Shashank Singh[1]

3 Algorithms for matrix completion [30 points] (Sashank)

(a) **[10]** See code submitted in `code.zip`.

(b) **[5]** For $\lambda \approx 17.4$, the algorithm seems to converge very quickly (24 iterations) without significantly increasing the RMSE. While $\lambda \approx 5.30$ appears to minimize the RMSE, it also requires many more iterations (299). The rank of the solution for $\lambda \approx 17.4$ is 9.

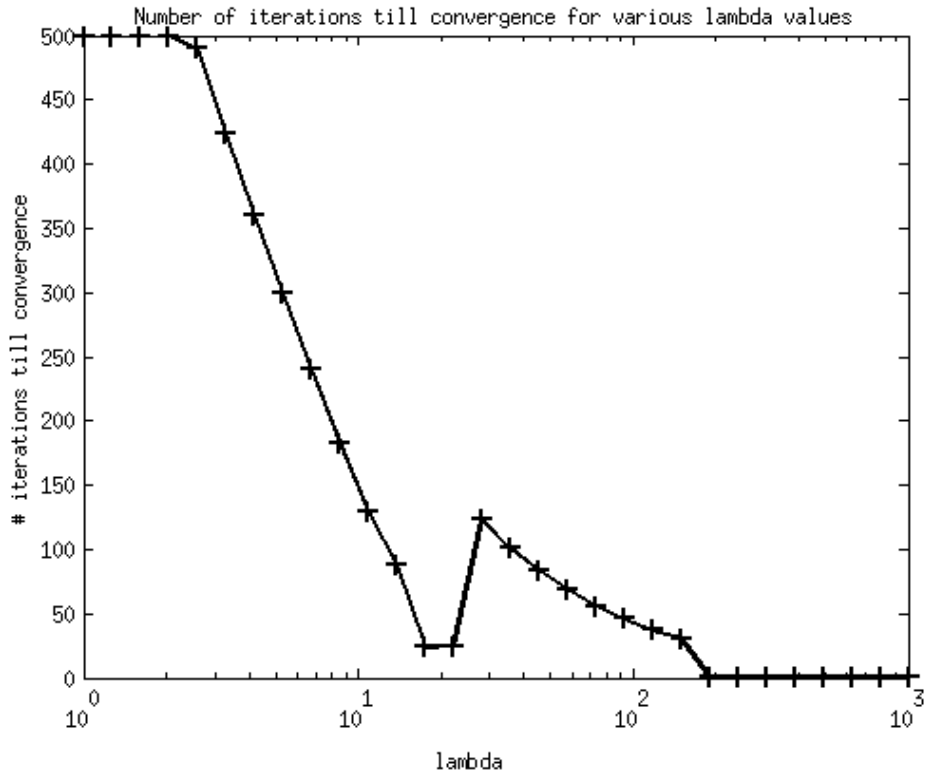

Figure 1: Semilog plot of number of iterations till convergence over λ.

(c) **[5]** As is clear from Figure 3, warm starts significantly reduce the number of iterations required to converge for lower values of λ. Since the convergence criterion $\frac{|f_{k+1}-f_k|}{f_k} < 10^{-4}$ occurs when the change in the objectie function at a step is small, which occurs near optima, and warm starts begin relatively near optima, warm starts result in much quicker convergence.

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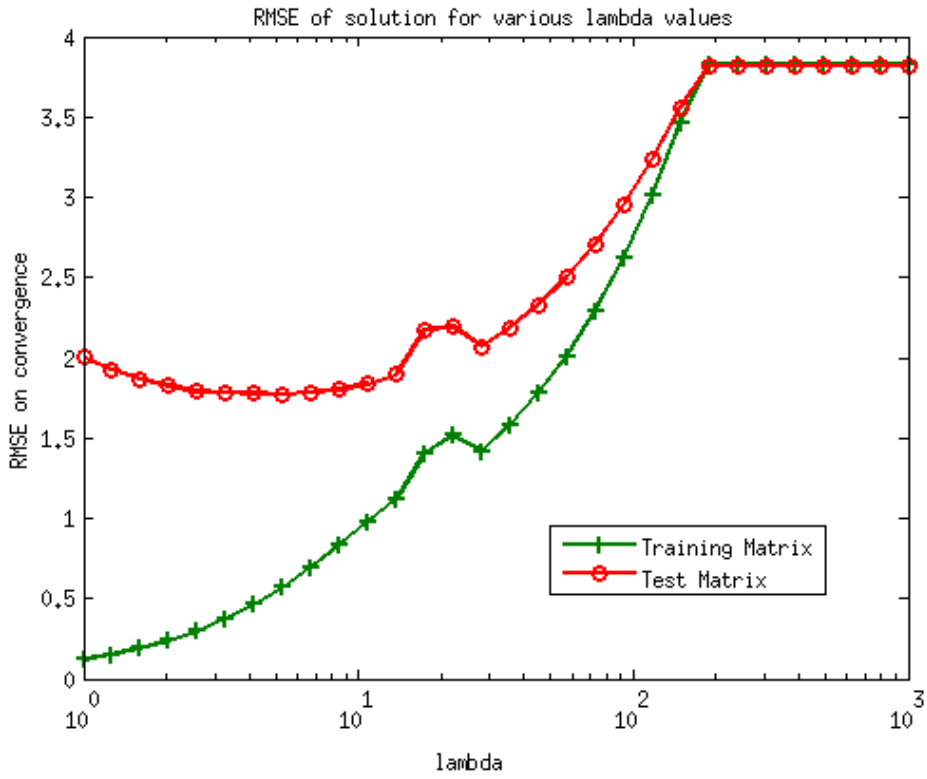

Figure 2: Semilog plots of solution RMSE (from training and test data) over λ.

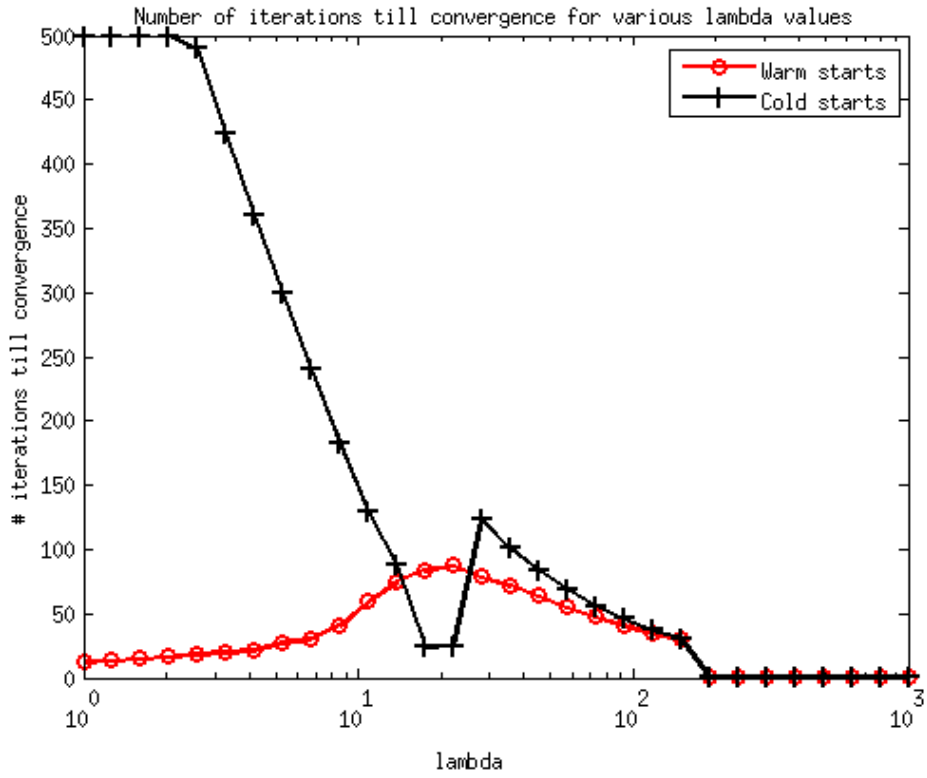

Figure 3: Semilog plots of number of iterations till convergence over λ, with and without warm starts.