CSE 455 : Computer Vision

MATLAB 101

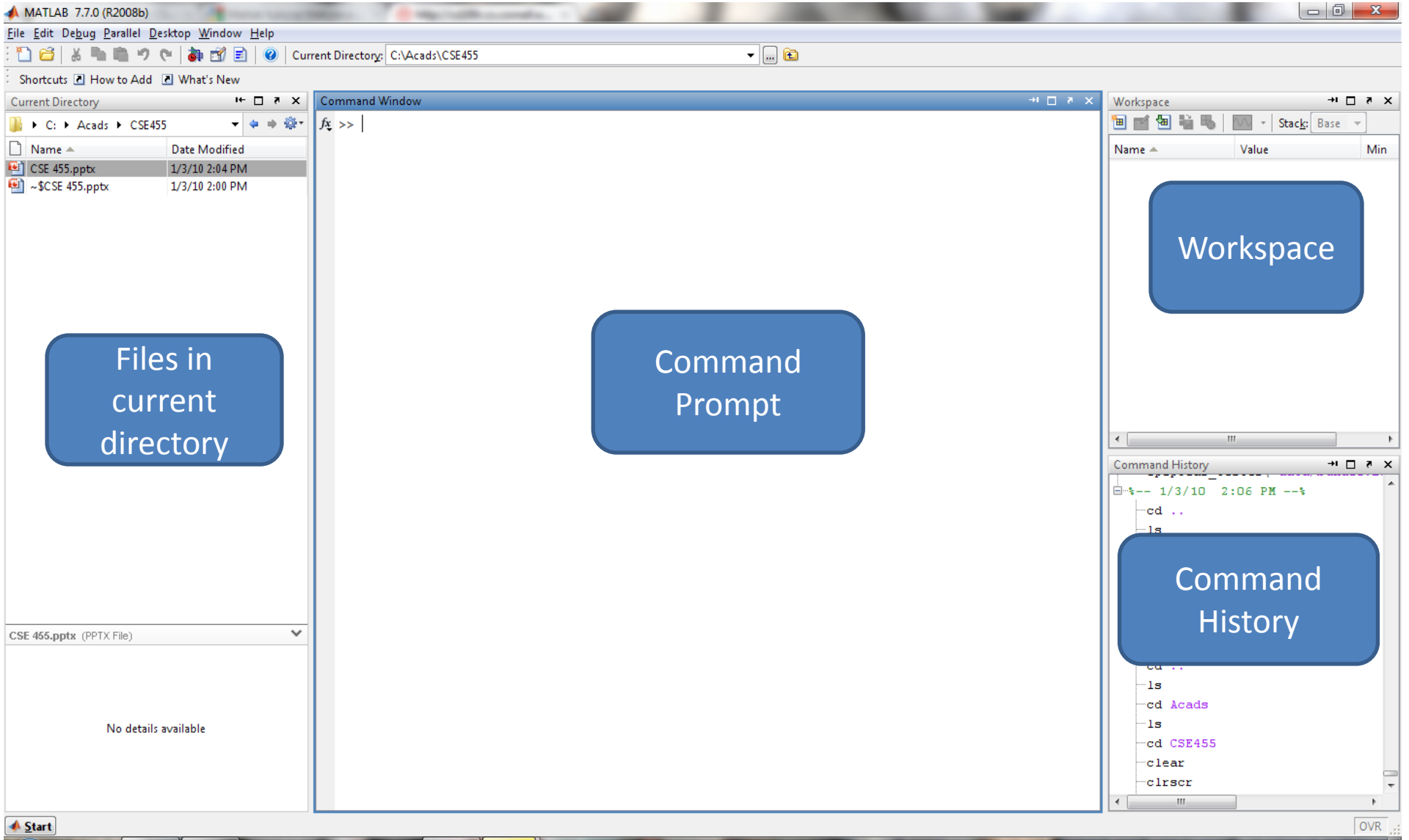
Getting Started with MATLAB

Why?

- All assignments are going to be in MATLAB

- Interactive programming environment, easy manipulation of image data, allows rapid prototyping

Getting Started



Files in current directory

Command Prompt

Workspace

Command History

Getting Started

- Common operators: +,-,/,*

- Variables:
  - Assigned using =
  - There is no need to explicitly define the type of variable

Control of Flow

- if statements and loops

```
If <logical expression>
   <statements>
end

for <var> = <start_exp>:<end_exp>
   <statements>
end
```

Matrices

- MATLAB's power lies in efficiently manipulating matrices

Matrices

- Initializing matrices

  >> A = zeros(10,10)

  >> A = zeros(10)

  >> A = eye(10,10)

  >> A = [1 2 3;4 5 6]

  >> A = zeros(10,10,10)

- Accessing matrix elements
  - A(2,1) : 2nd row, 1st column of A
  - A(:,1) : 1st column of A
  - A(1:10,:) : first 10 rows and all columns of A

Manipulating Matrices

- +,-,*,/ can be applied to matrices (provided dimensions agree)

- Element wise operations:

  .* : Element wise multiplication

  ./ : Element wise division

- Transposing a matrix: A’

Manipulating Matrices

- Some very useful operations:
  - B = reshape(A,m,n) : Takes a matrix A with m*n elements and reshapes it into a matrix with m rows and n columns

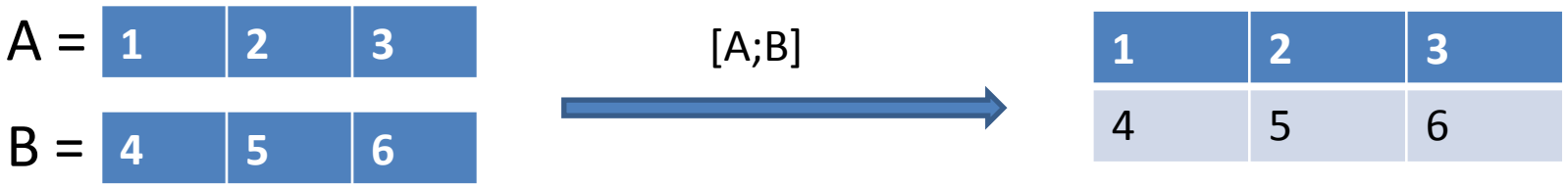
1	4	7	10
2	5	8	11
3	6	9	12

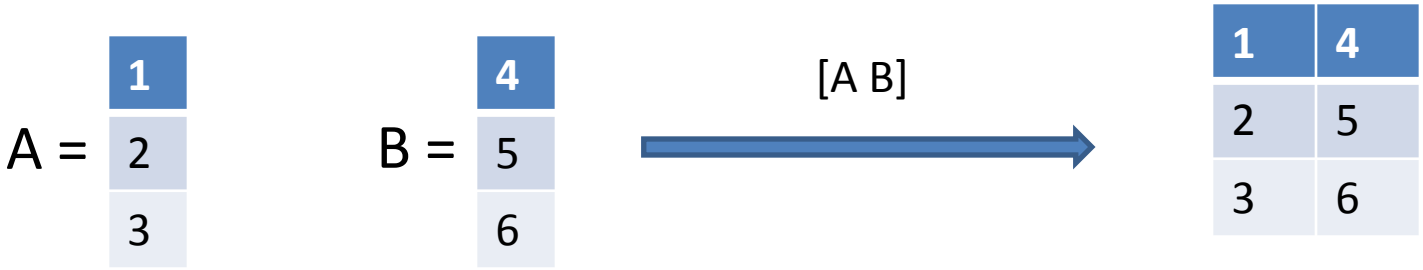
Reshape(A,2,6)

1	3	5	7	9	11
2	4	6	8	10	12

Manipulating Matrices

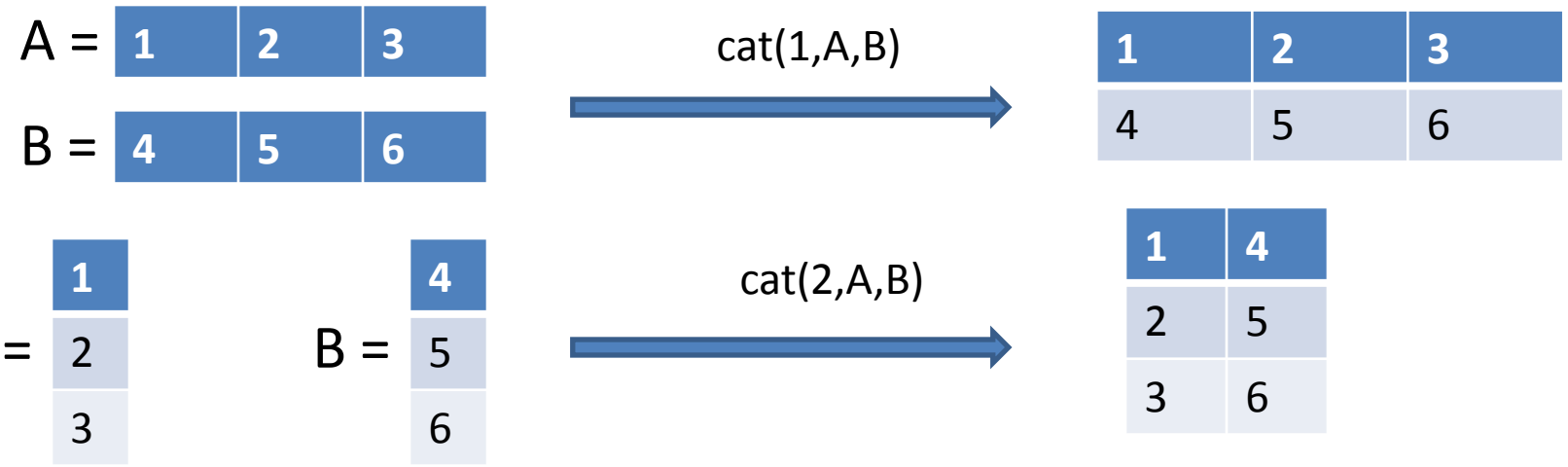
- Some very useful operations:
  - Concatenating matrices:





Manipulating Matrices

- Some very useful operations:
  - Concatenating matrices:



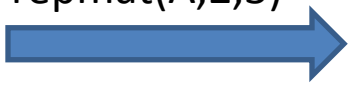
  - Useful for concatenating along higher dimensions

Manipulating Matrices

- Some very useful operations:
  - repmat(A,m,n) : Repeats A, m times along rows and n times along columns

1	2
3	4

repmat(A,2,3)



1	2	1	2	1	2
3	4	3	4	3	4
1	2	1	2	1	2
3	4	3	4	3	4

Manipulating Matrices

- *find*

  >> inds = find(A>0);

- *sum*

  >> sum(A,1); % sum A along first dimension

- *mean, var, etc.*

Manipulating Matrices

- Summary:
  - Operators: + , - , / , * , .*, ./
  - reshape
  - cat
  - repmat
  - find, sum, mean, etc.

MATLAB Help

- help <function_name>

OR

- doc <function_name>

Matlab Scripts: m-files

- Save a sequence of MATLAB commands as a script

- MATLAB has a built-in editor which can be invoked using the *edit* command

Matlab Functions

- Function name same as the filename

- Header of a function file:

  function <retval> = <function_name>(arglist)

- MATLAB will recognize all function files in the working directory. Additional directories may be added to the path.

Debugging in MATLAB

- Demo

Images in MATLAB

- Loading an image

  >> I = imread(‘filename’);

- Image is represented as a H x W x 3 matrix

- imagesc(I) displays the image

- Saving images: imwrite(I,’filename’);

Image Filtering Example

Input Image					
1	0	1	2	7	8
0	5	0	3	6	9
0	3	0	0	6	1
0	3	0	6	7	8
6	6	5	5	4	4

Filtered Image					

Take weighted sum of values in the box, weights specified by the filter

1*1 + 1*0 + 1*1 + 1*0 + 2*5 + 1*0 + 1*0 + 1*3 + 1*0 = 15

Filter		
1	1	1
1	2	1
1	1	1

Image Filtering Example

Input Image					
1	0	1	2	7	8
0	5	0	3	6	9
0	3	0	0	6	1
0	3	0	6	7	8
6	6	5	5	4	4

Filtered Image					

Assume zero values outside the boundary.

Filter		
1	1	1
1	2	1
1	1	1

MATLAB Demo

MATLAB Tips

- MATLAB is slow

MATLAB Tips

- MATLAB can be slow
- Dynamic allocation is evil
- For loops are evil

Data Visualization

- plot, bar, hist, scatter

- surf/mesh