

The R package bigstatsr: Memory- and Computation-Efficient Tools for Big Matrices

useR!2017 lightning talk

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About

I'm a PhD Student (2016-2019) in **Predictive Human Genetics** in Grenoble.

Disease \sim DNA mutations

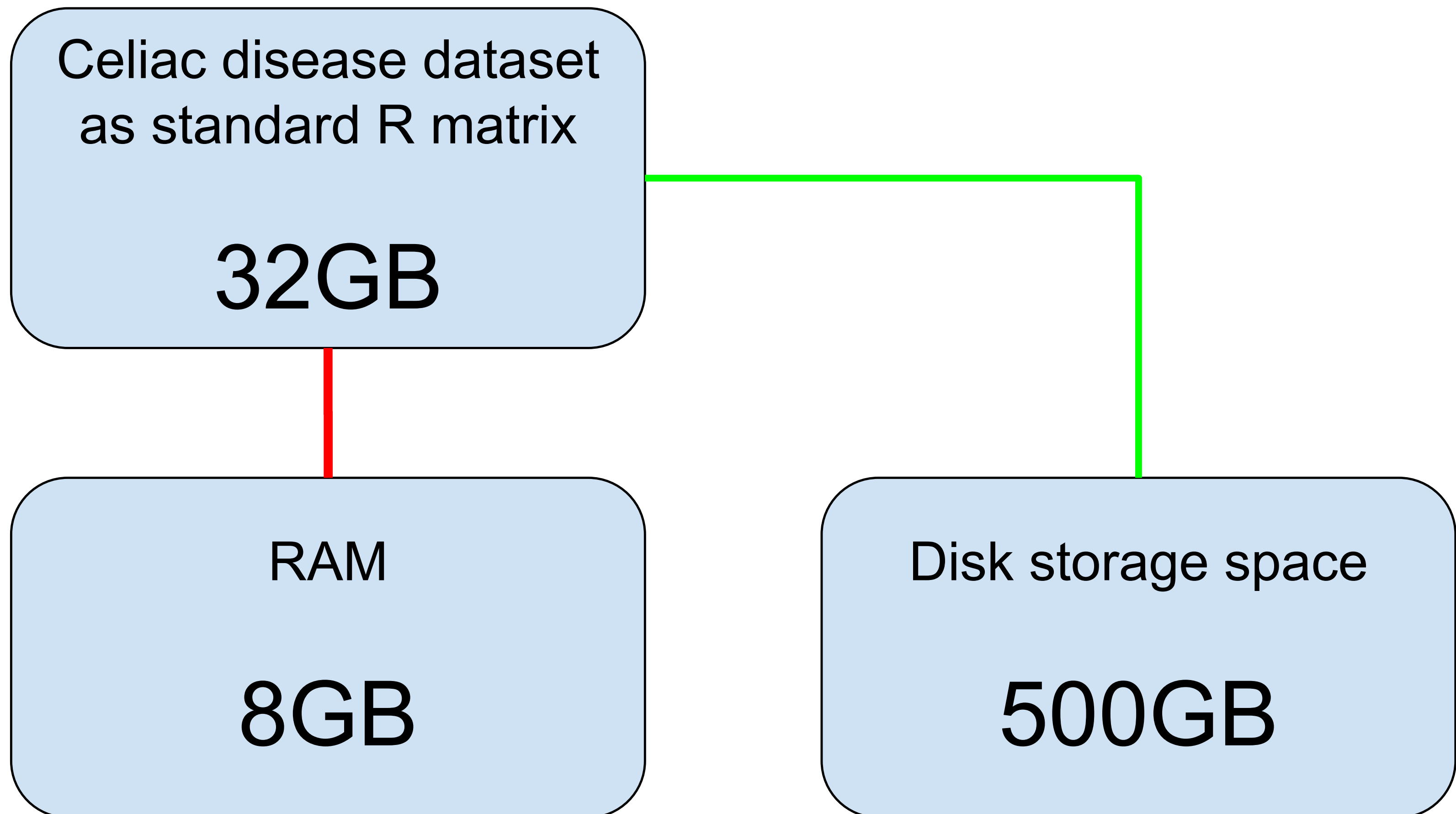


Very large genotype matrices

- currently: 15K x 300K, celiac disease
- soon: 500K x 800K, UK Biobank

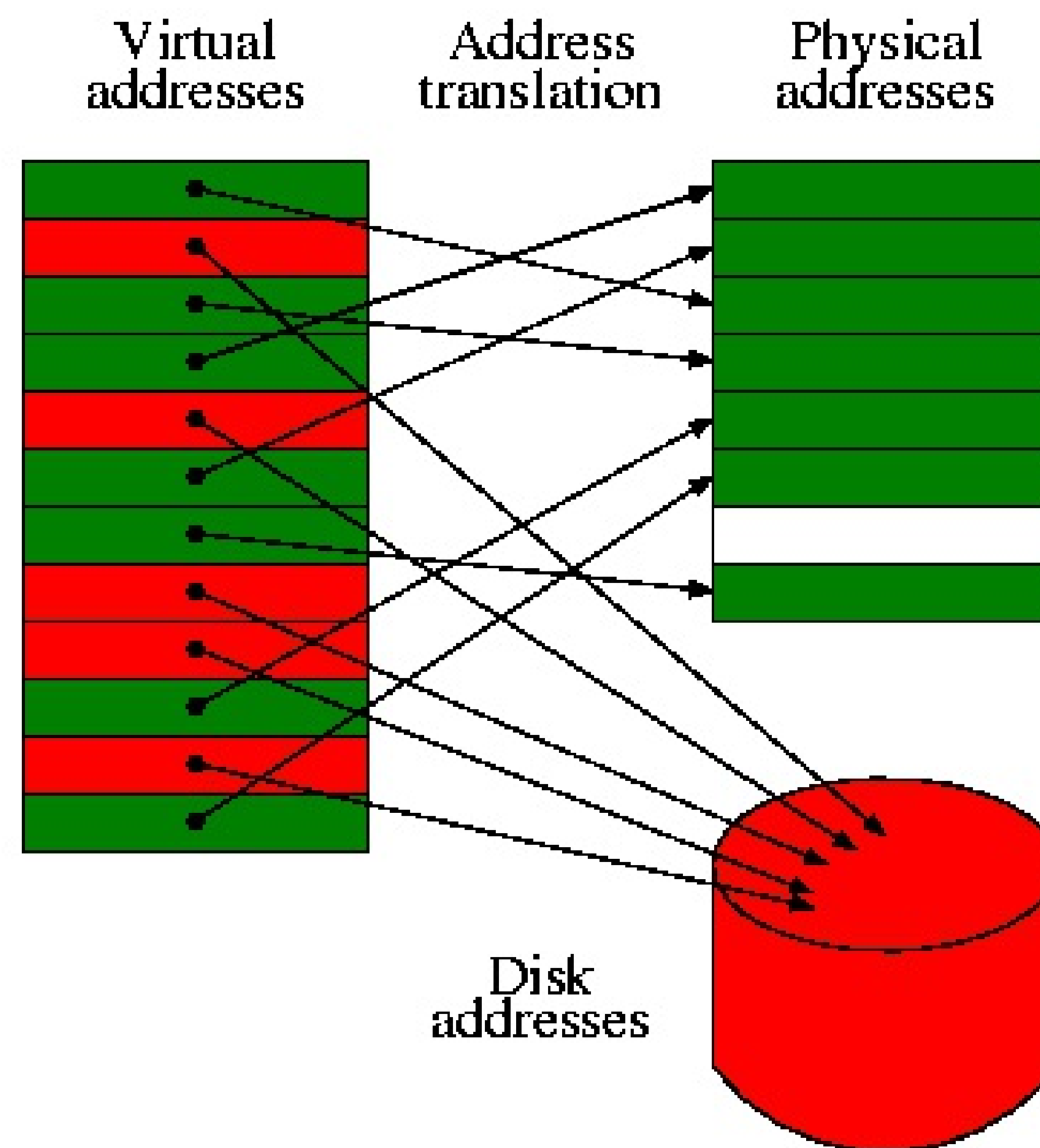


Problem I had



Solution I found: R package bigmemory

Store matrices on disk and access them from there



Michael J. Kane, John Emerson, Stephen Weston (2013).

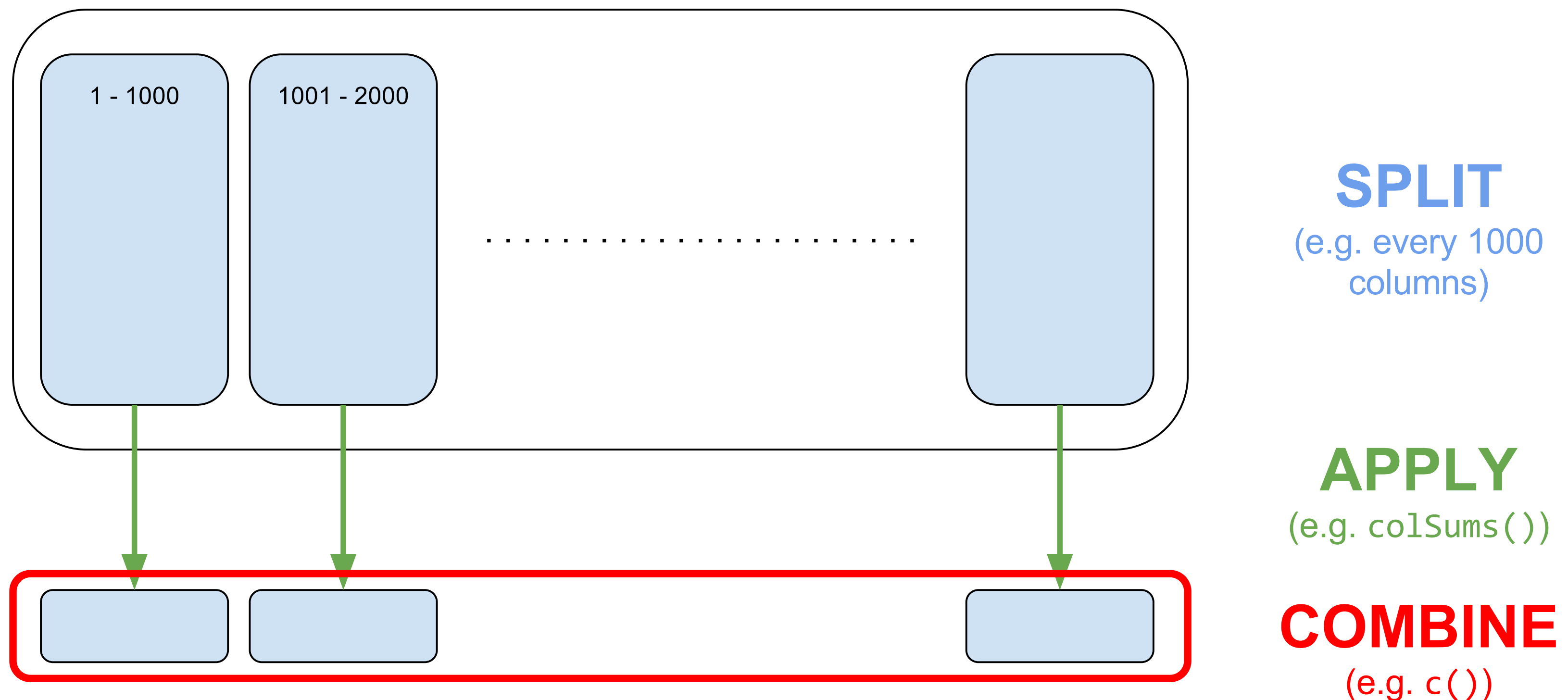
Accesses almost as if the matrix were in memory

- in **R**: accesses with `[]`, as standard R matrices,
- in **Rcpp**: accesses single elements with `X(i, j)`, as standard Rcpp matrices.



Split-(par)Apply-Combine Strategy

Apply standard R functions to big matrices (in parallel)



strategy coined by Hadley Wickham (2011)

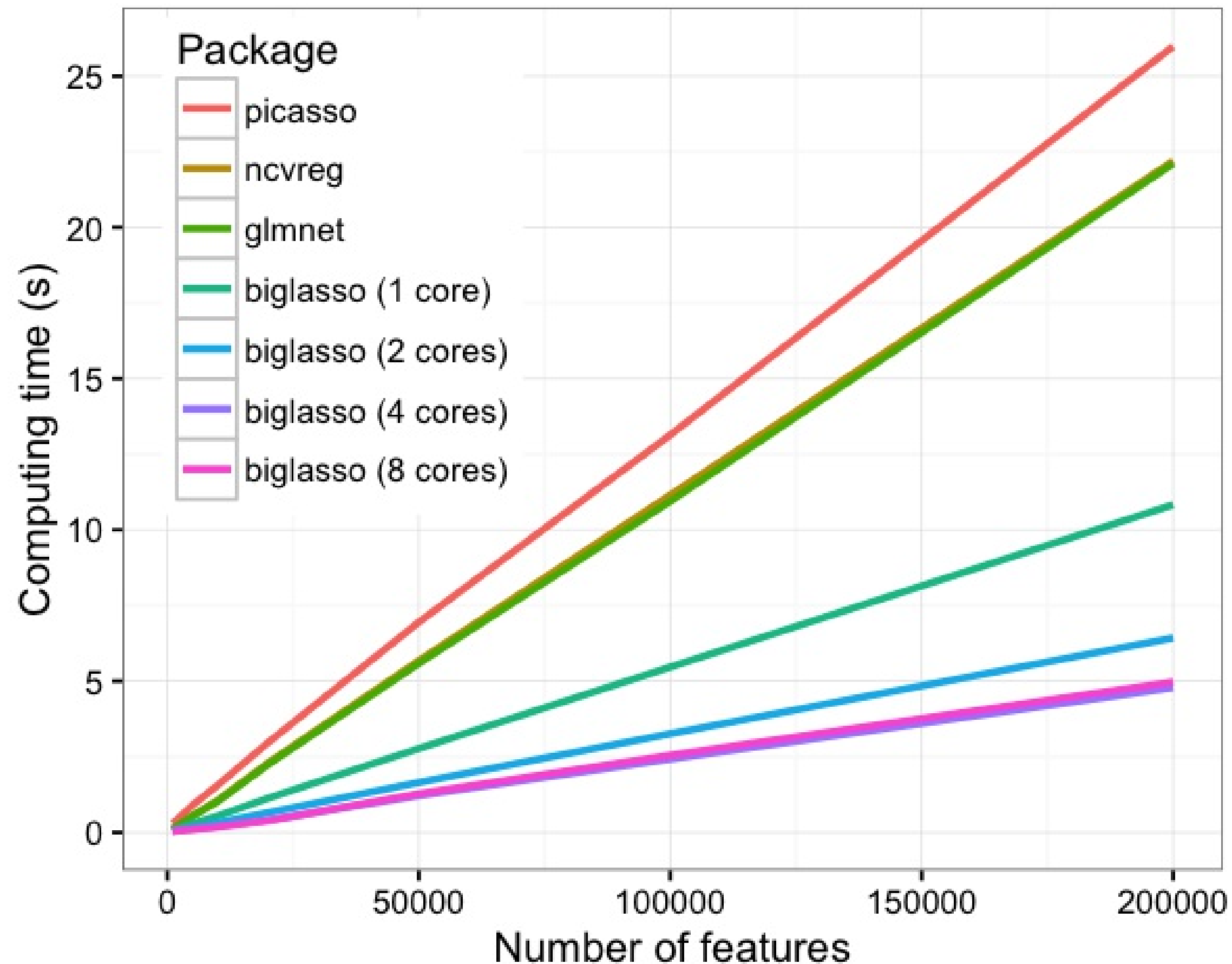
Matrix operations

- (cross-)products with matrices/vectors
- special tricks for handling scaling ([vignette](#) and [blog post](#))

Example: computation of correlation of a 100,000 x 5000 matrix

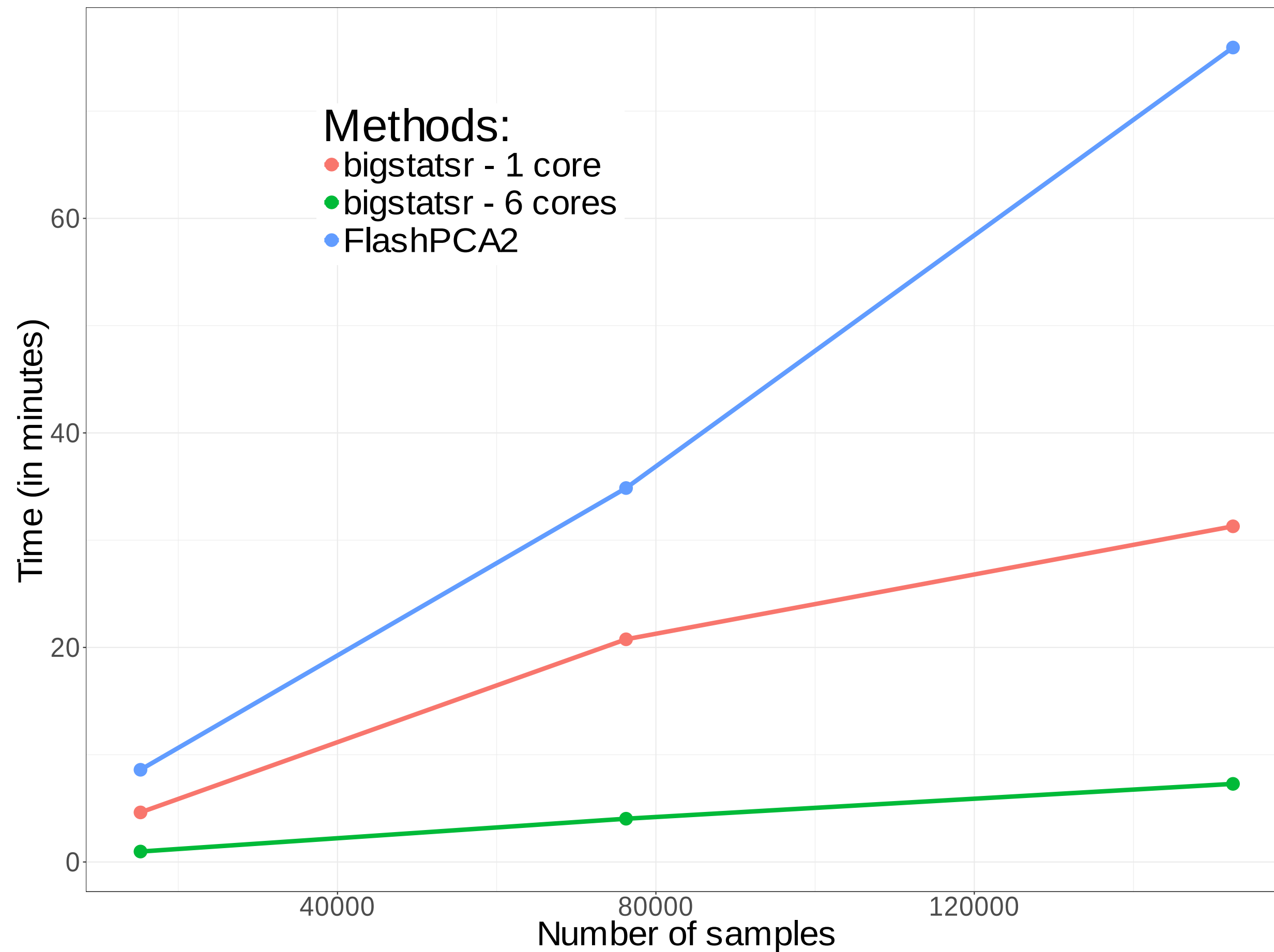
- cor: 22 minutes
- big_cor: 1 minute

Sparse linear models: biglasso



Zeng, Y., and Breheny, P. (2017).

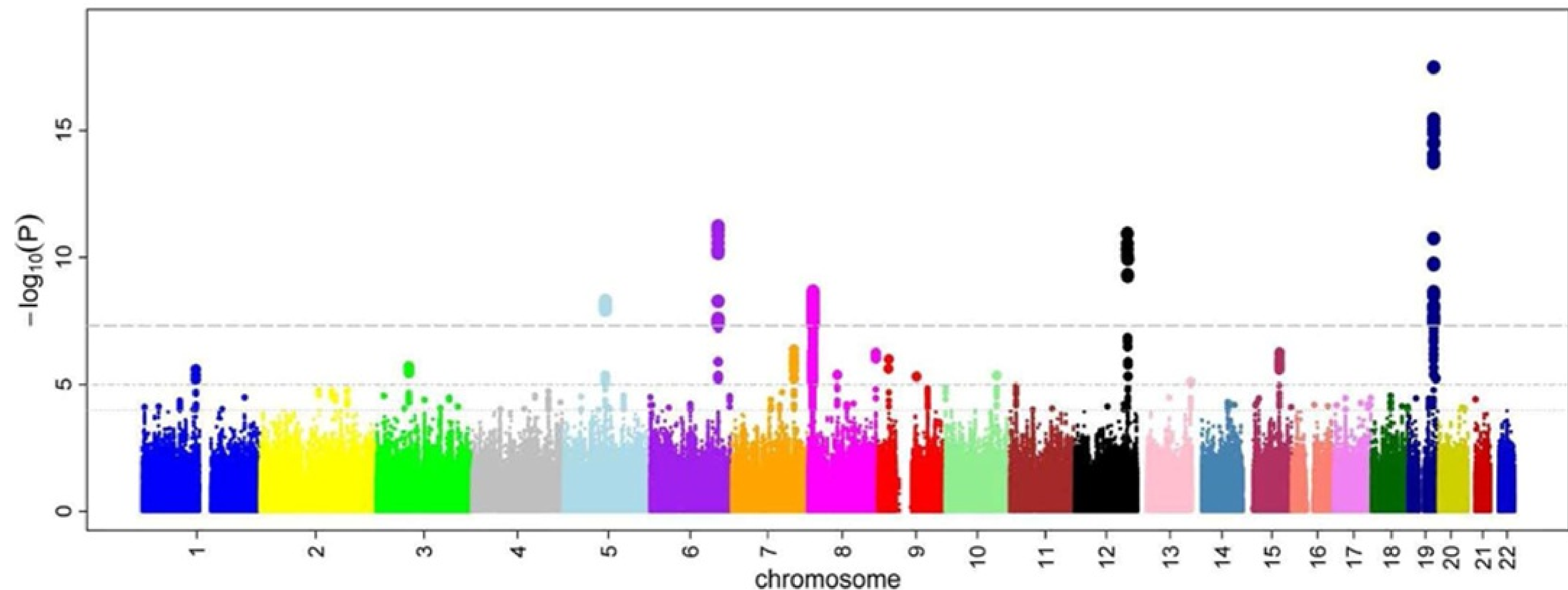
Partial Singular Value Decomposition



based on R package **RSpectra**

Test association of each variable with an outcome

In genetics, this is called a Genome-Wide Association Study (GWAS)



Manhattan plot

I'm now able
to run algorithms
on 100GB of data

R Packages

bigmemory	`big.matrix` object
bigstatsr	Statistical functions for `big.matrix` objects to be used by any field
bigsnpr	Specific functions for SNP arrays

Paper in preparation: "Efficient management and analysis of large-scale genome-wide data with two R packages: bigstatsr and bigsnpr".

Any contributor is welcomed!



Thanks!

Package's website: <https://privefl.github.io/bigstatsr/>

Twitter and GitHub: [@privefl](#)

Presentation available online: <https://goo.gl/nNg0hw>

Slides created via the R package **xaringan**.