Chunked

Chunked processing with dplyr

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Who am I?

- Data scientist / Methodologist at Statistics Netherlands (aka CBS).
- Author of several R-packages, including `whisker`, `validate`, `errorlocate`, `docopt`, `daff`, `tableplot`, `ffbase`,...
- Co-author of *Statistical Data Cleaning with applications in R (2018)* (together with @markvdloo)
- Co-worker of next speaker (Jan van der Laan)

What is `chunked`?

Short answer:

for data in text files

Process Data in GB-sized Text Files:

(pre)Process text files to:

- select columns
- filter rows
- derive new variables

Save result into:

- Another text file
- A database

Option 1: Read data with R

Use:

- ~~`read.csv`~~ uh, `readr::read_csv`[1]
- `datatable::fread`
- Fast reading of data into memory!

However...

- You will need a lot of RAM![2]
- Text files tend to be 1 to 100 Gb.
- **Even though these procedures use memory mapping the resulting `data.frame` does not!**
- development cycle of processing script is looooooong...

[1] `chunked` has inspired `readr::read_csv_chunked`, also a nice option!

[2] Maybe `ALTVEC` in R3.5 changes the game...

Option 2: Use unix tools

Good choice!

- `sed`
- `awk`
- `grep`
- fast processing!

However...

It is nice to stay in `R`-universe (one data-processing tool)

- Instead of learning at least 3 extra tools `sed`, `awk` and `grep` voodoo.
- Does it work on my OS/shell?
- I want to use dplyr verbs! (dplyr-deprivation...)

Option 3: Import data in DB

Import data into DB

- Use DB tool to import data.
- Process database with dplyr.

However

- It is not really a R, but a DB solution
- May be not efficient.

Process in chunks?

Option 4: Use chunked!

Idea:

- Process data chunk by chunk using `dplyr` verbs
- Memory efficient, only one chunk at a time in memory
- Lazy processing
- Development cycle is short: test on first chunk.

- Read (and write) on chunk at a time using R package `LaF`.
- All `dplyr` verbs on `chunk_wise` objects are recorded and replayed when writing.

Scenario 1: TXT -> TXT

Preprocess a text file with data

```
read_chunkwise("my_data.csv", chunk_size = 5000) %>%
 select(col1, col2) %>%
 filter(col1 > 1) %>%
 mutate(col3 = col1 + 1) %>%
write_chunkwise("output.csv")
```

This code:

- evals chunk by chunk
- allows for column name completion in Rstudio!

Scenario 2: TXT -> DB

Insert processed text data in DB

```
db <- src_sqlite('test.db', create=TRUE)

tbl <-
  read_chunkwise("./large_file_in.csv") %>%
  select(col1, col2, col5) %>%
  filter(col1 > 10) %>%
  mutate(col6 = col1 + col2) %>%
  write_chunkwise(db, 'my_large_table')
```

Scenario 3: DB -> TXT

Extract a large table from a DB to a text file

```
tbl<-
  ( src_sqlite("test.db") %>%
    tbl("my_table")
  ) %>%
  read_chunkwise(chunk_size=5000) %>%
  select(col1, col2, col5) %>%
  filter(col1 > 10) %>%
  mutate(col6 = col1 + col2) %>%
  write_chunkwise('my_large_table.csv')
```

Caveat

Working:

- Working on chunks is memory efficient
- `filter`, `select`, `rename`,`mutate`,`mutate_each`,`transmute`,`do`, `tbl_vars`, `inner_join`, `left_join`, `semi_join`,`anti_join` all work , also with name completion!

However:

- **`summarize` and `group_by` work chunkwise (and not for all data!)**
- No `arrange`, `right_join`, `full_join`

Implementation

- When reading from a file or db an object of type `chunkwise` is created.

`chunkwise` contains:

- a connection to input
- current position in input
- a list of dplyr expressions
- internal method: `record` and `play`

methods implemented

- `head` to quickly scan the input file
- `dplyr::tbl_vars`: powers the Rstudio `colname` completion.
- `dplyr` verbs (as mentioned above)

- dplyr commands are records and replayed.
- lazy evaluation with `lazyeval` / `rlang`

e.g. `filter`

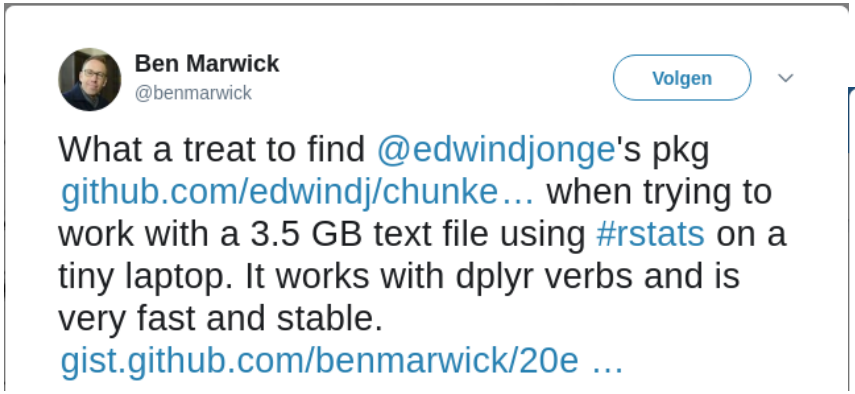
```
filter.chunkwise <- function(.data, ..., .dots){
  .dots <- lazyeval::all_dots(.dots, ...)
  cmd <- lazyeval::lazy(filter_(.data, .dots=.dots))
  record(.data, cmd)    # internal `chunked` function
                        # that stores dplyr expressions
}
```

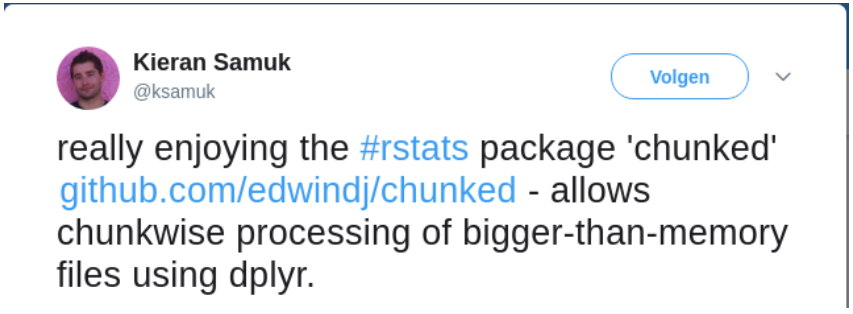
Ideas

- Add sampling: `chunkwise.sample_n` or `chunkwise.sample_frac`
- Create a chunk generic: chunkwise processing is useful for several formats:
  - `ffbase`,
  - `feather`
  - `arrow`
  - `fst`
  - `ldat`
- Maybe unify the interface or cooperation?
- ?

Usage?

I don't know the stats, but. . .





Thank you!

Interested?

```
install.packages("chunked")
```

Ideas and suggestions?

http://github.com/edwindj/chunked