

**Meeting:** 1003, Atlanta, Georgia, MAA CP B1, MAA Session on My Favorite Demo: Innovative Strategies for Mathematics Instructors, I

1003-B1-292      **Brian Hopkins\*** (bhopkins@spc.edu). *Picture Compression and Linear Algebra.*

The singular value decomposition is a powerful follow-up to the discussion of eigenvectors. Every matrix has a SVD and, from it, a pseudo-inverse. Another application of the SVD provides the best possible lower rank approximations of the original matrix. The demo presented here allows students to see the veracity of these approximations by examining compressions of a photograph, using MATLAB.

A pixilated black & white photograph is essentially a matrix of gray-scale values. For instance, MATLAB includes a 480 by 640 pixel photograph from the first Gatlinburg Conference. Lower rank matrix approximations are produced by zeroing out singular values in the SVD, starting with the smallest. These approximations can also be displayed, and it is surprising how much data can be thrown out with only minor effect on the original image. The demonstration also includes measuring this effect with the Frobenius norm and computing the savings in memory achieved by using lower rank approximations. (Received September 08, 2004)