Validate your data

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useR!2021

`validate`: *data validation infrastructure for R*

A domain-specific language for rule definition

Define *any* check on your data, using the *full power* of the R language.

Rules as first-class citizens

- CRUD operations (create, read, update, delete)
- Summarize, plot, investigate rules
- Rich metadata

Validate data

- Confront data with rules
- CRUD on results, summarize, plot
- Export to ESS standard reporting format (upcoming)

Assignment 1

Try the following code.

```
library(validate)
library(magrittr)
data(retailers)
head(retailers)
retailers %>%
  check_that(turnover + other.rev == total.rev
             , turnover > 0, other.rev > 0 ) %>%
  summary()
```

Assignment 1

```r
library(validate)
library(magrittr)
data(retailers)
retailers %>%
  check_that(turnover + other.rev == total.rev
           , turnover > 0, other.rev > 0 ) %>%
  summary()
```

```
##   name items passes fails nNA error warning
## 1   V1    60     19     4  37 FALSE   FALSE
## 2   V2    60     56     0   4 FALSE   FALSE
## 3   V3    60     23     1  36 FALSE   FALSE
##                                       expression
## 1 abs(turnover + other.rev - total.rev) <= 1e-08
## 2                                   turnover > 0
## 3                                  other.rev > 0
```

Data validation with `validate`

```r
library(validate)
data(retailers)
head(retailers,3)[3:7]
```

```
##   staff turnover other.rev total.rev staff.costs
## 1    75       NA        NA      1130          NA
## 2     9     1607        NA      1607         131
## 3    NA     6886       -33      6919         324
```

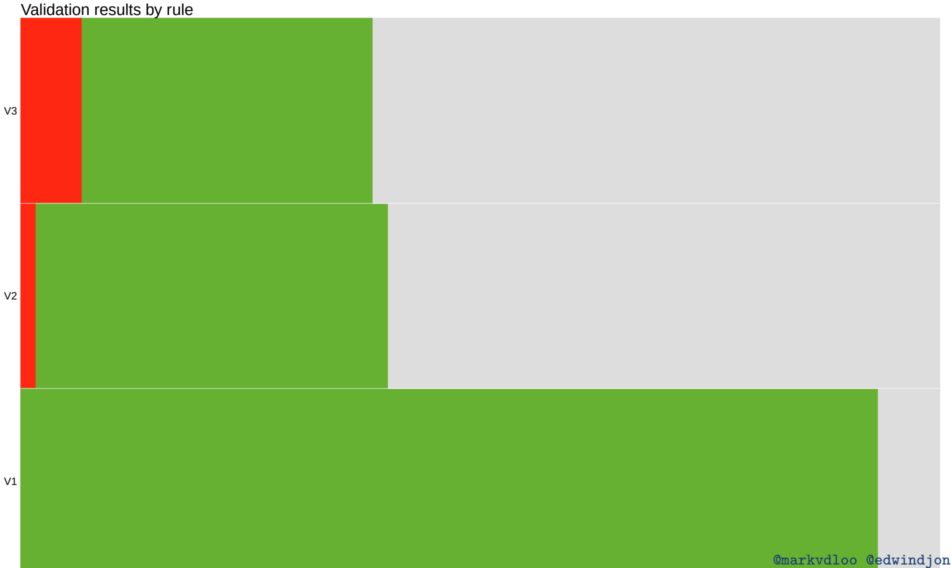
Data validation with `validate`

```r
rules <- validator(
   turnover >= 0
  , other.rev >= 0
  , turnover + other.rev == total.rev
)

out <- confront(retailers, rules)
summary(out)
```

Plotting output

```
plot(out)
```



Reading rules from file

```
### myrulez.txt

# some basic checks
staff >= 0
turnover >= 0
other.rev >= 0
# account balance checks
turnover + other.rev == total.rev
# other common sense stuff
if (staff >= 1) staff.costs >= 1
```

```
rulez <- validator(.file="myrulez.txt")
```

Domain Specific Language

Validation DSL

Any R statement resulting in a `logical`.

Examples

```
# Range checks
has_job %in% c('yes','no')
turnover >= 0
# Multivariate checks
abs(profit) <= 0.6 * turnover
# Multi-row checks
mean(profit) > 10
# Logical implications
if (staff > 0) staff.costs > 0
```

Validation DSL

Comparisons

```
>, >=,==, <=, <, %in%
```

Boolean operations

```
!, all(), any(), &, &&, |, ||, if () else
```

Text search

```
grepl
```

Functional dependencies (Armstrong)

```
city + zipcode ~ streetname
```

Refer to the dataset with .

```
nrow(.) == 40, "turnover" %in% names(.)
```

Transient assignments (macros) using :=

Example 1

$$\max\left(\frac{x}{x^*}, \frac{x^*}{x}\right) \leq 10$$

```
med := median(turnover,na.rm=TRUE)
hb := pmax(turnover/med, med/turnover, na.rm=TRUE)
hb <= 10
```

Example 2

```
beta_2 := coefficients(lm(turnover ~ profit))[2]
beta_2 >= 0
```

Variable groups

Many variables, same rule

```
G := var_group(staff, turnover, other.rev, total.costs)
G >= 0
```

Error handling

```
out <- check_that(women, hite > 0, weight>0)
out
```

```
## Object of class 'validation'
## Call:
##     check_that(women, hite > 0, weight > 0)
##
## Rules confronted: 2
##    With fails   : 0
##    With missings: 0
##    Threw warning: 0
##    Threw error  : 1
```

```
errors(out)
```

```
## $V1
## [1] "object 'hite' not found"
```

Assignment 3

1. Create a new textfile
2. Define 10 rules for the `retailers` dataset
3. Read the rules (`validator(.file="your file")`)
4. `confront` rules with data
5. Summarize and plot the results.
6. Use `as.data.frame` and `View` to convert and display the results.
7. Make a `plot` of the `validator` object.

Naming rules

```r
rules <- validator(
  to_pos = turnover >= 0
  , or_pos = other.rev >= 0
  , balance = turnover + other.rev == total.rev)
rules
```

```
## Object of class 'validator' with 3 elements:
##  to_pos : turnover >= 0
##  or_pos : other.rev >= 0
##  balance: turnover + other.rev == total.rev
```

Rule selection

```
rules[1:2]
```

```
## Object of class 'validator' with 2 elements:
##  to_pos: turnover >= 0
##  or_pos: other.rev >= 0
## Rules are evaluated using locally defined options
```

```
rules["balance"]
```

```
## Object of class 'validator' with 1 elements:
##  balance: turnover + other.rev == total.rev
## Rules are evaluated using locally defined options
```

Rule metadata

```r
rules[[3]]
```

```
##
## Object of class rule.
##  expr       : turnover + other.rev == total.rev
##  name       : balance
##  label      :
##  description:
##  origin     : command-line
##  created    : 2021-07-06 20:50:33
##  meta       : language<chr>, severity<chr>
```

More manipulation: combining rule sets

```r
validator(x > 0) + validator(x <= 1)
```

```
## Object of class 'validator' with 2 elements:
##  V1  : x > 0
##  V1.1: x <= 1
```

Export rules & metadata to and import from `data.frame`

Create data frame

```r
rules_df <- as.data.frame(rules)
```

Read from data frame

```r
myrules <- validator(.data = rules_df)
```

Setting options

Global options

```
# stop at error instead of catching
voptions(raise="all")
```

Options per object

```
# value to replace NA outcomes
voptions(rules, na.value=FALSE)
```

When confronting data with rules

```
out <- confront(retailers, rules
        , lin.eq.eps=1e-2 )
```