

data.table

News from 1.6, 1.7 & 1.8

Matthew Dowle

LondonR, June 2012

Overview

- **Real example**
- **Review of last presentation 2 years ago**
- **Package statistics**
- **New features**
- **Q&A**



3



I have a data frame that is some 35,000 rows, by 7 columns. it looks like this:

```
head(nuc)
```

	chr	feature	start	end	gene_id	pctAT	pctGC	length
1	1	CDS	67000042	67000051	NM_032291	0.600000	0.400000	10
2	1	CDS	67091530	67091593	NM_032291	0.609375	0.390625	64
3	1	CDS	67098753	67098777	NM_032291	0.600000	0.400000	25
4	1	CDS	67101627	67101698	NM_032291	0.472222	0.527778	72
5	1	CDS	67105460	67105516	NM_032291	0.631579	0.368421	57
6	1	CDS	67108493	67108547	NM_032291	0.436364	0.563636	55



gene_id is a factor, that has about 3,500 unique levels. I want to, for each level of gene_id get the `min(start)`, `max(end)`, `mean(pctAT)`, `mean(pctGC)`, and `sum(length)`.

I tried using `lapply` and `do.call` for this, but it's taking forever +30 minutes to run. the code I'm using is:

```
nuc_prof = lapply(levels(nuc$gene_id), function(gene){
  t = nuc[nuc$gene_id==gene, ]
  return(list(gene_id=gene, start=min(t$start), end=max(t$end), pctGC =
    mean(t$pctGC), pct = mean(t$pctAT), cdslength = sum(t$length)))
})
nuc_prof = do.call(rbind, nuc_prof)
```

I'm certain I'm doing something wrong to slow this down. I haven't waited for it to finish as I'm sure it can be faster. Any ideas?

First answer

 **8**  `do.call` can be extremely slow on large objects. I think this is due to how it constructs the call, but I'm not certain. A faster alternative would be the `data.table` package. Or, as @Andrie suggested in a comment, use `tapply` for each calculation and `cbind` the results.

A note on your current implementation: rather than doing the subsetting in your function, you could use the `split` function to break up your `data.frame` into a list of `data.frames` you can loop over.

```
g <- function(tnuc) {  
  list(gene_id=tnuc$gene_id[1], start=min(tnuc$start), end=max(tnuc$end),  
       pctGC=mean(tnuc$pctGC), pct=mean(tnuc$pctAT), cdslength=sum(tnuc$length))  
}  
nuc_prof <- lapply(split(nuc, nuc$gene_id), g)
```

[link](#) | [edit](#) | [flag](#)

answered Jun 15 at 16:05



Joshua Ulrich

30.6k ● 3 ● 34 ● 67

[add comment](#)

Follow up answer

Since I'm in an evangelizing mood ... here's what the fast `data.table` solution would look like:

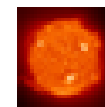
```
library(data.table)
dt <- data.table(nuc, key="gene_id")

dt[, list(A=min(start),
          B=max(end),
          C=mean(pctAT),
          D=mean(pctGC),
          E=sum(length)), by=key(dt)]
```

#	gene_id	A	B	C	D	E
# 1:	NM_032291	67000042	67108547	0.5582567	0.4417433	283
# 2:	ZZZ	67000042	67108547	0.5582567	0.4417433	283

[link](#) | [edit](#) | [flag](#)

answered Jun 15 at 16:14



Josh O'Brien

20.4k ● 2 ● 14 ● 40

NB: It isn't just the speed, but the simplicity. It's easy to write and easy to read.

User's reaction

**Holy fudge buckets!!! data.table is awesome!
That took about 3 seconds for the whole
thing!!!**

**I think that congratulations are well in order
for the frankly amazingly well written quick
start guide and FAQ. Seriously. Where is the
button to make all R and bioconductor
packages like this one?**

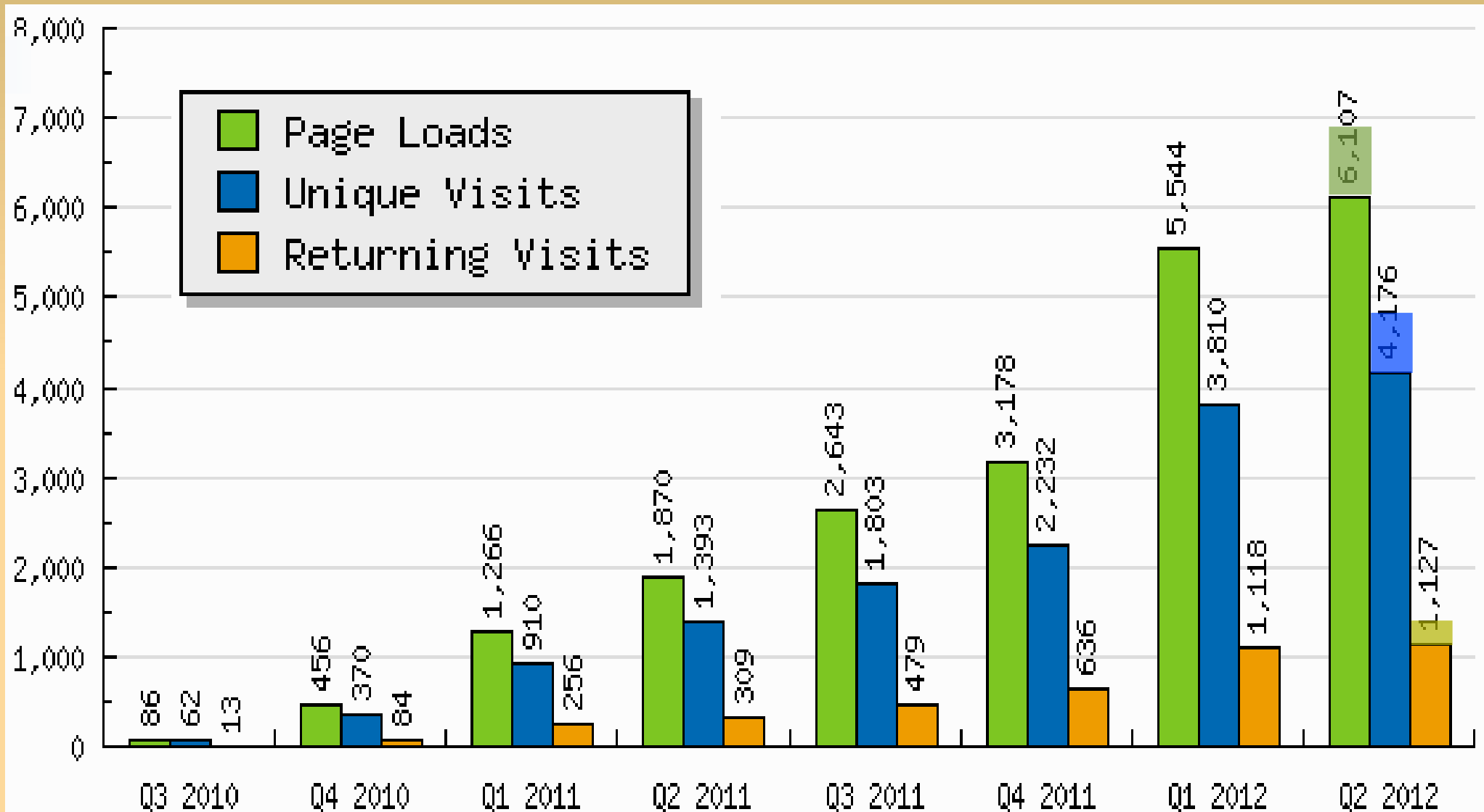
Davy Kavanagh, 15 Jun 2012

**Review of presentation
2 years ago**

(Including why grouping is fast)

Link to pdf

Since then



Rank all packages by users

Rank	CRAN package	Users	AvgVote	NumVotes	Crantastic Rank	Inside-R Votes
1	ggplot2	77	4.0	50	7	2018
2	data.table	60	3.9	49	12	1581
3	plyr	55	3.7	32	24	1338
4	reshape	33	3.6	16	31	772
5	Sim.DiffProc	23	4.3	30	9	825
6	Sim.DiffProcGUI	23	4.3	30	10	825
7	lme4	23	3.6	7	34	363
8	Hmisc	21	3.9	11	25	422
9	lattice	19	4.7	4	4	259
10	RODBC	17	4.2	11	19	520

15 reviews

Link

- "It is much easier to subset, summarize, and investigate data.tables"
- "Improves programming and computing speed"
- "Great library for data.mining"
- "data.table is a perfect combination of useability and speed"
- "The more I use it, the better it gets"
- "A very useful package!"
- "The fast way to do SQL like operations in R"

Reviews continued

- "data.table is fast compared to ddply and ave"
- "data.table rocks!"
- "Efficient and simple"
- "I use it on a regular basis and I managed to cut computing time dramatically."
- "Amazing package!"
- "Fast"
- "I don't know where I would be w/o data.table"
- "Fast splitting/sorting operations in frames"

Stack Overflow tag

Link

13,629

questions tagged

[r](#) [about »](#)

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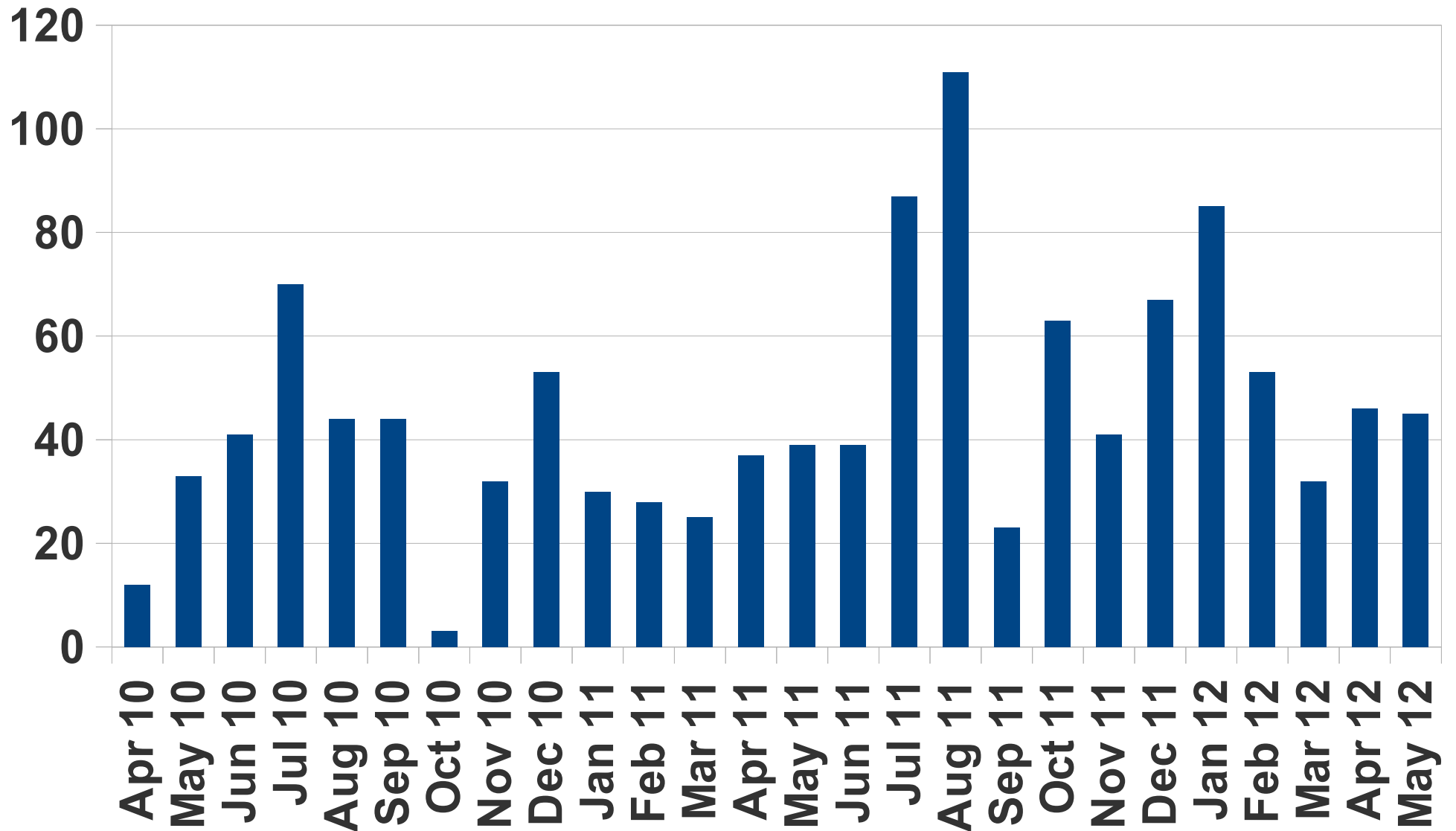
[date](#) × 116

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[for-loop](#) × 115

[java](#) × 114

datatable-help: posts per month



Other stats

- 24 articles "data.table" on R-bloggers
- 108 bugs fixed, 5 outstanding
- 66 feature requests implemented, 64 left
- 191 items in NEWS 1.6.0-1.8.1
- 2,600 lines of R
- 2,000 lines of C
- 653 unit tests

First released Aug 2008

Thanked in NEWS

Chris Neff	Prasad Chalasani	Stavros Macrakis	gkaupas
Yike Lu	Helge Liebert	Branson Owen	Juliet Hannah
user1393348	Dieter Menne	RYogi	Iterator
Leon Baum	Yang Zhang	Prof Brian Ripley	Allan Engelhardt
Michael Weylandt	Steven Bagley	Ivo Welch	Sean Creighton
Christoph Jaeckel	Ivan Zhang	Simon Urbanek	ilprincipe
Muhammad Waliji	Joshua Ulrich	Luke Tierney	Dennis Murphy
Josh O'Brien	Eric	Eugene Tyurin	Vanja
Malcolm Cook	DM	Nicolas Servant	Alexander Peterhansl
Joseph Voelkel	Damian Betebenner	Jean-Francois Rami	
user1165199	Jim Holtman	Jelmer Ypma	
Karl Ove Hufthammer	Timothée Carayol	Theil Fowler	
Ina	Johann Hibsichman	Andreas Borg	

In appearance order in NEWS. Special thanks to Chris Neff for weeks of help to solve difficult crash bug Jan 2012.

Hierarchical indexes

- 4 years old (released Aug 2008)
- `setkey(DT, id, date)`
- `setkey(DT, category, id, date)`
- `DT[X]` or `merge(DT,X)`
- But, it was integer columns only
- NEW : character and double now ok
fractional seconds in `POSIXct` ok

Assign to a subset

Link to question on S.O.

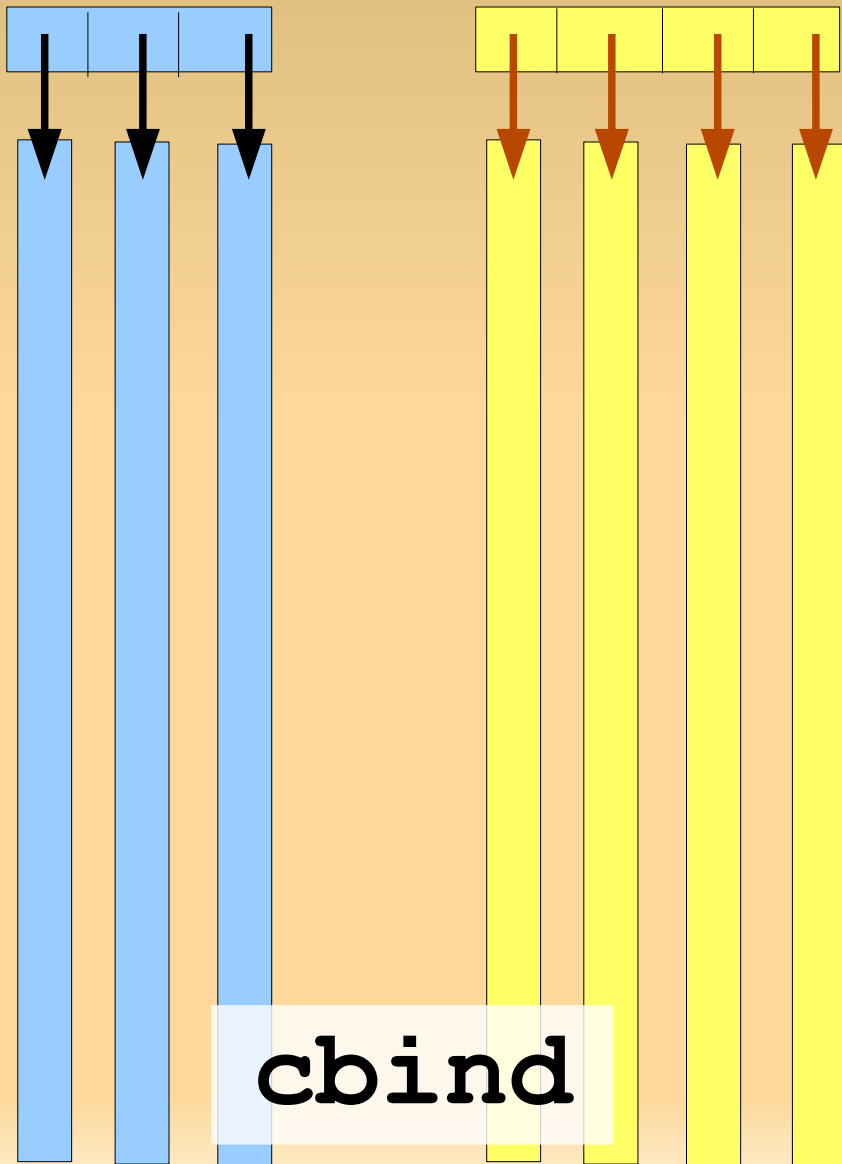
” In R I find myself doing something like this a lot:”

```
adataframe[adataframe$col==something]<-  
adataframe[adataframe$col==something])+1
```

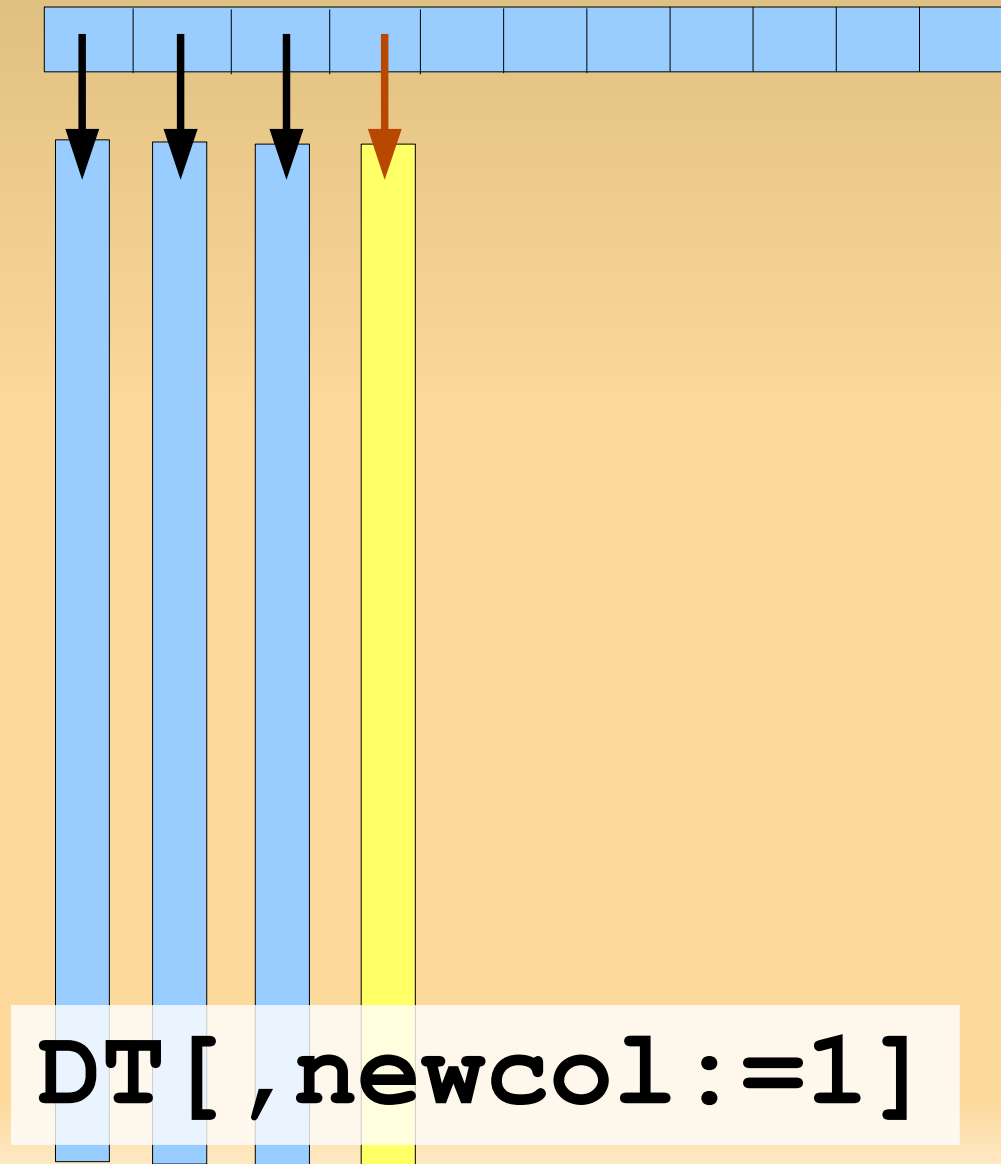
- **DT[col1==something, col2:=col3+1]**
- **Easy to write, easy to read**

Over allocation (add by reference)

data.frame



data.table



Delete in place

- **DT[,colname:=NULL]**
- **Instant, regardless of size**
- **By reference, memmove internally**
- **Don't have to copy all but that column**

copy()

- data.table IS copied-on-change by `<-` as usual
- No copy by `set*` functions (`setkey`, `setnames`, `setattr`)
- No copy by `:=`
- When you need a copy, call `copy(DT)`
- Why copy a 20GB data.table, even once.

Other

- **Print method now prints head and tail**
- **Automatic optimization (sum -vs- mean)**
- **rbenchmark() replications default of 100 times overhead. Set to 1 and increase size of data, instead.**
- **Notice variable name repetition**
- **:= by group now in v1.8.1**

Analogous to SQL

- Link to [data.table FAQ](#)

**DT[where,
select | update,
group by]
[having]
[order by]
[]...[]**

**Compound [] is key
reason it's all inside
[.data.table**

Not (that) much to learn

- One manual page: `?data.table`
- Run `example(data.table)` at the prompt
- No methods, no functions, just use what you're used to in R

list columns

- Each cell can be a different type
- Each cell can be vector
- Each cell can itself be a data.table

- Combining list columns with i and by

list column example

```
data.table(x=letters[1:3],  
           y=list(1:10,  
                 letters[1:4],  
                 data.table(a=1:3,b=4:6) ))
```

```
      x      y  
1: a 1,2,3,4,5,6,  
2: b      a,b,c,d  
3: c <data.table>
```

Questions?
Suggestions?
Feedback?

Thank you!
[Homepage](#)