ELEG 404/604 Digital Imaging and Audio Signal Processing

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Matlab Introduction

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Matlab Desktop

![Matlab Desktop Image]
▶ Menu and toolbar: Menu items and tools at the top of a window.

▶ Current Folder: Shows the current MATLAB folder listed in the Address field. You can add files and folders as needed to store your MATLAB data.

▶ Command Window: Writing area that you will see when you start MATLAB. In this window you give the commands to MATLAB. If you write longer programs, you will find it more convenient to write the program code in a separate window, and then run it in the command window.

▶ Workspace: Displays the variables that have been declared and their values.

▶ Command History: The commands you type in the command window are stored by MATLAB and can be viewed in the Command History window.
Vectors and Matrices in Matlab

- All entities in Matlab are matrices
- Easy to define. Use “,” to separate row elements and “;” to separate rows.
Vectors and Matrices in Matlab

```
>> A=[1,2;3,4];
>> B=A' %Transpose
B =
    1   3
    2   4

>> x=0:0.5:3 %Vector Equally Spaced Intervals
x =

Columns 1 through 4
         0   0.5000   1.0000   1.5000

Columns 5 through 7
         2.0000   2.5000   3.0000

>> x=linspace(0,1,3,4) %Create vector with n equally spaced intervals
x =

0 0.4333 0.8667 1.3000
```
Indexing Matrices

Given the matrix:

\[
A = \begin{pmatrix}
0.9501 & 0.6068 & 0.4231 \\
0.2311 & 0.4860 & 0.2774
\end{pmatrix}
\]

Then:

\[
A(1, 2) = 0.6068 \quad \rightarrow \quad A_{ij}, i = 1...m, j = 1...n
\]

\[
A(3) = 0.6068 \quad \rightarrow \quad index = (i - 1)m + j
\]

\[
A(:, 1) = [0.9501 \\
0.2311]
\]

\[
A(1, 2:3) = [0.6068 \quad 0.4231]
\]
Matrix Operations
▶ ^: exponentiation
▶ *: multiplication
▶ /: division
▶ +: addition
▶ -: subtraction

Array Operations
▶ .^: array power
▶ .*: array multiplication
▶ ./: array division
Some Built-in functions

- mean(A): mean value of a vector
- max(A), min (A): maximum and minimum.
- sum(A): summation.
- sort(A): sorted vector
- median(A): median value
- std(A): standard deviation.
- det(A) : determinant of a square matrix
- dot(a,b): dot product of two vectors
- Cross(a,b): cross product of two vectors
- Inv(A): Inverse of a matrix A
Loading and Displaying Images

Image Filename as a string

Matrix with image data

Dimensions of I (red, green and blue intensity information)
Representation of Images

- Images are an array of numbers
- Intensity of each pixel is represented by the pixel element’s value in the red, green and blue matrices.
RGB Image to Grayscale

```matlab
>> img = rgb2gray(I);
>> img = double(img);
>> imshow(img, []);

Warning: Image is too big to fit on screen; displaying at 33%
> In imui
tools/private/initSize at
> In imshow at 282
```

![Image of a kitten](image.png)