Solving Systems of Equations

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Opening Discussion

- What did we talk about last class?
- Do you have any questions about the reading?

Strings

- Like most other languages, Matlab does give you the ability to use strings, though that isn't a real strength.
- A Matlab string is simply a row array of characters.
- A downside of this is that an array with multiple strings must have all the strings be the same length. The char function can help with that.
- You can also convert from numbers to strings and back with str2num and num2str.
- Matlab also has fprintf and sprintf functions that work much like the C functions.
- Similarly, sscanf will pull numbers out of strings.
- eval and evalc let you process a string like it were a Matlab function.

Files

- Save and load commands let you access native files that store Matlab variables.
- Doing help fileformats will also show you all the other formats the Matlab supports normally.
- You can do low level I/O with C-like functions. fopen, fclose, fread, fwrite, fscanf, fprintf, etc.
- In addition, Matlab will also let you play with directories and even has built in support for ftp if you want to pull things across a network in Matlab.
- Let's populate an array with a bunch of values, write it out in a text file, then read it back in.

Matrix Algebra

- Now we get into the things that Matlab was really developed for and where it really stands out.
- 2-D arrays are basically matrices and can be used for doing all types of math.
- Before we get into this we should talk about systems of linear equations and how they can be solved.
- Matlab actually has routines that will try to solve systems of equations that aren't “well behaved”. That is, it will approximate both over-determined and under-determined systems.

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- A set of linear equations is typically expressed as Ax=y, where A is an n by n matrix and x and y are n by 1 matrices. You are given A and y and want to solve for x.
- If the equations are “well behaved” there is a single solution $x=A^{-1}y$. Use \ instead of inv().

Overdetermined and Underdetermined

- If A isn't square there isn't a single solution. When A has more rows than columns there is no exact solution (overdetermined). When A has more columns than rows there are an infinite number of solutions (underdetermined).
- Matlab actually has routines that will try to solve systems of equations that aren't “well behaved”. That is, it will approximate both over-determined and under-determined systems.
- In the overdetermined case, A\y will give you the least squares solution. This is can be viewed as an optimal fit.

Sparse Matrices

- Matlab also has hat ability to store sparse matrices.
- We aren't really going to take advantage of this in this class, but if you have a large matrix has has mostly zeros in it, this can be significant.

Closing Remarks

- Instead of moving forward with the reading we'll spend next class talking about some problems that involve vector math and see how we would do that in Matlab.