Casey Barnette

Math 2605

Wang

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SVD Decomposition

Question:

In my testing with the program I have found that you only really need a σ_{k+1} that is small relative to σ_1. This makes the image fairly recognizable. I have also found that human faces were recognizable with a sigma as small as 3; however, this varies based on the quality of the initial image. The lower the quality of the initial image the larger the value of k needs to be.

Discussion:

For this project, I decided to use Java with the help of an external library named JAMA. I used JAMA because finding the SVD decomposition of a matrix computationally is rather difficult. The program is in a single class and contains 8 methods. The methods were main, print, show, convertTo2D, parseFile, compress, matrix, and saveImageAsText. The main method hands the user input and actual running of the program. The print method prints out a matrix in a nice format. The show method will show the image in a frame along with the necessary sigma values. The method, convertTo2D, is a helper method that takes the byte[] for the pixel data of an image and converts it into an int[][]. Another helper method, parseFile, takes in a file that conforms to standards stated by the program and constructs an image out of it. The largest portion of this assignment was the compress method which takes an image and compresses it for a given k value. The method matrix is constructs an mxn matrix from user input then uses svd on it to output a matrix for the given k value. Lastly the method, saveImageAsText, allows the user to specify an image that they want to save in the format that parseFile will accept.