

# Computer Lab (March 5)

We'll look at two main topics in this lab: (1) How to solve a matrix equation, and (2) How to compute the SVD (and have some fun with images).

## Solve $Ax = b$ for $x$

- First, try out the sample problem on pg. 58 of today's notes.
- Work through problems 2 and 3 by hand (pg 59).
- Solve exercise 5 using either Matlab/Octave or Python, but you need to build the pseudo-inverse yourself (like the sample problem you started with).

## The SVD and the Clown

First, look over the video. In it, we will:

- Learn how to upload data to Octave-Online (or download it to your computer for Matlab or Python).
- Represent a matrix as an image (and look at colormaps).
- Take the SVD of a matrix.
- Inspect the singular values.
- Perform partial (rank  $k$ ) reconstructions of the matrix (or image).

On the class website, you'll find the script files for the Matlab commands from the video, plus the identical commands for Python, and the image file for your work below.

Your homework will be to do operations similar to the video with an image, `pansy.png`, (on the class website). For Octave-online, download the image file onto your computer, then "drag and drop" the image file onto the left panel. You might see a warning, but this image is fairly small.

Once the image is uploaded to Octave-online (or on your current directory for Python), then here are the commands to read the image. You might note that the image being read in, which we assign to `img` has dimensions  $183 \times 276 \times 3$ . We interpret this to mean that the image is  $183 \times 276$ , and there is one matrix of values for red, one for green, and one for blue.

Matlab

Python

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```
img=imread('pansy.png');  img=mpimg.imread('pansy.png')
                          The next line extracts a single color plane
X=img(:,:,1);             X=img[:, :, 0];
image(X);                 plt.imshow(X, cmap='gray');
colormap('gray')
```

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Now, for the lab, continue on the matrix  $X$ :

1. Compute the SVD.
2. Read off the 100<sup>th</sup> singular value.
3. Show the image representing a rank 10 approximation, then one representing a rank 100 approximation.

You can upload screenshots of the two images, along with a script file of commands, or include the commands in your screenshots.