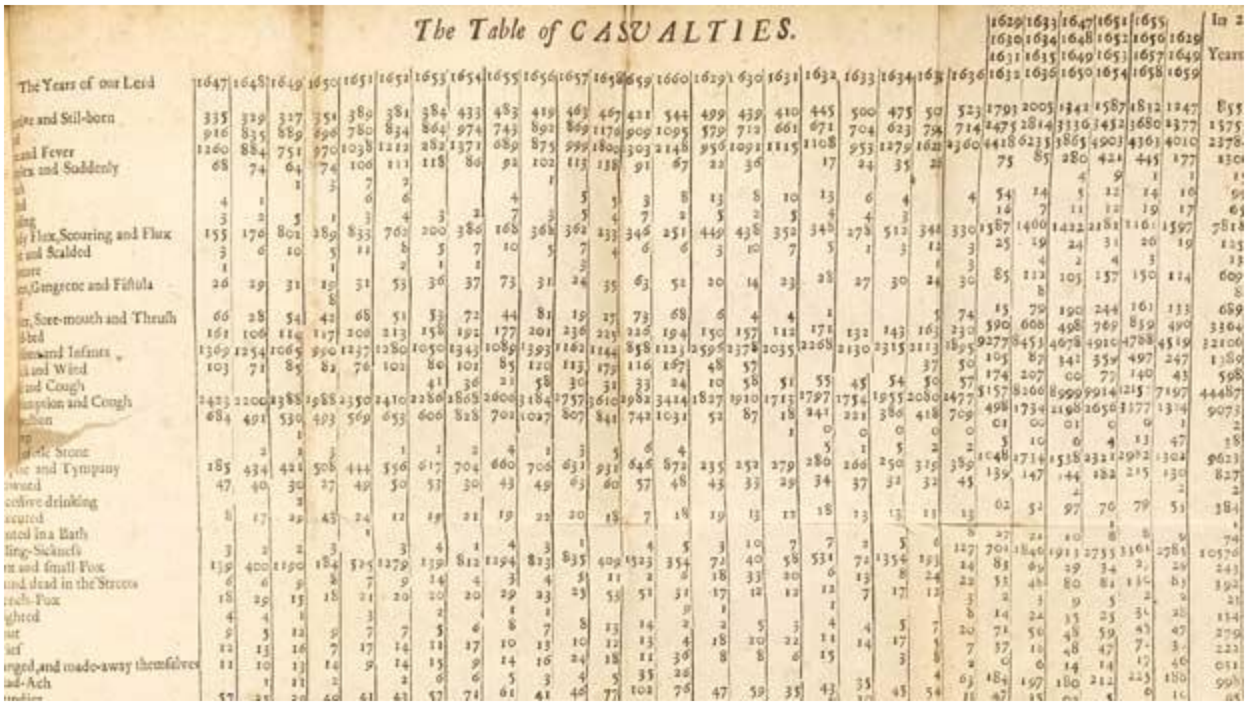
Datenanalyse

- Google´s Chef-Ökonom Hal Varian
  - „The next sexy job“
  - „The ability to take data – to be able to understand it, to process it, to extract value from it, to communicate it – that´s going to be a hugely important skill.“
  - New York Times, 2009
- „Hot new gig in tech“ – Fortune

Bills of Mortality

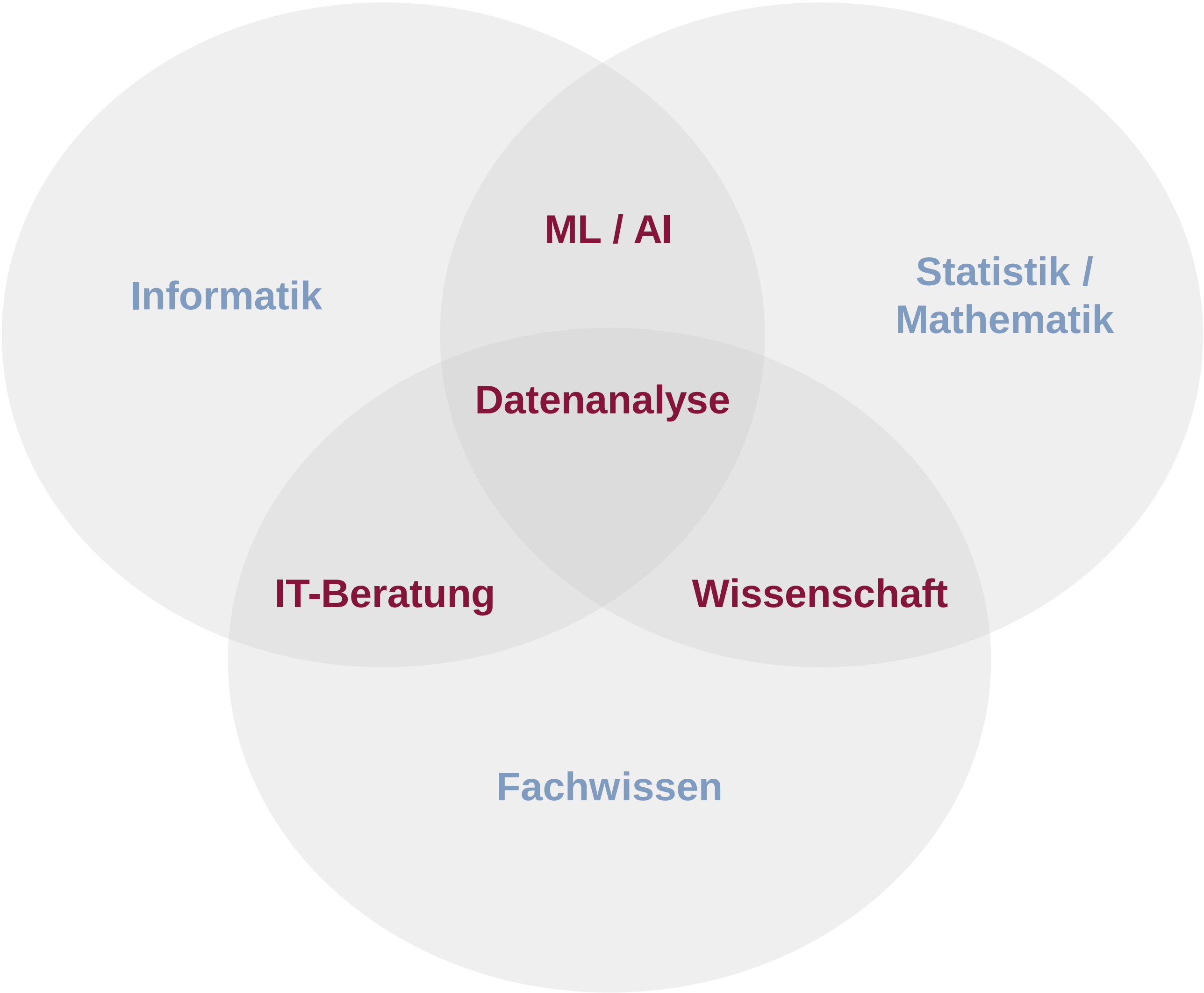


Bills of Mortality



Wöchentliche Todesstatistiken

Datenanalyse nach Drew Conway



US Census Income Data

Explorative Datenanalyse

Daten

adult.data

```
39, State-gov, 77516, Bachelors, 13, Never-married, Adm-clerical, Not-in-family, White, Male,
50, Self-emp-not-inc, 83311, Bachelors, 13, Married-civ-spouse, Exec-managerial, Husband, Whit
38, Private, 215646, HS-grad, 9, Divorced, Handlers-cleaners, Not-in-family, White, Male, 0, 0,
53, Private, 234721, 11th, 7, Married-civ-spouse, Handlers-cleaners, Husband, Black, Male, 0,
28, Private, 338409, Bachelors, 13, Married-civ-spouse, Prof-specialty, Wife, Black, Female, 0,
37, Private, 284582, Masters, 14, Married-civ-spouse, Exec-managerial, Wife, White, Female, 0,
49, Private, 160187, 9th, 5, Married-spouse-absent, Other-service, Not-in-family, Black, Femal
52, Self-emp-not-inc, 209642, HS-grad, 9, Married-civ-spouse, Exec-managerial, Husband, White,
31, Private, 45781, Masters, 14, Never-married, Prof-specialty, Not-in-family, White, Female,
42, Private, 159449, Bachelors, 13, Married-civ-spouse, Exec-managerial, Husband, White, Male,
37, Private, 280464, Some-college, 10, Married-civ-spouse, Exec-managerial, Husband, Black, Ma
30, State-gov, 141297, Bachelors, 13, Married-civ-spouse, Prof-specialty, Husband, Asian-Pac-I
```

- Erste 12 Instanzen mit
- 15 Variablen

Daten

.msg systems

CensusData.R × rawData ×

32,561 observations of 15 variables

	id	employerKind	fnlwgt	degree	yearsOfEd	maritalStatus	occupation	relationshipRole
1	39	State-gov	77516	Bachelors	13	Never-married	Adm-clerical	Not-in-family
2	50	Self-emp-not-inc	83311	Bachelors	13	Married-civ-spouse	Exec-managerial	Husband
3	38	Private	215646	HS-grad	9	Divorced	Handlers-cleaners	Not-in-family
4	53	Private	234721	11th	7	Married-civ-spouse	Handlers-cleaners	Husband
5	28	Private	338409	Bachelors	13	Married-civ-spouse	Prof-specialty	Wife
6	37	Private	284582	Masters	14	Married-civ-spouse	Exec-managerial	Wife
7	49	Private	160187	9th	5	Married-spouse-absent	Other-service	Not-in-family
8	52	Self-emp-not-inc	209642	HS-grad	9	Married-civ-spouse	Exec-managerial	Husband
9	31	Private	45781	Masters	14	Never-married	Prof-specialty	Not-in-family
10	42	Private	159449	Bachelors	13	Married-civ-spouse	Exec-managerial	Husband
11	37	Private	280464	Some-college	10	Married-civ-spouse	Exec-managerial	Husband
12	30	State-gov	141297	Bachelors	13	Married-civ-spouse	Prof-specialty	Husband

- Erste 12 Instanzen als Data-Frame mit
- 8 von 15 Variablen

Daten

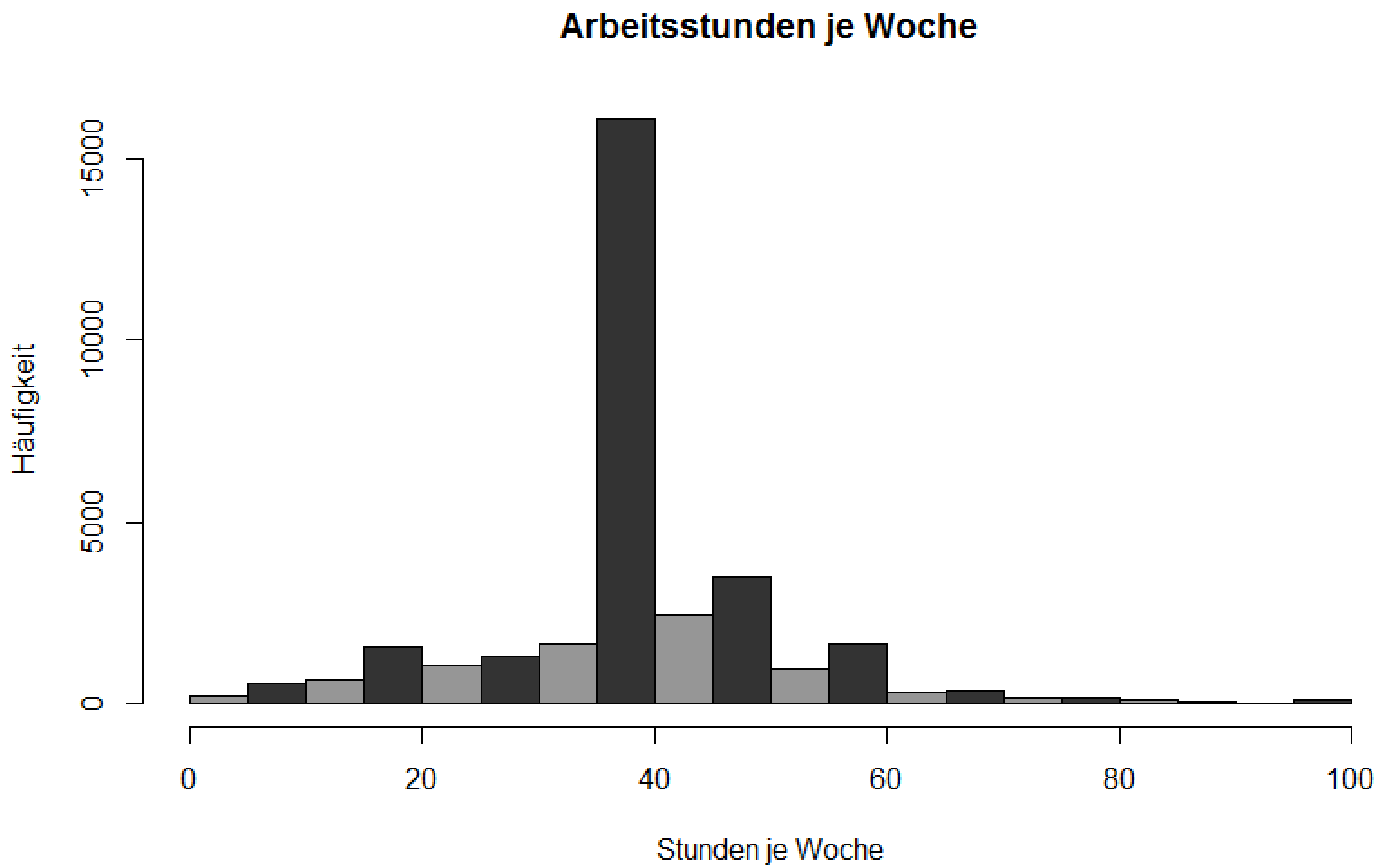
CensusData.R | rawData

32,561 observations of 20 variables

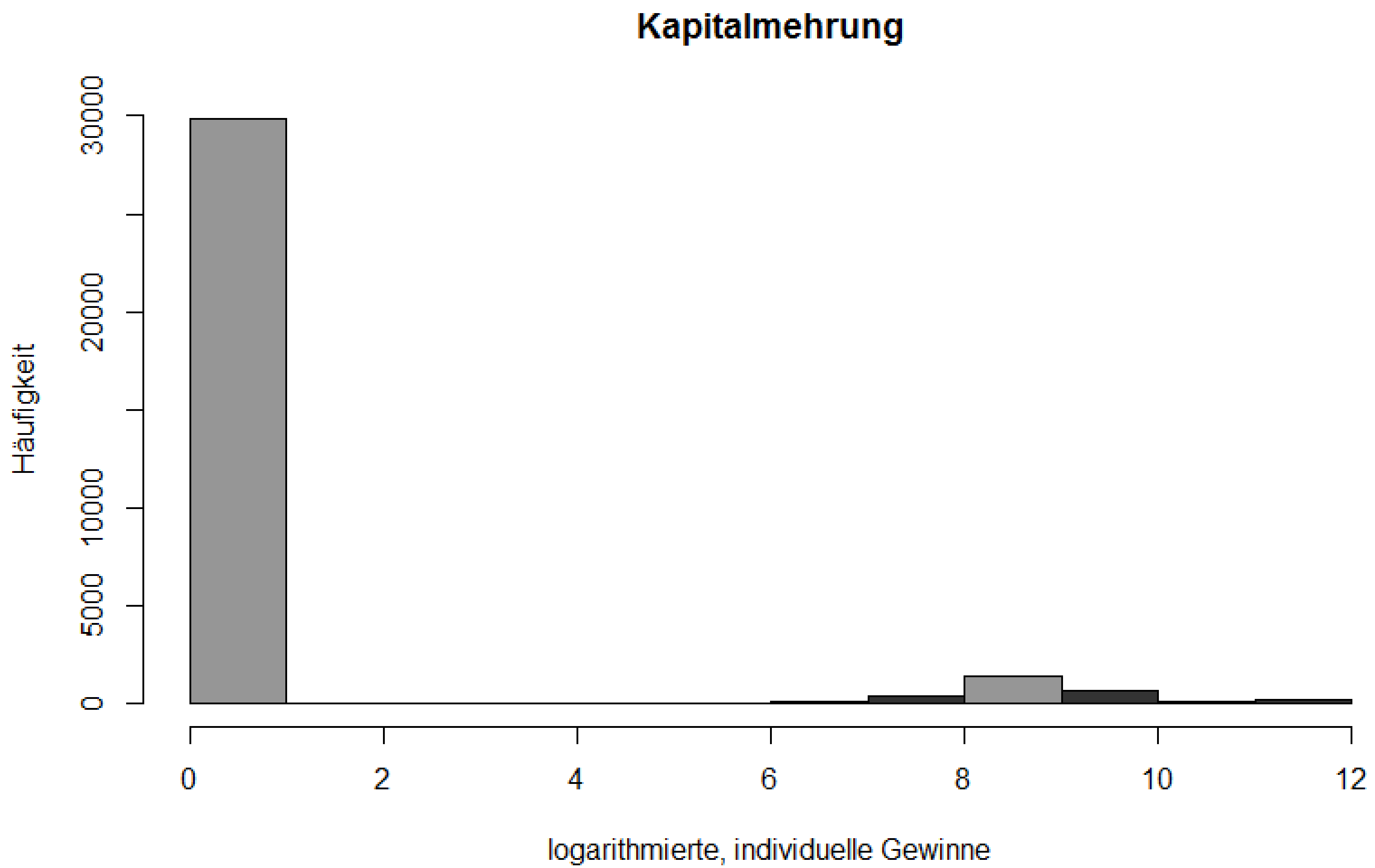
incomeGroup	academicLvl	incomeMoreThan50K	capitalDeviation	yearsOfEdStdUnits	workingHoursAWeekStdUnits
<=50K	Bachelor	TRUE	2.7562412	1.13472134	-0.03542890
<=50K	Bachelor	TRUE	-0.3071748	1.13472134	-2.22211900
<=50K	Highschool	TRUE	-0.3071748	-0.42005317	-0.03542890
<=50K	1	TRUE	-0.3071748	-1.19744043	-0.03542890
<=50K	Bachelor	TRUE	-0.3071748	1.13472134	-0.03542890
<=50K	Master	TRUE	-0.3071748	1.52341497	-0.03542890
<=50K	1	TRUE	-0.3071748	-1.97482769	-1.97915343
>50K	Highschool	FALSE	-0.3071748	-0.42005317	0.36951371
>50K	Master	FALSE	3.5009221	1.52341497	0.77445632
>50K	Bachelor	FALSE	3.1020895	1.13472134	-0.03542890
>50K	College	FALSE	-0.3071748	-0.03135955	3.20411198
>50K	Bachelor	FALSE	-0.3071748	1.13472134	-0.03542890

5 Sekundärvariablen

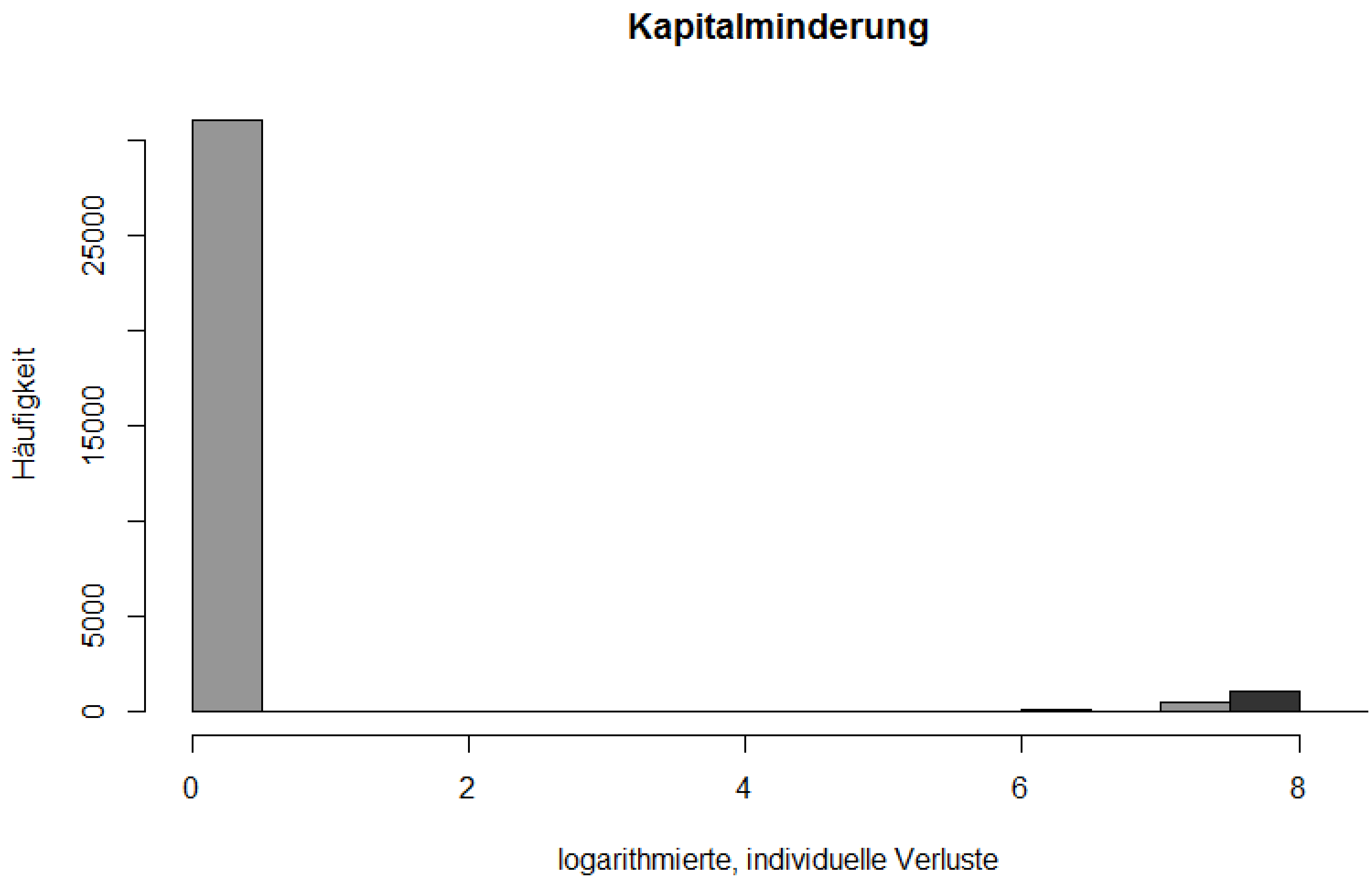
Visualisierungen



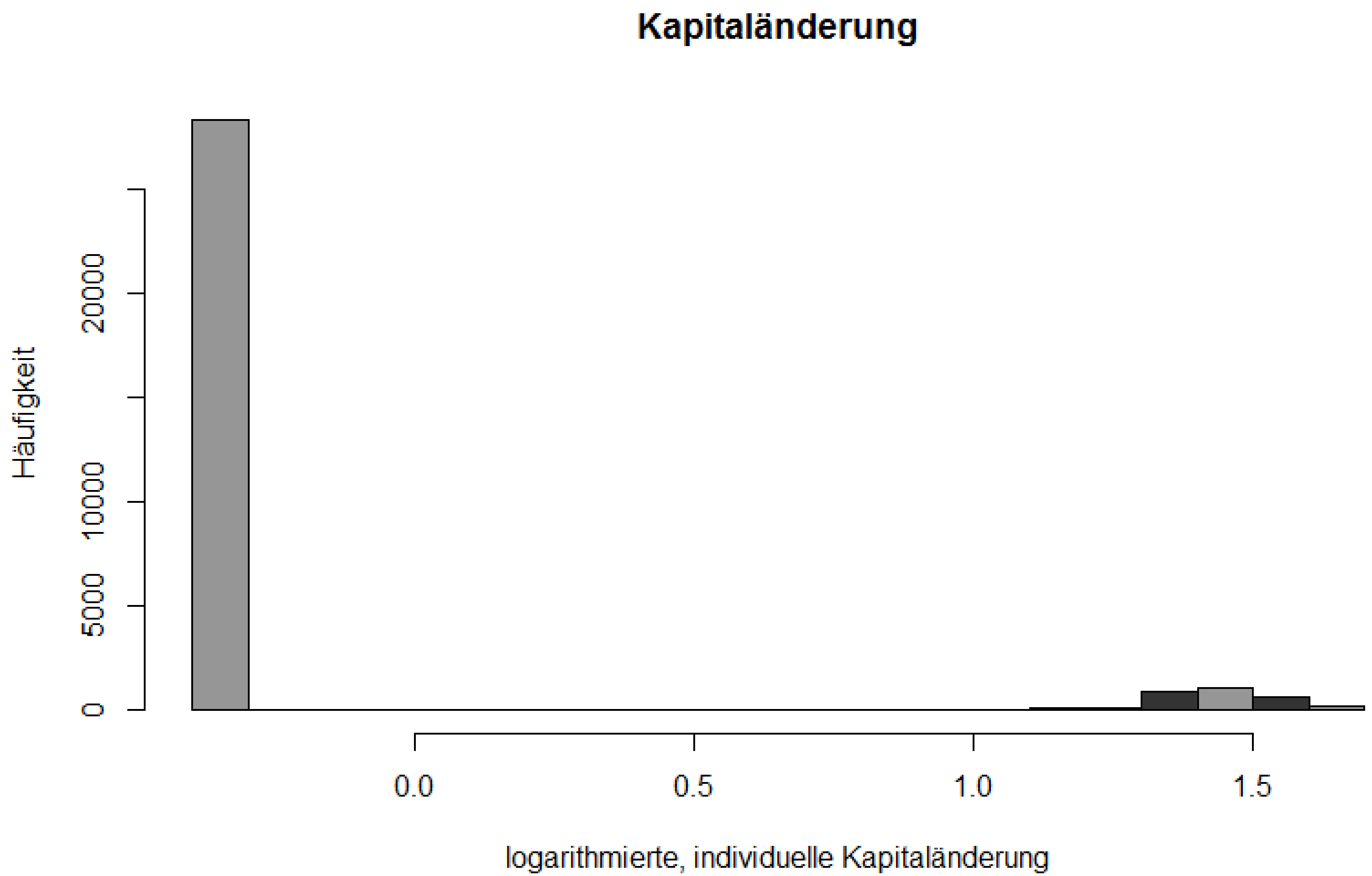
Visualisierungen



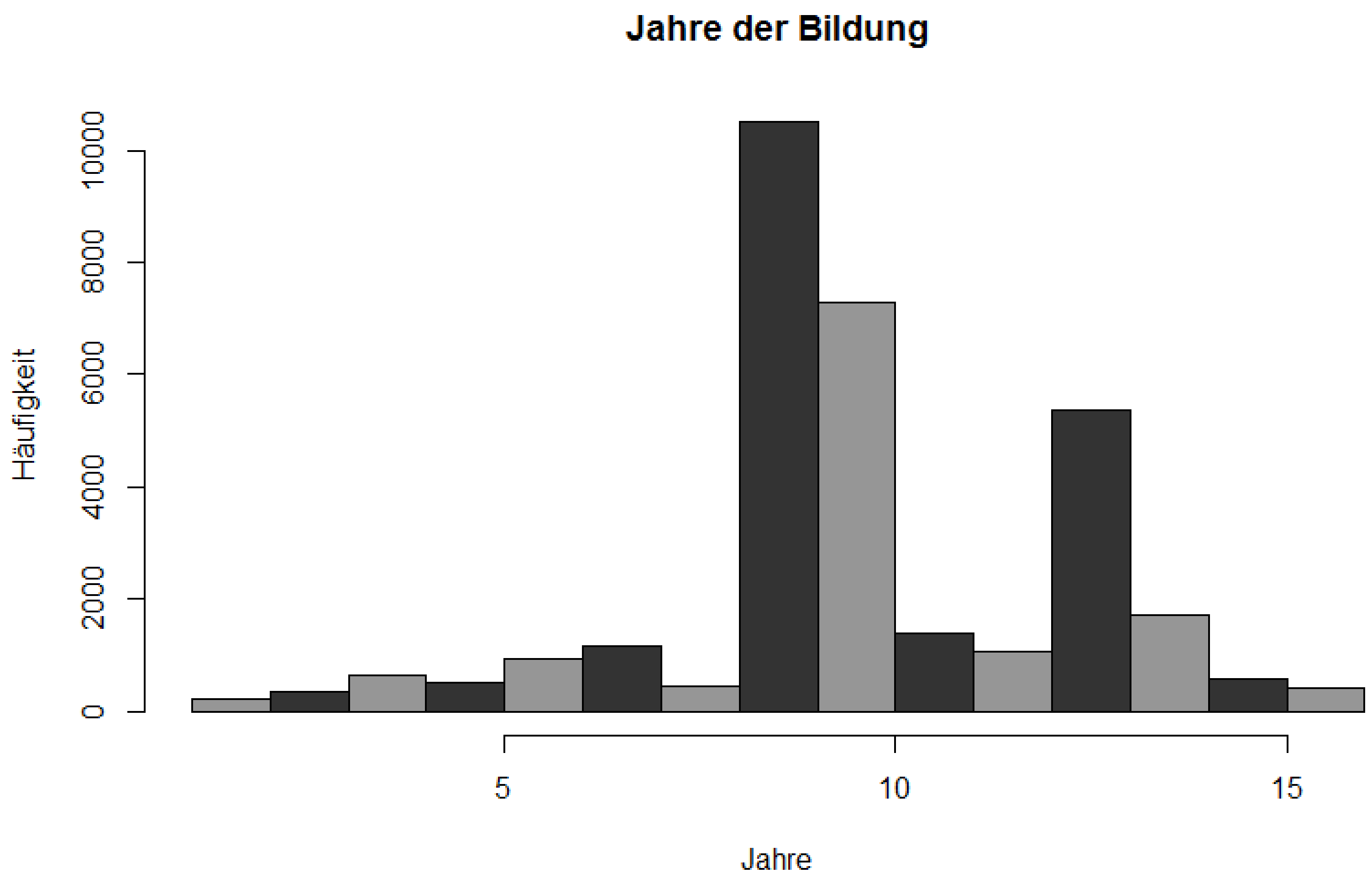
Visualisierungen



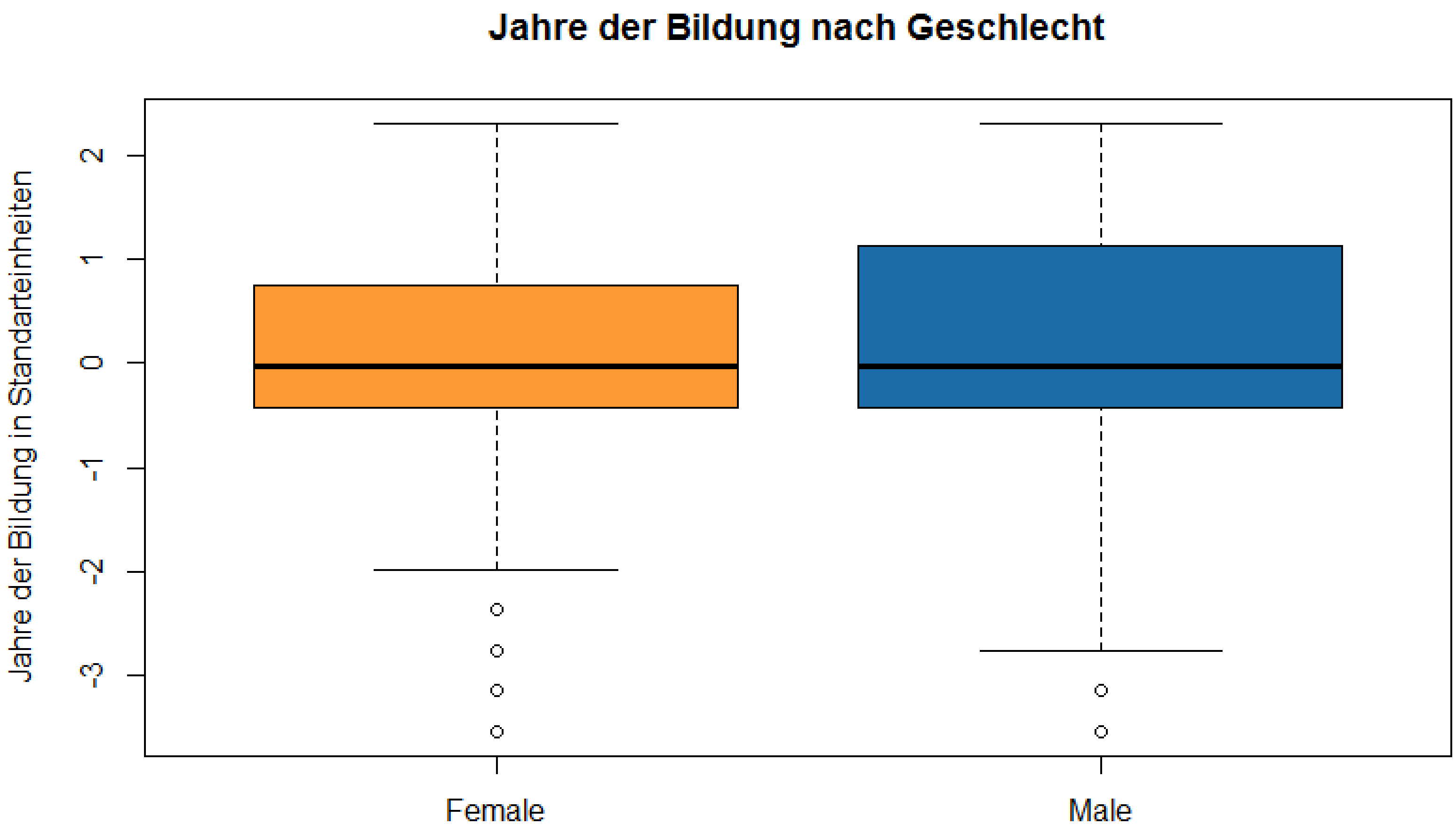
Visualisierungen



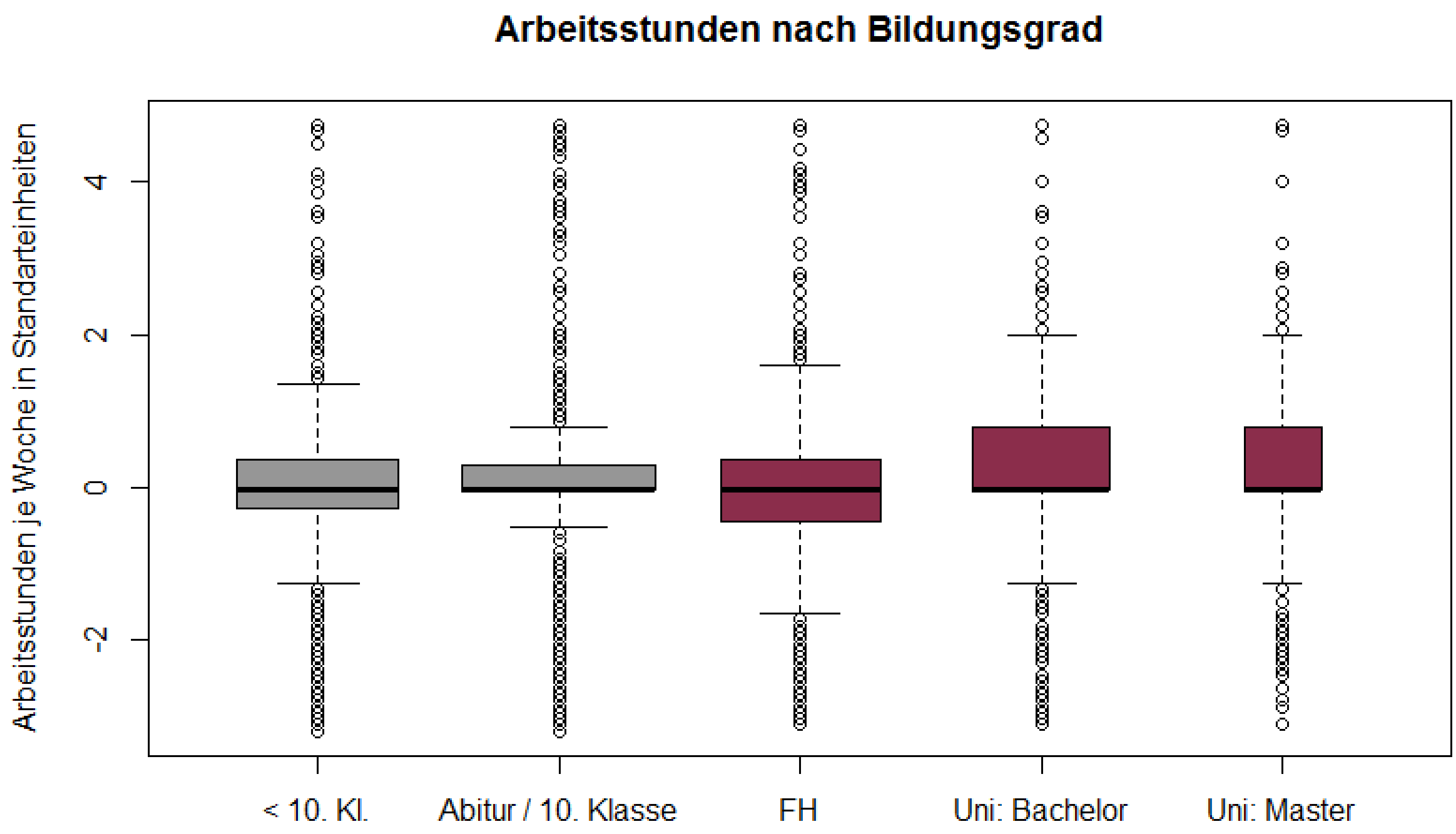
Visualisierungen



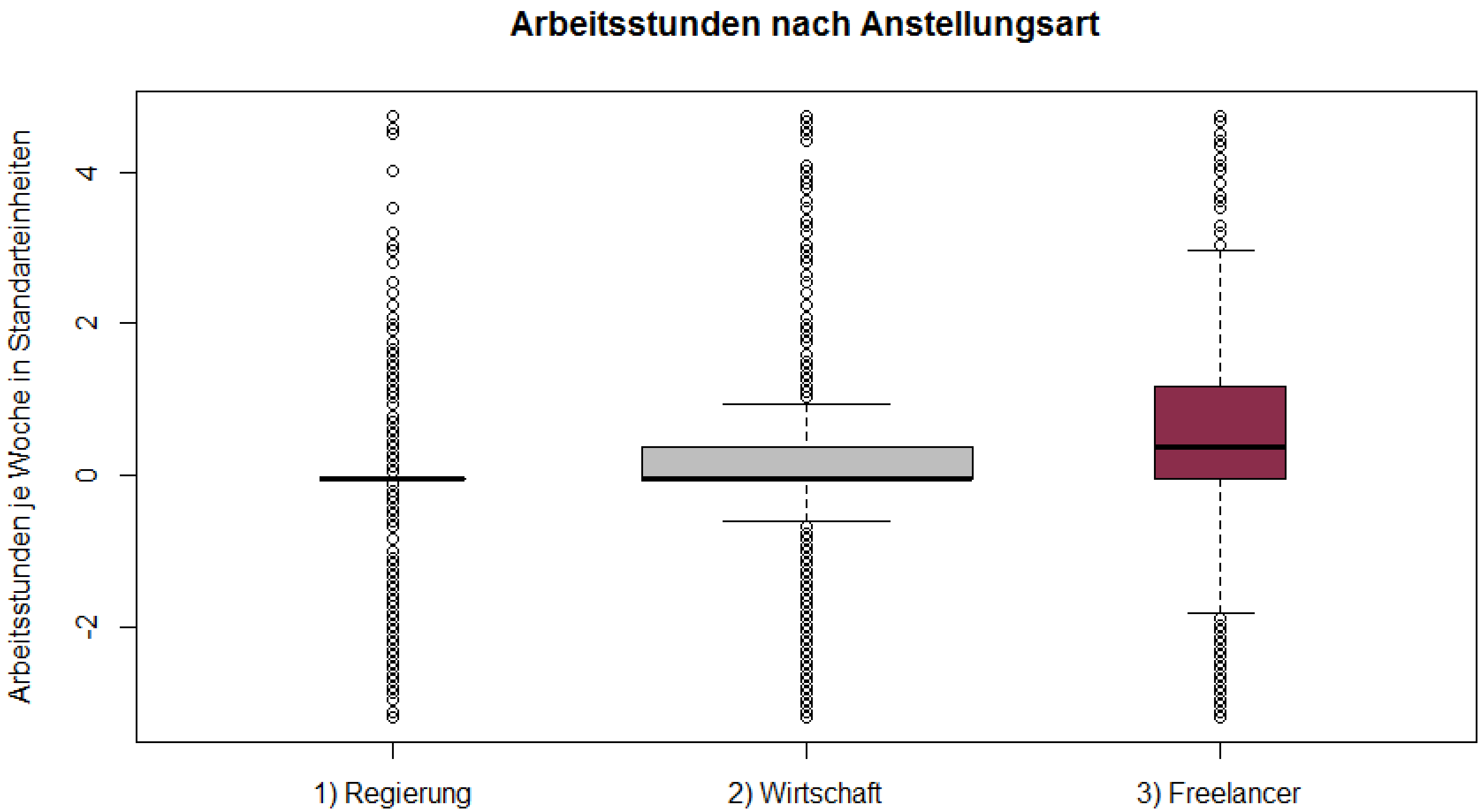
Visualisierungen



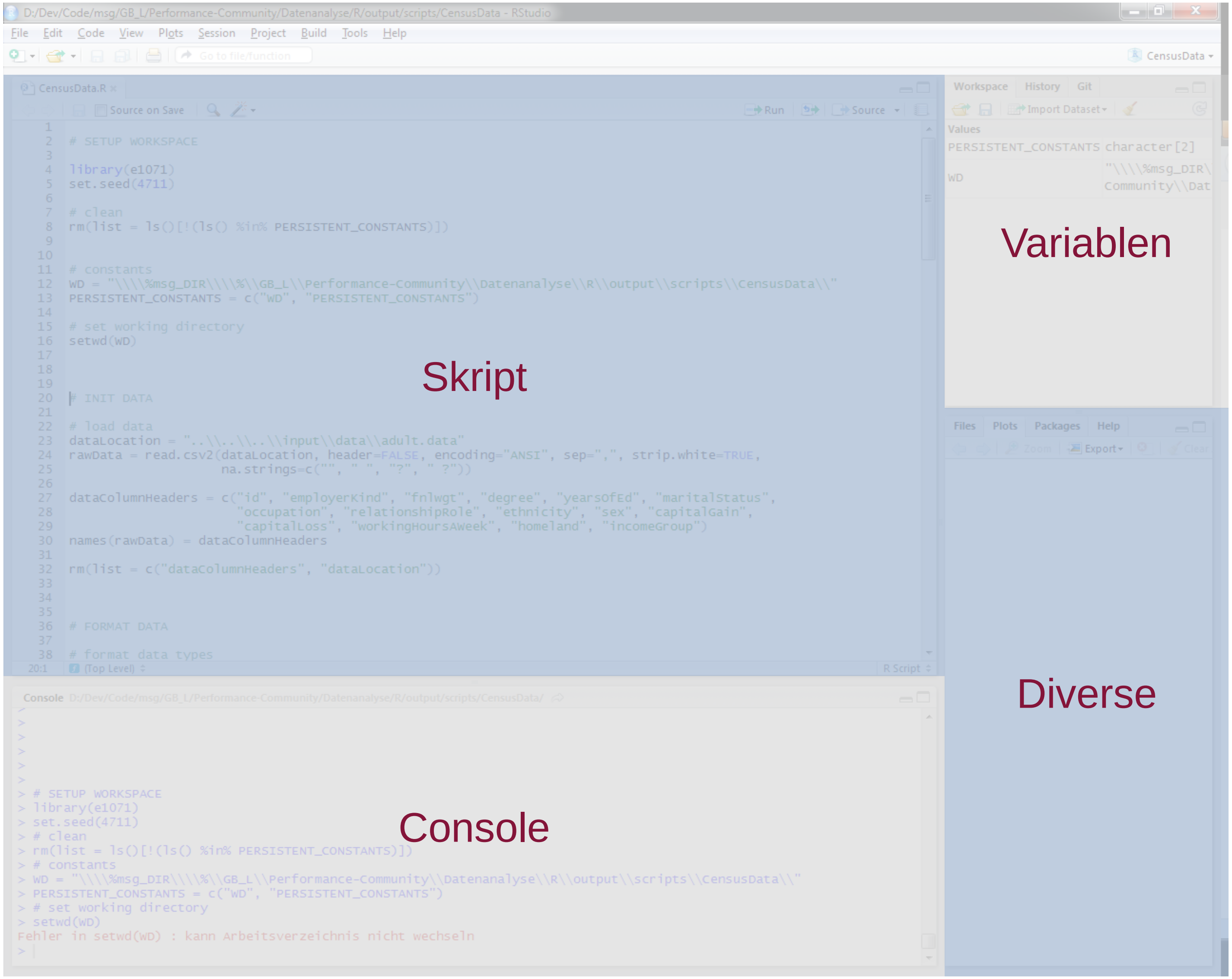
Visualisierungen



Visualisierungen



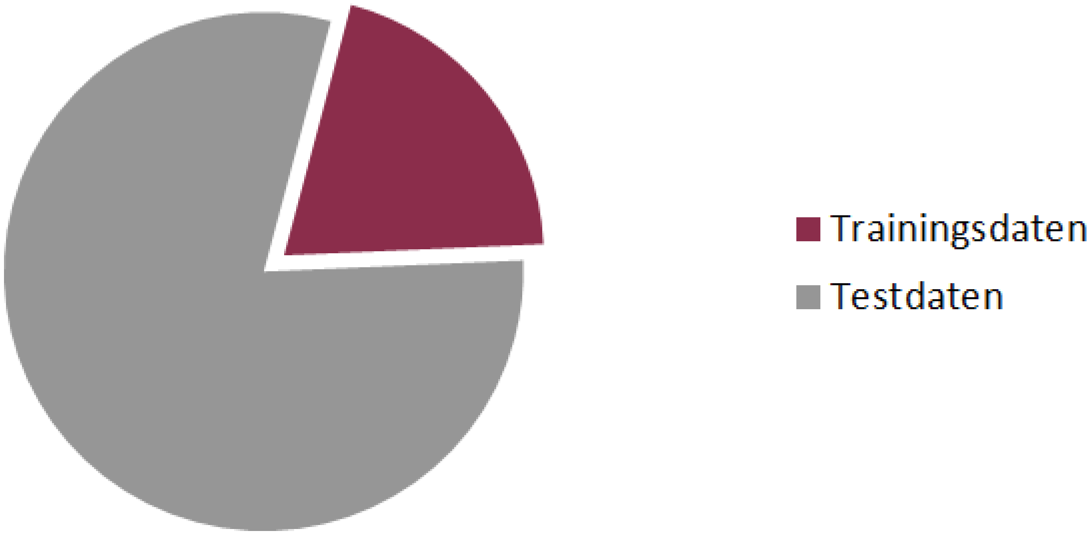
RStudio



US Census Income Data

Klassifikation

Klassifizierung

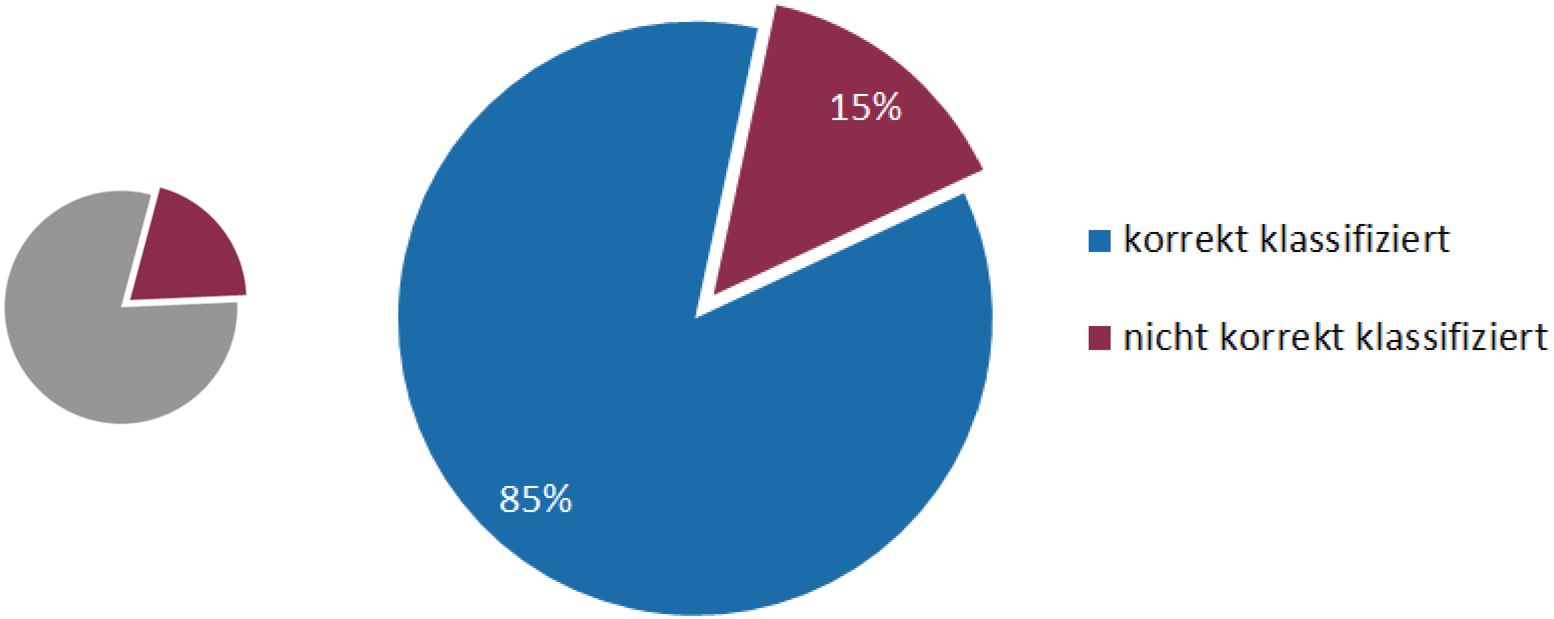


Klassifizierung

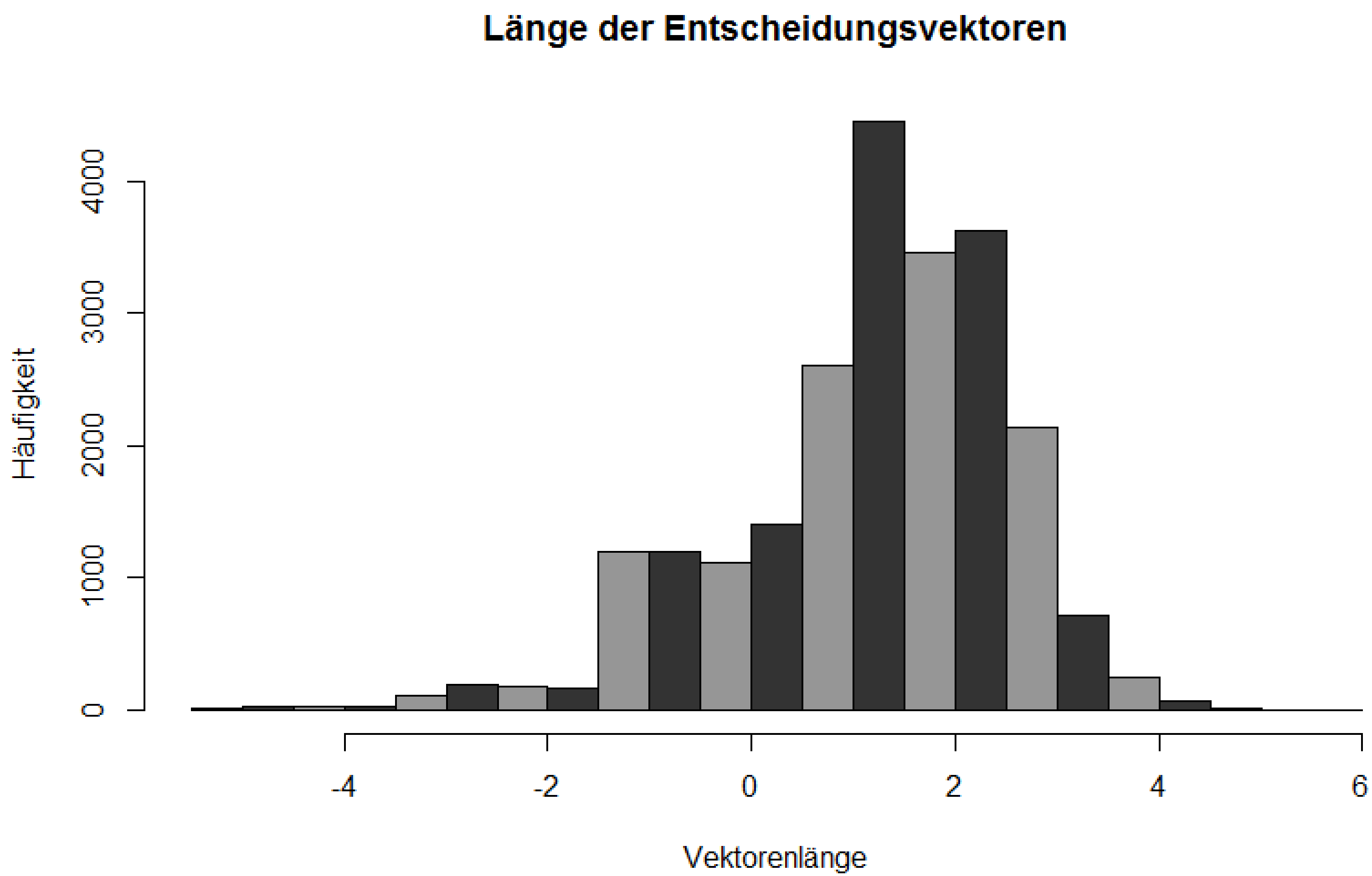
Klassifikation: Sensitivität & Spezifität

	tatsächlich nicht hohes Einkommen	tatsächlich hohes Einkommen
geschätzt nicht hohes Einkommen	13%	5%
geschätzt hohes Einkommen	10%	72%

Klassifizierung



Klassifizierung

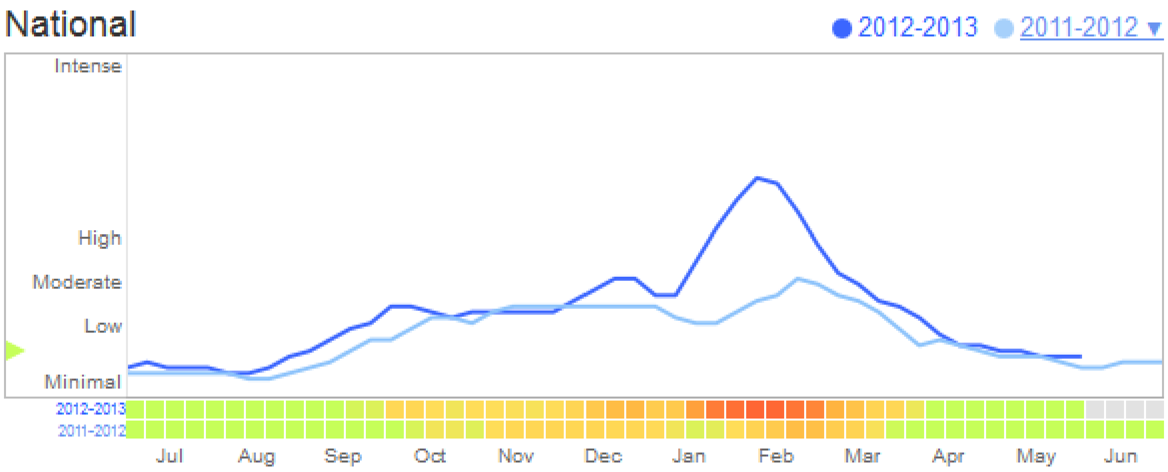


Anwendung

Anwendung

Google

Anwendung


National
2012-2013
2011-2012
Intense
High
Moderate
Low
Minimal
2012-2013
2011-2012
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun

Anwendung

Stanford
University

Anwendung

Prof. Sebastian Thrun mit autonom fahrenden VW Touareg „Stanley“

Datenquellen

UNIVERSITY of CALIFORNIA | IRVINE

UCI Machine Learning Repository
archive.ics.uci.edu/ml

Datenquellen

kaggle

kaggle.com

Datenquellen

data.gov

Ressourcen

github
SOCIAL CODING

LearningR

Training Dataset for R Beginners

Last updated 3 minutes ago

AddHealth-Data-Analysis

The analysis of biases and influencer in attendance of religious services

Last updated a month ago

github.com/danielschulz/LearningR

US Census Income Data

Übersicht: Code-Sektionen Schritt für Schritt

US Census Income Data

```r

# SETUP WORKSPACE

library(e1071)
set.seed(4711)

# clean
rm(list = ls()[!(ls() %in% PERSISTENT_CONSTANTS)])

```

Workspace einrichten

US Census Income Data

```r

# INIT DATA

# load data
dataLocation = "..\\..\\..\\input\\data\\adult.data"
rawData = read.csv2(dataLocation, header=FALSE, encoding="ANSI", sep=",", strip.white=TRUE,
                    na.strings=c("", " ", "?", " ?"))

dataColumnHeaders = c("id", "employerKind", "fnlwgt", "degree", "yearsOfEd", "maritalStatus",
                      "occupation", "relationshipRole", "ethnicity", "sex", "capitalGain",
                      "capitalLoss", "workingHoursAWeek", "homeland", "incomeGroup")
names(rawData) = dataColumnHeaders

rm(list = c("dataColumnHeaders", "dataLocation"))

```

Daten laden, Headernamen zuweisen

US Census Income Data

```
# FORMAT DATA

# format data types
rawData$id = as.numeric(rawData$id)
rawData$employerKind = as.factor(rawData$employerKind)
rawData$degree = as.factor(rawData$degree)

# assign secondary variable academic level
rawData$academicLvl = "none"
rawData$academicLvl = as.factor(rawData$academicLvl)

rawData$academicLvl = ifelse ("Doctorate" == rawData$degree || "Prof-school" == rawData$degree,
                              "PhD", rawData$academicLvl)
rawData$academicLvl = ifelse ("Masters" == rawData$degree, "Master", rawData$academicLvl)
rawData$academicLvl = ifelse ("Bachelors" == rawData$degree, "Bachelor", rawData$academicLvl)
rawData$academicLvl = ifelse ("Some-college" == rawData$degree, "College", rawData$academicLvl)
rawData$academicLvl = ifelse ("HS-grad" == rawData$degree, "Highschool", rawData$academicLvl)
```

- Daten-Typen zuweisen
- Sekundärvariablen einfügen

US Census Income Data

```r

# assign secondary variable income to be more than 50000 USD / yr
rawData$incomeMoreThan50K = FALSE
rawData$incomeMoreThan50K = as.logical(rawData$incomeMoreThan50K)
rawData$incomeMoreThan50K = ifelse ("<=50K" == rawData$incomeGroup, TRUE, rawData$incomeMoreThan50K)


# assign secondary variable capitial deviation / difference in standard units
rawData$capitalDeviation = rawData$capitalGain - rawData$capitalLoss
rawData$capitalDeviation = scale(log(rawData$capitalDeviation + 1))

# assign secondary variable working hours / wk in standard units
rawData$yearsOfEdStdUnits = scale(rawData$yearsOfEd)
rawData$workingHoursAWeekStdUnits = scale(rawData$workingHoursAWeek)

# format data types
rawData$maritalStatus = as.factor(rawData$maritalStatus)
rawData$occupation = as.factor(rawData$occupation)
rawData$relationshipRole = as.factor(rawData$relationshipRole)
rawData$ethnicity = as.factor(rawData$ethnicity)
rawData$sex = as.factor(rawData$sex)
rawData$homeland = as.factor(rawData$homeland)
rawData$capitalDeviation = as.numeric(rawData$capitalDeviation)
rawData$workingHoursAWeekStdUnits = as.numeric(rawData$workingHoursAWeekStdUnits)
rawData$yearsOfEdStdUnits = as.numeric(rawData$yearsOfEdStdUnits)

```

- Daten-Typen zuweisen
- Sekundärvariablen einfügen

US Census Income Data

```r
# DROP COLUMNS
dropColumns = c("id", "fnlwgt", "yearsOfEd", "workingHoursAWeek", "capitalGain",
                "capitalLoss", "incomeGroup")
rawData = rawData[,!(names(rawData) %in% dropColumns)]

# remove dropping column from workspace value list
rm(list = c("dropColumns"))
```

Nicht benötigte Spalten entfernen

US Census Income Data

```
# SAMPLE TRAINING AND TEST DATA
rawData$clazz = sample(1:5, dim(rawData)[1], replace=TRUE)
rawData$clazz = as.factor(rawData$clazz)

data = rawData
data = na.omit(data) # drop missing value instances

train = subset(data, 1 == data$clazz)
test = subset(data, 1 != data$clazz)

dropColumns = c("clazz")
train = train[,!(names(train) %in% dropColumns)]
test = test[,!(names(test) %in% dropColumns)]
data = data[,!(names(data) %in% dropColumns)]

# remove dropping column from workspace value list
rm(list = c("dropColumns", "rawData"))
```

Trainings- und Testdaten erzeugen

US Census Income Data

```r

# TRAIN CLASSIFICATION MODEL SUPPORT VECTOR MACHINES AND EVALUATE ACCURANCY
svm = svm(train$incomeMoreThan50K ~ ., train, type="C-classification", probability=TRUE,
          gamma=0.0001, cost=100000)
pr = predict(svm, test, probability=TRUE)
# plot(formula=train$capitalDeviation ~ train$workingHoursAWeekStdUnits, data=train)
# plot(formula=test$capitalDeviation ~ test$workingHoursAWeekStdUnits, data=test)

table = table(classifications = pr, test$incomeMoreThan50K)
table

# chisquare = chisq.test(table)
# chisquare
# summary(chisquare)


sumInTable = 0

for (i in c(1:4)) {
  sumInTable = sumInTable + table[i]
}
for (i in c(1:4)) {
  table[i] = table[i] / sumInTable
}

# prediction accurancy is one the main diagonal table[1] + table[4] or for table t: t_11 + t_22
table

rm(list = c("i", "sumInTable", "chisquare"))

```

SVM-Classifizierung trainieren und testen

Vielen Dank für Ihre Aufmerksamkeit

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