SI2-SSE Enhancing the PRIMME Software with New Methods and Functionality for Eigenvalues and SVD problems
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Goal
Compute a few:
- eigenvalues and eigenvectors ($\lambda_i, x_i$)
  $$Ax_i = x_i\lambda_i, \quad A \text{ Hermitian}$$
- singular values and singular vectors ($\sigma_i, u_i, v_i$)
  $$Av_i = x_i\sigma_i, \quad A \text{ any shape matrix}$$
User provided matrix-vector and preconditioner functions

Applications in data mining, graph analysis, structural engineering, materials science, electromagnetics, lattice QCD

Progress Feb’15 – Feb’16
New features:
- Support for SVD problems
- New interfaces in MATLAB, Python and R (with SWIG)
- Support for BLAS/LAPACK with 64 bits integer
Repository activity:
- Releases: 1.2.1 (Sep’15), 1.2.2 (Oct’15), 2.0 (Feb’16)
- 170 commits, 10 fixed bugs
- 40 downloads and 270 visitors from GitHub

Documentation:
- Extended documentation which is now managed with Sphinx
- New usage examples in C, Fortran, Python and R, and in parallel (with PETSc)
Software distributed now on GitHub:
https://github.com/primme/primme

State-of-the-art Eigensolvers and SVD solvers

Remarkable features of PRIMME:
- Implement near optimal methods GD+k, JDQMR
- Full set of defaults and auto-tuning for end-users
- Full customizability for expert users
- Easy integration in applications and frameworks

Proposed Software Development

Filters Performance

Legend: Released Next developments

Next developments
- Support for generalized Hermitian problems (GHEP) using B-orthogonalization (B-CGS)
- Performance enhancement in block methods: blocked JDQMR and GS-SVQB
- Polynomial filters acceleration
- Examples calling PRIMME from Trilinos
- New interface in Julia
- Transition to templated code with support for multiple precisions