Continue where “General Problem We Are Trying to Solve” slide (statement of problem) left off

Generalization of low-rank matrix approximation problem:

* $\min\_{\rk(X) \leq r} \lVert A - BXC \rVert^2\_F$ for given $A, B, C$
* Solution via SVD discussed in paper by Zihao Li and Lek-Heng Lim
* Question: what do the critical points look like?
  + Baseline problem:
    - All critical points are real (!)
    - All look like optimal solution from Eckart-Young-Mirksy, up to permutation of the diagonal matrix of singular values
    - $\binom{\min\{m,n\}}{r}$ many of them
* Approach: numerically compute critical points using Homotopy Continuation library to help develop any conjectures
  + 1st, offline phase: solve the problem for a (hopefully) gentle choice of generic A, B, C
  + 2nd, online phase: solve the problem for chosen parameters A, B, C by continuously deforming the generic problem’s solutions into solutions of the problem of interest
* Challenges:
  + Homotopy Continuation is relatively new; not a “mature” technology yet
    - (make verbal comparison to relative ease with which we can solve a linear system of equations)
    - Method can fail if there are too many solutions; need to impose additional constraints/exploit symmetries to make things more tractable
    - Runtime blows up very quickly even for modestly sized parameters
  + Spare documentation for library
  + Setting up code & unit tests
    - Convert and combine parameter matrices into vectors, then unpack them after