Spring ’25: Newton’s Method and ADMM on cellular sheaves

Getting to a paper

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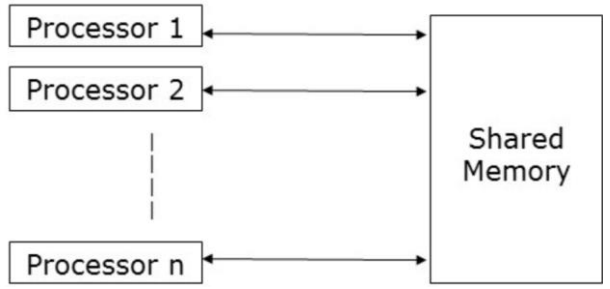
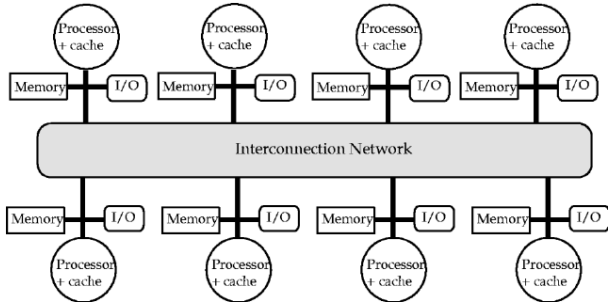
Progress so far

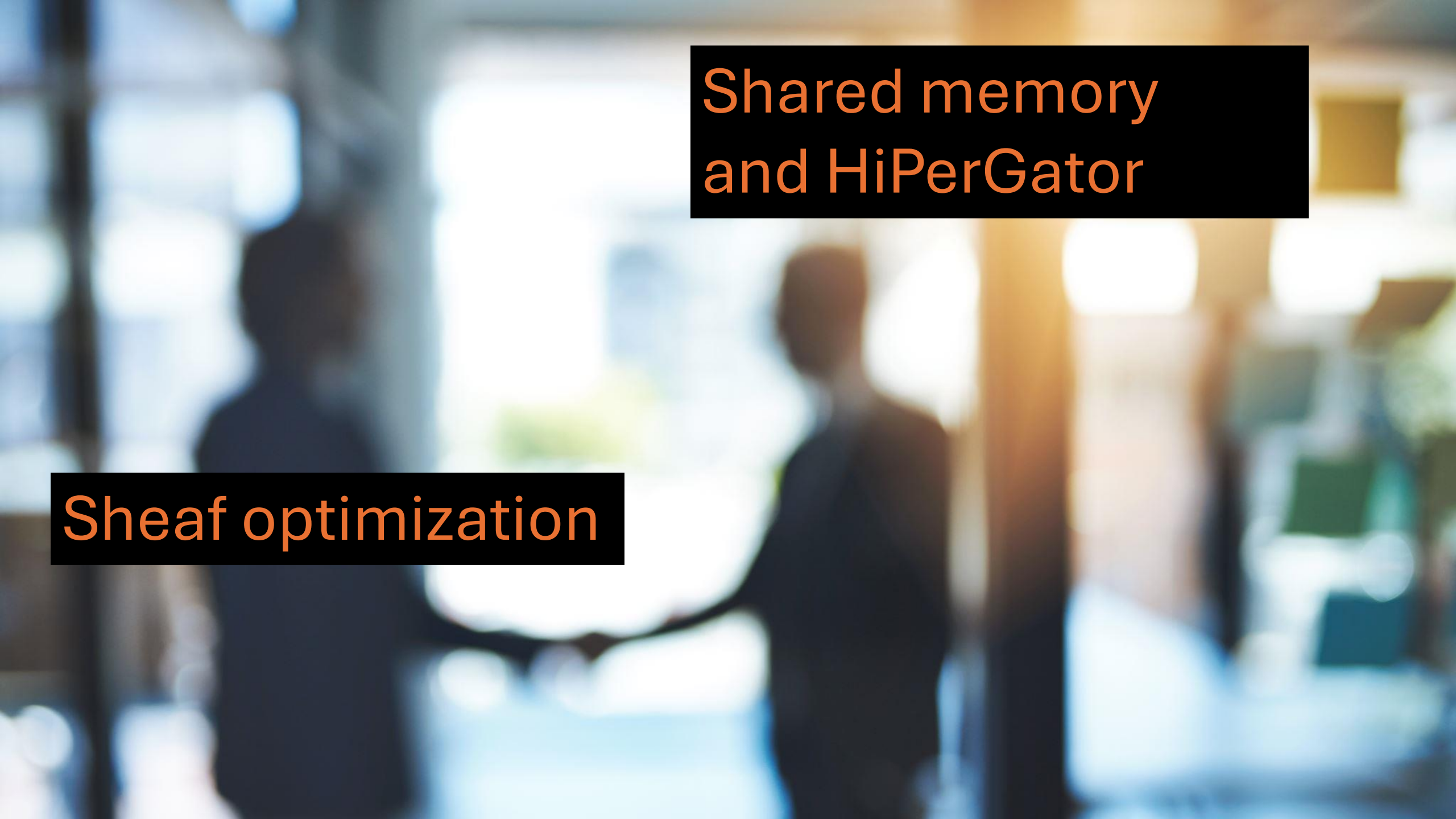
- MatrixSheaf
  - Model using large sparse arrays and shared memory
- ThreadedSheaf
  - Model using nodes, channels, and shared memory
- DistributedSheaf
  - Model using nodes, remote channels, and distributed memory

$$A := \begin{bmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 9 & 8 & 7 & 6 & 5 & 4 & 3 & 2 & 1 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 9 & 8 & 7 & 6 & 5 & 4 & 3 & 2 & 1 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 9 & 8 & 7 & 6 & 5 & 4 & 3 & 2 & 1 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 9 & 8 & 7 & 6 & 5 & 4 & 3 & 2 & 1 \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \end{bmatrix}$$



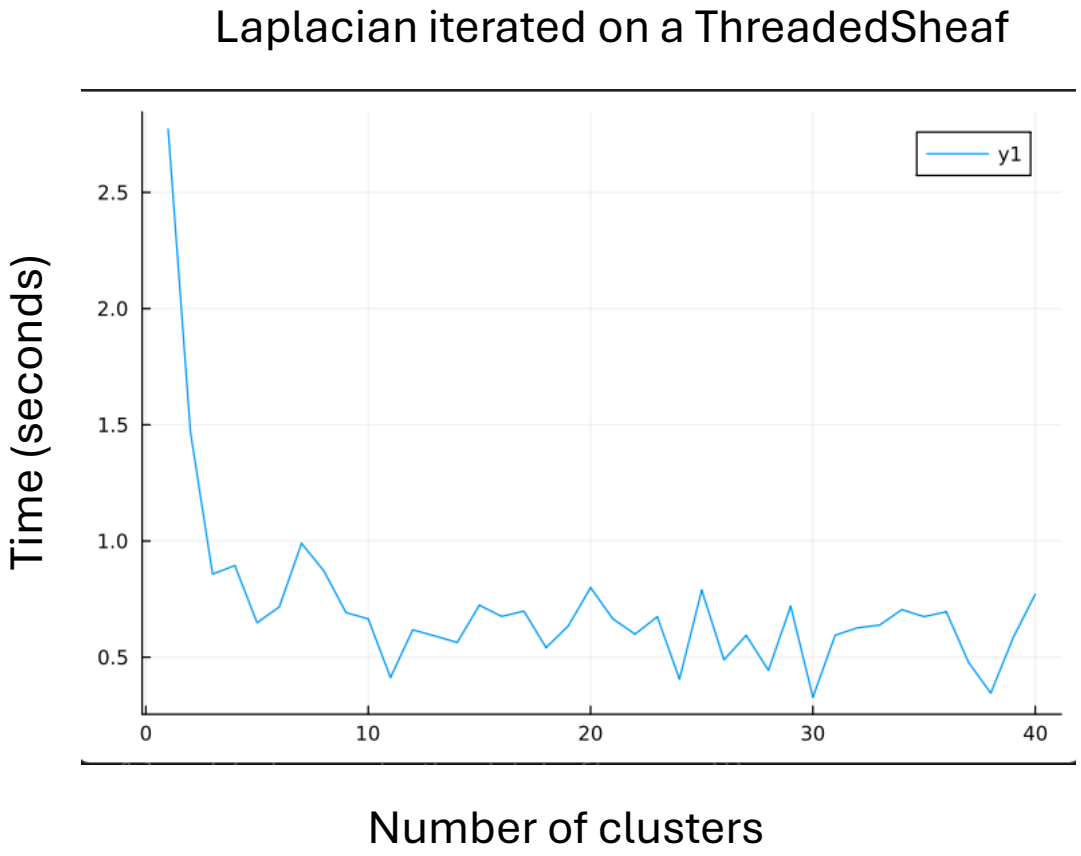


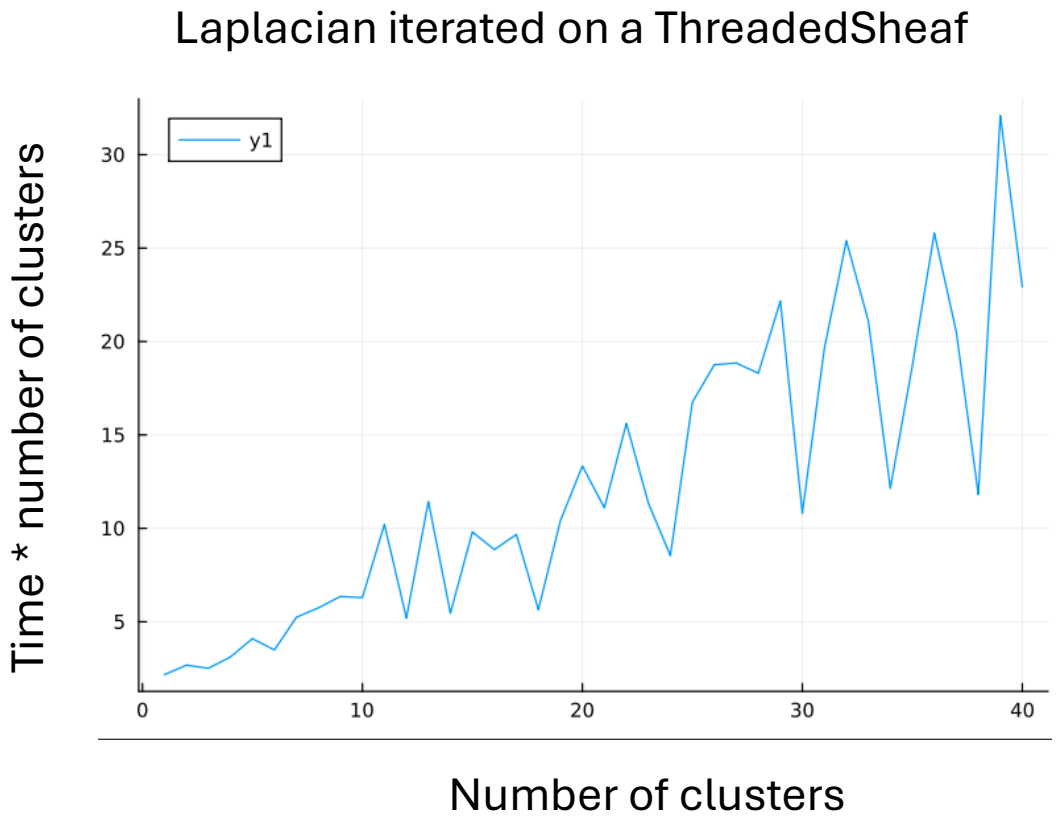
Distributed memory and HiPerGator
Sheaf optimization


Shared memory
and HiPerGator
Sheaf optimization

Progress so far

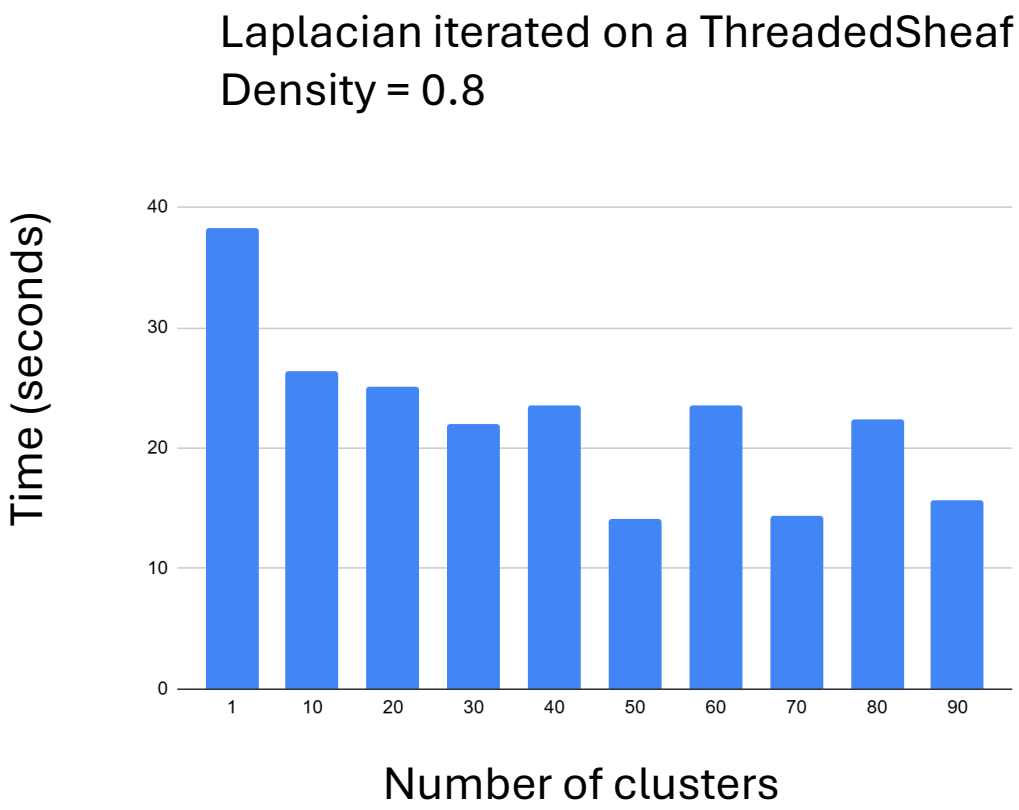
- Benchmarks on my laptop
  - 20 threads

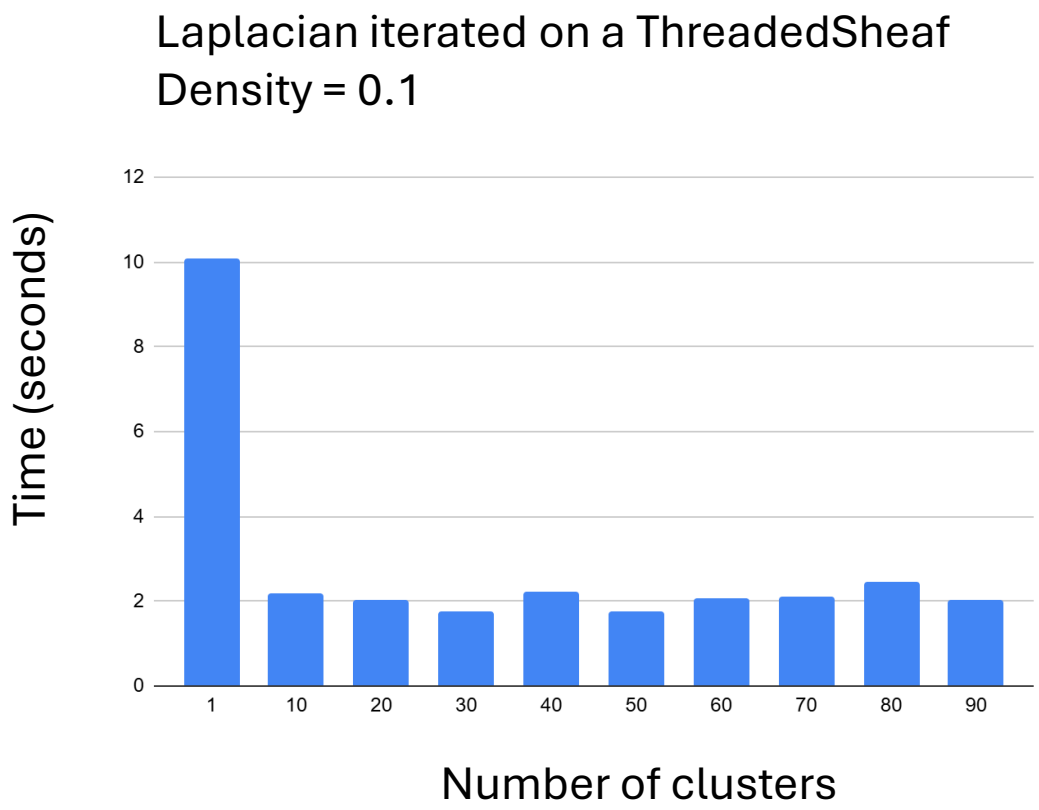




Progress so far

- Benchmarks on HiPerGator
  - 64 threads

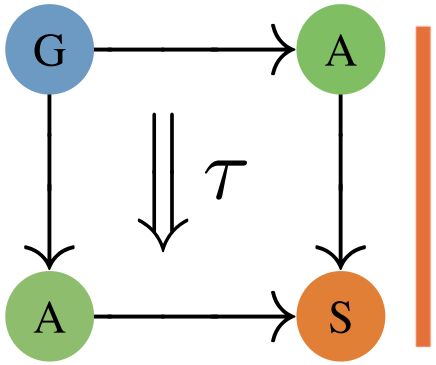
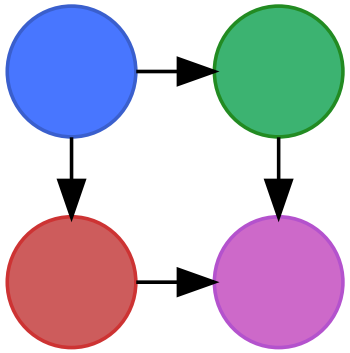




What's next

- Implement Newton's Method and ADMM on ThreadedSheaf and MatrixSheaf
- Benchmark on HiPerGator for various datasets, graphs, sparsity patterns, clusterings, restriction map matrix types, and sheaf implementations
- Write up background from the Hansen & Ghrist paper
- Machine learning application
- Documentation
- Submit to ___ by ____
  - NeurIPS by May pending good ML application

Thanks for listening!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