R has many great tools for data wrangling. Two of those are the *dplyr* and *data.table* packages. When people wonder which one should they learn it is often argued that *dplyr* is considerably slower compared with *data.table*.

Granted, *data.table* is blazing fast, but I personally find the syntax hard and un-intuitive and the speed difference doesn’t make much of a difference in most use cases I encountered.

The only frequent scenario where I’ve experienced a significant performance gap is when doing operations over a very large number of groups. This can happen when for example working with customer data, where each row describes a touch point or transaction and one is interested with calculating the number of rows per customer, monetary value of all transactions per customer etc.

Recently Rstudio [released](https://www.tidyverse.org/blog/2019/11/dtplyr-1-0-0/) *dtplyr* package version 1.0.0 which provides a *data.table* backend for *dplyr*.

Using *dtplyr* requires learning almost no additional code. One initiates a *data.table* sequence using the lazy\_dt function, after which regular *dplyr* code is written. Execution of the code is done only when calling as\_tibble (or as.data.frame etc).

So for example a simple pipeline utilizing *dtplyr* for many group operations would look like:

mtcars %>%

lazy\_dt() %>%

filter(wt < 5) %>%

mutate(l100k = 235.21 / mpg) %>% # liters / 100 km

group\_by(cyl) %>%

summarise(l100k = mean(l100k))

## Source: local data table [?? x 2]

## Call: `\_DT1`[wt < 5][, `:=`(l100k = 235.21/mpg)][, .(l100k = mean(l100k)),

## keyby = .(cyl)]

##

## cyl l100k

##

## 1 4 9.05

## 2 6 12.0

## 3 8 14.9

##

## # Use as.data.table()/as.data.frame()/as\_tibble() to access results

The only caveat is, as with all other *dbplyr* like interfaces, that some of the more complex operations might not be supported.

Interestingly enough, I wasn’t able to find any bench-marking for *dtplyr* other than a walled piece on Medium. So I decided to go ahead and run a quick benchmark test myself.

In this post I’ll check by how much does *dtplyr* improve on *dplyr* and whether it’s performance is close enough to *data.table* to be considered a valid alternative.

The bench-marking consist of:

* 5 simple queries: large groups and small groups on different columns of different types. Similar to what a data analyst might do in practice; i.e., various ad hoc aggregations as the data is explored and investigated.
* Each package is tested separately in its own fresh session. To that end I’ve restarted my machine before running the benchmark code for every package.
* Each query is repeated once more, immediately. This is to isolate cache effects and confirm the first timing. The first and second total elapsed times are plotted.

My analysis will diverge from the original in the following respects:

1. I’ll compare *data.table*, *dtyplr* and *dplyr*. I’ll also check how starting a *dtplyr* pipe with a data.table rather than a data.frame affects performance (dubbed *dt\_dtplyr* below)
2. I’ll use my personal laptop instead of spinning up a virtual machine
3. I’m generating a much smaller dataset (~4.9 Gb). I think that is representative of some of the larger datasets I’ve worked with in-memory (for larger datasets I usually switch to Spark).

Other than that the code is mostly the same.

data.table benchmark code

require(data.table)

N <- 1e8

K <- 100

set.seed(1)

DT <- data.table(

id1 = sample(sprintf("id%03d", 1:K), N, TRUE), # large groups (char)

id2 = sample(sprintf("id%03d", 1:K), N, TRUE), # large groups (char)

id3 = sample(sprintf("id%010d", 1:(N / K)), N, TRUE), # small groups (char)

id4 = sample(K, N, TRUE), # large groups (int)

id5 = sample(K, N, TRUE), # large groups (int)

id6 = sample(N / K, N, TRUE), # small groups (int)

v1 = sample(5, N, TRUE), # int in range [1,5]

v2 = sample(5, N, TRUE), # int in range [1,5]

v3 = sample(round(runif(100, max = 100), 4), N, TRUE) # numeric e.g. 23.5749

)

q1a <- system.time(DT[, sum(v1), keyby = id1])[3]

q1b <- system.time(DT[, sum(v1), keyby = id1])[3]

q2a <- system.time(DT[, sum(v1), keyby = "id1,id2"])[3]

q2b <- system.time(DT[, sum(v1), keyby = "id1,id2"])[3]

q3a <- system.time(DT[, list(sum(v1), mean(v3)), keyby = id3])[3]

q3b <- system.time(DT[, list(sum(v1), mean(v3)), keyby = id3])[3]

q4a <- system.time(DT[, lapply(.SD, mean), keyby = id4, .SDcols = 7:9])[3]

q4b <- system.time(DT[, lapply(.SD, mean), keyby = id4, .SDcols = 7:9])[3]

q5a <- system.time(DT[, lapply(.SD, sum), keyby = id6, .SDcols = 7:9])[3]

q5b <- system.time(DT[, lapply(.SD, sum), keyby = id6, .SDcols = 7:9])[3]

data\_table\_results <- list(

q1a = q1a, q1b = q1b,

q2a = q2a, q2b = q2b,

q3a = q3a, q3b = q3b,

q4a = q4a, q4b = q4b,

q5a = q5a, q5b = q5b

)

dtplyr benchmark code

require(dplyr)

require(dtplyr)

N <- 1e8

K <- 100

set.seed(1)

DF <- data.frame(

stringsAsFactors = FALSE,

id1 = sample(sprintf("id%03d", 1:K), N, TRUE),

id2 = sample(sprintf("id%03d", 1:K), N, TRUE),

id3 = sample(sprintf("id%010d", 1:(N / K)), N, TRUE),

id4 = sample(K, N, TRUE),

id5 = sample(K, N, TRUE),

id6 = sample(N / K, N, TRUE),

v1 = sample(5, N, TRUE),

v2 = sample(5, N, TRUE),

v3 = sample(round(runif(100, max = 100), 4), N, TRUE)

)

q1a <- system.time(DF %>% lazy\_dt() %>% group\_by(id1) %>%

summarise(sum(v1)) %>% as\_tibble())[3]

q1b <- system.time(DF %>% lazy\_dt() %>% group\_by(id1) %>%

summarise(sum(v1)) %>% as\_tibble())[3]

q2a <- system.time(DF %>% lazy\_dt() %>% group\_by(id1, id2) %>%

summarise(sum(v1)) %>% as\_tibble())[3]

q2b <- system.time(DF %>% lazy\_dt() %>% group\_by(id1, id2) %>%

summarise(sum(v1)) %>% as\_tibble())[3]

q3a <- system.time(DF %>% lazy\_dt() %>% group\_by(id3) %>% summarise(sum(v1), mean(v3)) %>% as\_tibble())[3]

q3b <- system.time(DF %>% lazy\_dt() %>% group\_by(id3) %>%

summarise(sum(v1), mean(v3)) %>% as\_tibble())[3]

q4a <- system.time(DF %>% lazy\_dt() %>% group\_by(id4) %>%

summarise\_at(vars(v1:v3), mean) %>% as\_tibble())[3]

q4b <- system.time(DF %>% lazy\_dt() %>% group\_by(id4) %>%

summarise\_at(vars(v1:v3), mean) %>% as\_tibble())[3]

q5a <- system.time(DF %>% lazy\_dt() %>% group\_by(id6) %>%

summarise\_at(vars(v1:v3), sum) %>% as\_tibble())[3]

q5b <- system.time(DF %>% lazy\_dt() %>% group\_by(id6) %>%

summarise\_at(vars(v1:v3), sum) %>% as\_tibble())[3]

dtplyr\_results <- list(

q1a = q1a, q1b = q1b,

q2a = q2a, q2b = q2b,

q3a = q3a, q3b = q3b,

q4a = q4a, q4b = q4b,

q5a = q5a, q5b = q5b

)

dt\_dtplyr benchmark code

require(dplyr)

require(dtplyr)

library(data.table)

N <- 1e8

K <- 100

set.seed(1)

DF <- data.frame(

stringsAsFactors = FALSE,

id1 = sample(sprintf("id%03d", 1:K), N, TRUE),

id2 = sample(sprintf("id%03d", 1:K), N, TRUE),

id3 = sample(sprintf("id%010d", 1:(N / K)), N, TRUE),

id4 = sample(K, N, TRUE),

id5 = sample(K, N, TRUE),

id6 = sample(N / K, N, TRUE),

v1 = sample(5, N, TRUE),

v2 = sample(5, N, TRUE),

v3 = sample(round(runif(100, max = 100), 4), N, TRUE)

)

DF <- as.data.table(DF)

q1a <- system.time(DF %>% lazy\_dt() %>% group\_by(id1) %>%

summarise(sum(v1)) %>% as\_tibble())[3]

q1b <- system.time(DF %>% lazy\_dt() %>% group\_by(id1) %>%

summarise(sum(v1)) %>% as\_tibble())[3]

q2a <- system.time(DF %>% lazy\_dt() %>% group\_by(id1, id2) %>%

summarise(sum(v1)) %>% as\_tibble())[3]

q2b <- system.time(DF %>% lazy\_dt() %>% group\_by(id1, id2) %>%

summarise(sum(v1)) %>% as\_tibble())[3]

q3a <- system.time(DF %>% lazy\_dt() %>% group\_by(id3) %>% summarise(sum(v1), mean(v3)) %>% as\_tibble())[3]

q3b <- system.time(DF %>% lazy\_dt() %>% group\_by(id3) %>%

summarise(sum(v1), mean(v3)) %>% as\_tibble())[3]

q4a <- system.time(DF %>% lazy\_dt() %>% group\_by(id4) %>%

summarise\_at(vars(v1:v3), mean) %>% as\_tibble())[3]

q4b <- system.time(DF %>% lazy\_dt() %>% group\_by(id4) %>%

summarise\_at(vars(v1:v3), mean) %>% as\_tibble())[3]

q5a <- system.time(DF %>% lazy\_dt() %>% group\_by(id6) %>%

summarise\_at(vars(v1:v3), sum) %>% as\_tibble())[3]

q5b <- system.time(DF %>% lazy\_dt() %>% group\_by(id6) %>%

summarise\_at(vars(v1:v3), sum) %>% as\_tibble())[3]

dt\_dtplyr\_results <- list(

q1a = q1a, q1b = q1b,

q2a = q2a, q2b = q2b,

q3a = q3a, q3b = q3b,

q4a = q4a, q4b = q4b,

q5a = q5a, q5b = q5b

)

dplyr benchmark code

library(dplyr)

N <- 1e8

K <- 100

set.seed(1)

DF <- data.frame(

stringsAsFactors = FALSE,

id1 = sample(sprintf("id%03d", 1:K), N, TRUE),

id2 = sample(sprintf("id%03d", 1:K), N, TRUE),

id3 = sample(sprintf("id%010d", 1:(N / K)), N, TRUE),

id4 = sample(K, N, TRUE),

id5 = sample(K, N, TRUE),

id6 = sample(N / K, N, TRUE),

v1 = sample(5, N, TRUE),

v2 = sample(5, N, TRUE),

v3 = sample(round(runif(100, max = 100), 4), N, TRUE)

)

q1a <- system.time(DF %>% group\_by(id1) %>% summarise(sum(v1)) %>% as\_tibble())[3]

q1b <- system.time(DF %>% group\_by(id1) %>% summarise(sum(v1)) %>% as\_tibble())[3]

q2a <- system.time(DF %>% group\_by(id1, id2) %>% summarise(sum(v1)) %>% as\_tibble())[3]

q2b <- system.time(DF %>% group\_by(id1, id2) %>% summarise(sum(v1)) %>% as\_tibble())[3]

q3a <- system.time(DF %>% group\_by(id3) %>% summarise(sum(v1), mean(v3)) %>% as\_tibble())[3]

q3b <- system.time(DF %>% group\_by(id3) %>%

summarise(sum(v1), mean(v3)) %>% as\_tibble())[3]

q4a <- system.time(DF %>% group\_by(id4) %>%

summarise\_at(vars(v1:v3), mean) %>% as\_tibble())[3]

q4b <- system.time(DF %>% group\_by(id4) %>%

summarise\_at(vars(v1:v3), mean) %>% as\_tibble())[3]

q5a <- system.time(DF %>% group\_by(id6) %>%

summarise\_at(vars(v1:v3), sum) %>% as\_tibble())[3]

q5b <- system.time(DF %>% group\_by(id6) %>%

summarise\_at(vars(v1:v3), sum) %>% as\_tibble())[3]

dplyr\_results <- list(

q1a = q1a, q1b = q1b,

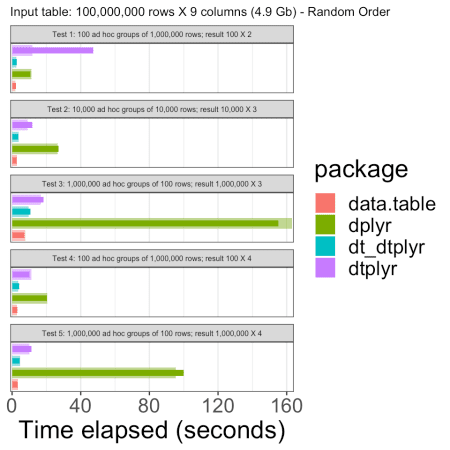
q2a = q2a, q2b = q2b,

q3a = q3a, q3b = q3b,

q4a = q4a, q4b = q4b,

q5a = q5a, q5b = q5b

)



We can see that using *dtplyr* improves the performance quite a bit, though still not as fast as *data.table*. It would seem however that most of the difference stems from the need to convert the data.frame object to a data.table one. That can be done once when reading in the file for example. Thus it would seem that ultimately the sacrifice in performance for the added benefit of tidy syntax (for those who dig tidy) isn’t too bad.

Personally, I’m hooked on the tidyverse and the *dtplyr* package is just another reason to keep using it, even for operations over a large number of groups.

**Session info**

sessionInfo()

## R version 3.6.2 (2019-12-12)

## Platform: x86\_64-apple-darwin15.6.0 (64-bit)

## Running under: macOS Mojave 10.14.6

##

## Matrix products: default

## BLAS: /Library/Frameworks/R.framework/Versions/3.6/Resources/lib/libRblas.0.dylib

## LAPACK: /Library/Frameworks/R.framework/Versions/3.6/Resources/lib/libRlapack.dylib

##

## locale:

## [1] en\_US.UTF-8/en\_US.UTF-8/en\_US.UTF-8/C/en\_US.UTF-8/en\_US.UTF-8

##

## attached base packages:

## [1] stats graphics grDevices utils datasets methods base

##

## other attached packages:

## [1] data.table\_1.12.8 pander\_0.6.3 dtplyr\_1.0.0 forcats\_0.4.0

## [5] stringr\_1.4.0 dplyr\_0.8.5 purrr\_0.3.4 readr\_1.3.1

## [9] tidyr\_1.0.3 tibble\_3.0.1 ggplot2\_3.3.0 tidyverse\_1.3.0

## [13] pacman\_0.5.1

##

## loaded via a namespace (and not attached):

## [1] tidyselect\_1.1.0 xfun\_0.12 haven\_2.2.0 lattice\_0.20-38

## [5] colorspace\_1.4-1 vctrs\_0.3.0 generics\_0.0.2 htmltools\_0.4.0

## [9] yaml\_2.2.1 utf8\_1.1.4 rlang\_0.4.6 pillar\_1.4.4

## [13] glue\_1.4.1 withr\_2.1.2 DBI\_1.1.0 dbplyr\_1.4.2

## [17] modelr\_0.1.5 readxl\_1.3.1 lifecycle\_0.2.0 munsell\_0.5.0

## [21] blogdown\_0.17 gtable\_0.3.0 cellranger\_1.1.0 rvest\_0.3.5

## [25] evaluate\_0.14 labeling\_0.3 knitr\_1.27 fansi\_0.4.1

## [29] broom\_0.5.3 Rcpp\_1.0.4.6 scales\_1.1.0 backports\_1.1.5

## [33] jsonlite\_1.6.1 farver\_2.0.3 fs\_1.4.1 hms\_0.5.3

## [37] digest\_0.6.25 stringi\_1.4.6 bookdown\_0.17 grid\_3.6.2

## [41] cli\_2.0.2 tools\_3.6.2 magrittr\_1.5 crayon\_1.3.4

## [45] pkgconfig\_2.0.3 ellipsis\_0.3.1 xml2\_1.2.2 reprex\_0.3.0

## [49] lubridate\_1.7.8 assertthat\_0.2.1 rmarkdown\_2.0 httr\_1.4.1

## [53] rstudioapi\_0.11 R6\_2.4.1 nlme\_3.1-143 compiler\_3.6.2