CS 6220 Spring 2011
Homework Set Three
Data Compression via SVD Decomposition

The file krispicture.jpg is available to download at the class website www.coe.utah.edu/∼ cs6220

1. Convert the file into a matrix A of floats.

2. Find the dimensions and rank of A.

3. Write down an SVD expression for the best rank k approximation to A. Call this approximation A_k.

4. Write down an SVD definition for the relative error for A_k. Call this relative error E_k.

5. With 4. in mind, compute A_k for selected values of k.

6. For each k in 5., convert matrix A_k into a jpg file.

7. By viewing the jpg files found in 6., pick out three values of k. In your hardcopy submissions include copies of the three corresponding images, commenting on their quality versus their associated relative errors. One of the k's, call it k_{min}, should be the smallest k where the image is still recognizable. Another k value, call it k^*, should be judged optimal in the sense that its image is the best carrying a highest relative error .

Note: For your convenience you may perform all the above steps in Matlab.

Here are some important Matlab commands.

(i) A=imread('krispicture.jpg');

(ii) save A

(iv) load A

(iv) imshow(A)

(v) A=im2double(A);

(vi) whos

where:

(i) loads the image file and stores it as the variable A.

(ii) saves the variable A.

(iii) loads a saved variable A.

(iv) displays the image.

(v) converts the variable A into doubles. This is an essential command because the imread command outputs a matrix of ints.

(vi) checks that commands have been carried out.