Sparse Model Matrices for Generalized Linear Models

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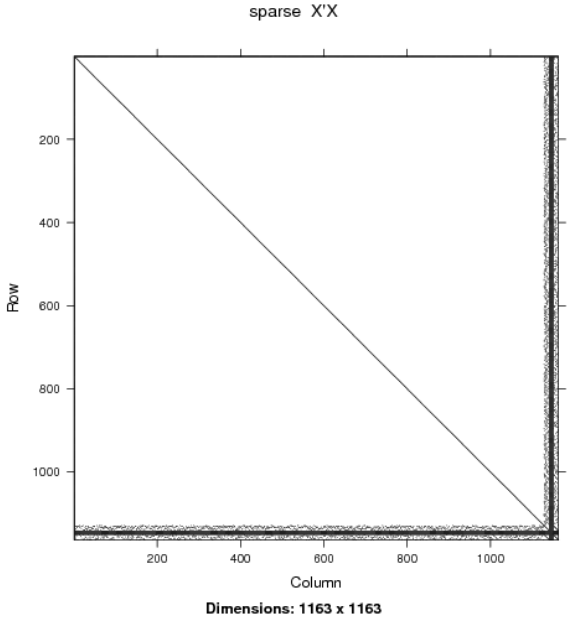
Using sparse model matrices for linear, generalized linear, and also (generalized) linear mixed effect models can be very advantageous particularly, when most predictor variables are categorical (`factor`s). We will demonstrate using such sparse matrices via function `sparse.model.matrix()` from the **Matrix** package and use sparse Cholesky decompositions to fit large linear and generalized linear models (GLM) efficiently. We will compare these with the corresponding functionality in R packages **biglm** and **speedglm**.

However, speed is not everything, and a not so well-known fact is that S and R have had smart "home-made" low-level code underlying `lm()`, for situations of ill-conditioned ("quasi-singular") design matrices $\mathbf{X}$. The benefit of this pivoting code has been the easy "identification" of components $\hat{\beta}_j$ to be set to `NA` such that other parts remained stably defined. Traditional high-quality code for matrix decompositions and least squares computation, as provided, e.g., by LAPACK, would not automatically provide the same functionality, nor do the analogous libraries for sparse computations.

We will explore some of these computational challenges in a mixed-effect model of moderately large data sets (e.g., $n = 73421$, $p = 1163$, $q = 2972$). Notably, the computation of standard errors for the fixed effects can pose problems which seem harder to solve than the parameter (maximum likelihood) estimation itself.



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