# 第二讲: MatLab 提高

## 数学模型和算法的应用与 MATLAB 实现

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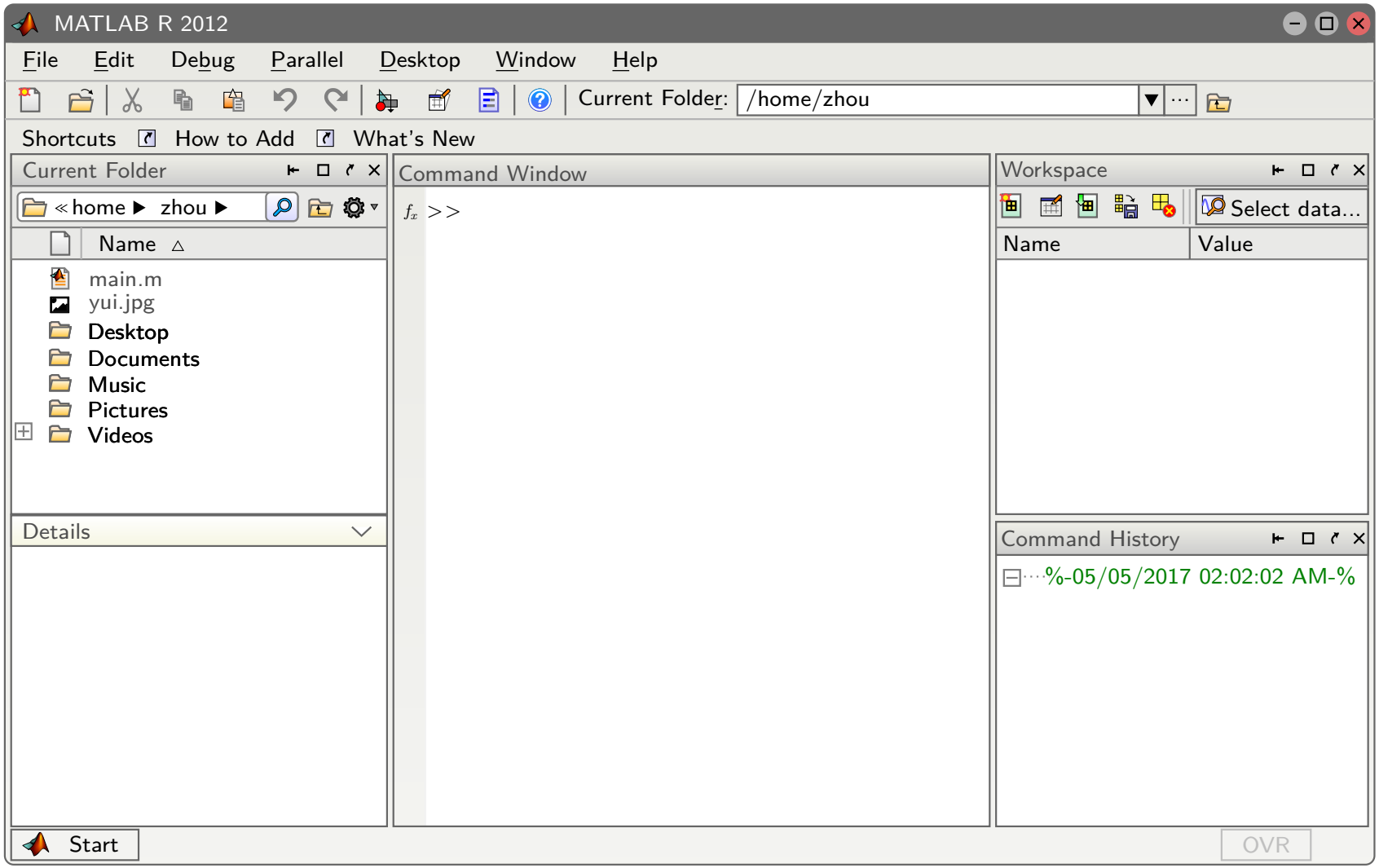
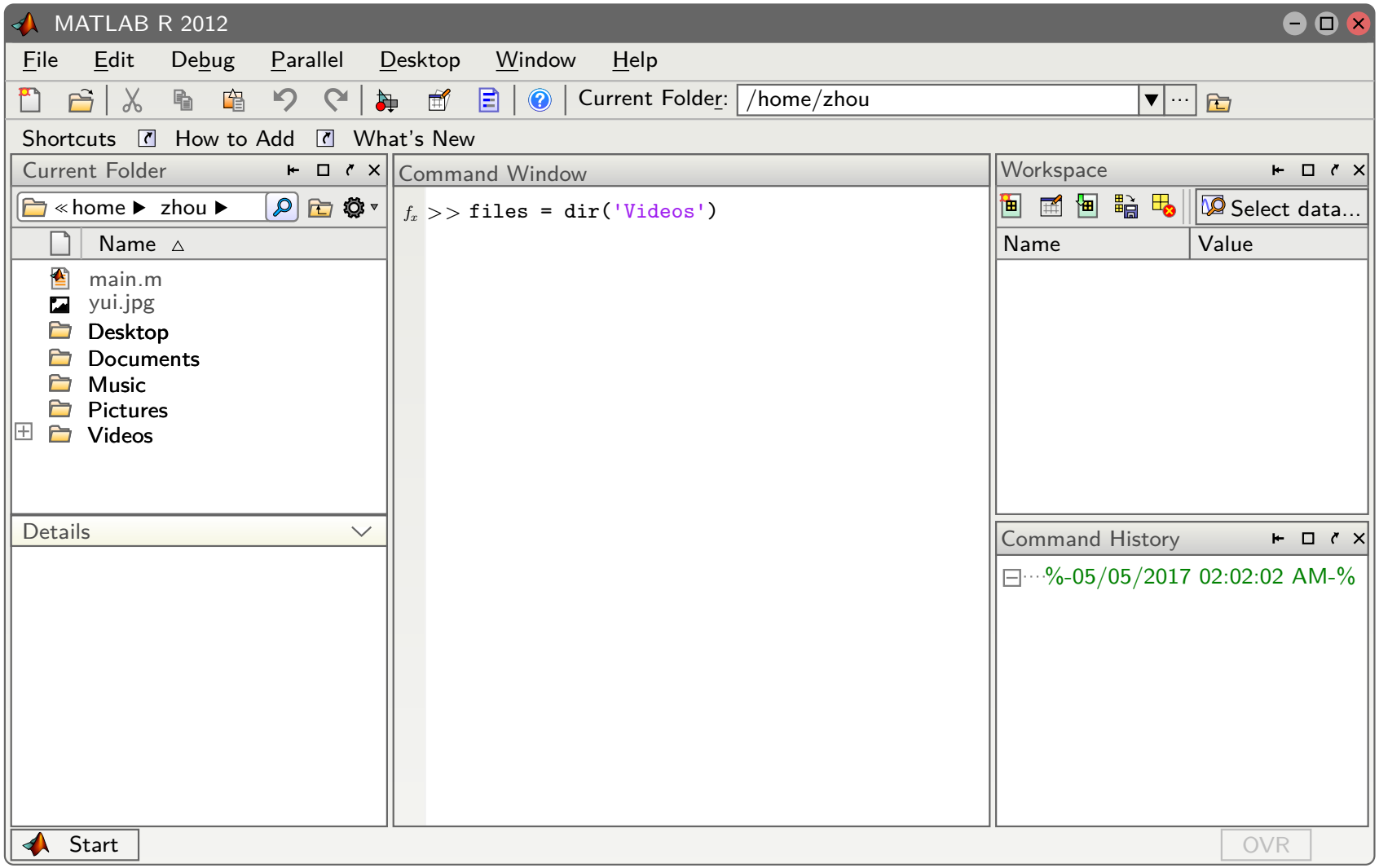
2017 年 6 月 18 日

微信公众号: 超级数学建模

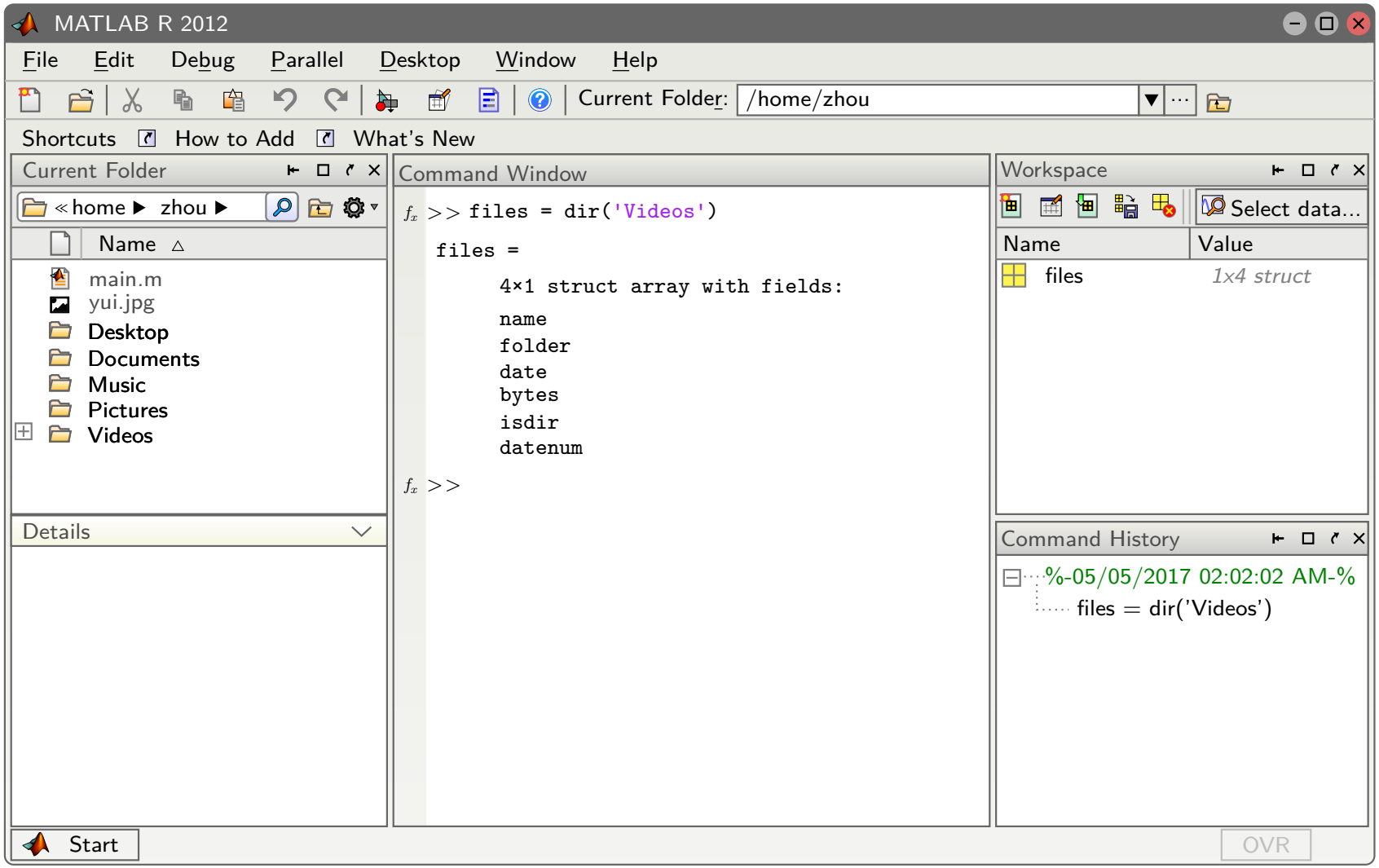
# 文件路径


MATLAB R 2012
File Edit Debug Parallel Desktop Window Help
Current Folder: /home/zhou
Shortcuts How to Add What's New
Current Folder
« home ▶ zhou ▶
Name
main.m
yui.jpg
Desktop
Documents
Music
Pictures
Videos
Details
Command Window
>>
Workspace
Select data...
Name
Value
Command History
%-05/05/2017 02:02:02 AM-%
Start
OVR

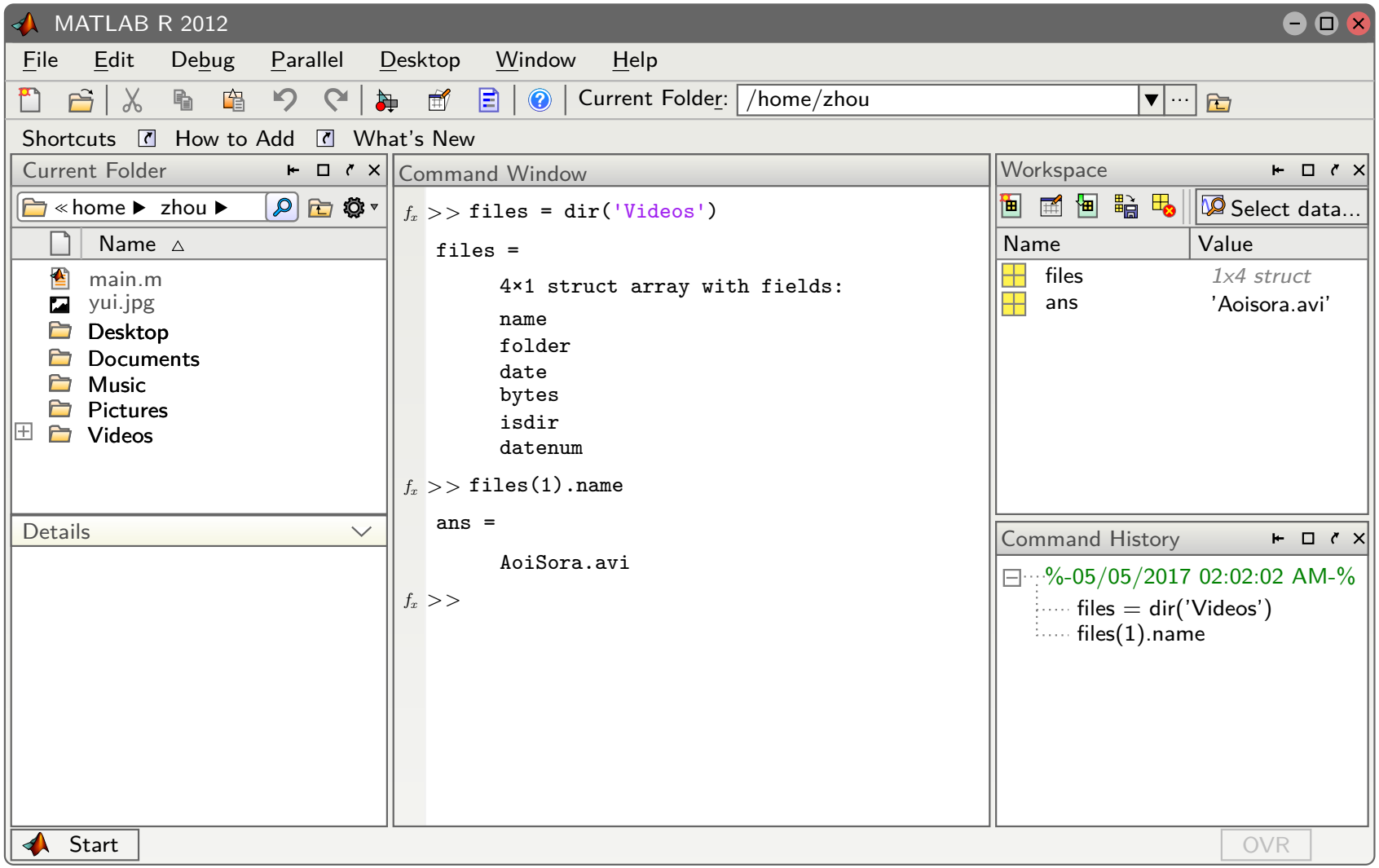
# 文件路径


MATLAB R 2012
File Edit Debug Parallel Desktop Window Help
Current Folder: /home/zhou
Shortcuts How to Add What's New
Current Folder
« home ▶ zhou ▶
Name △
main.m
yui.jpg
Desktop
Documents
Music
Pictures
Videos
Details
Command Window
>> files = dir('Videos')
Workspace
Select data...
Name
Value
Command History
%-05/05/2017 02:02:02 AM-%
Start
OVR

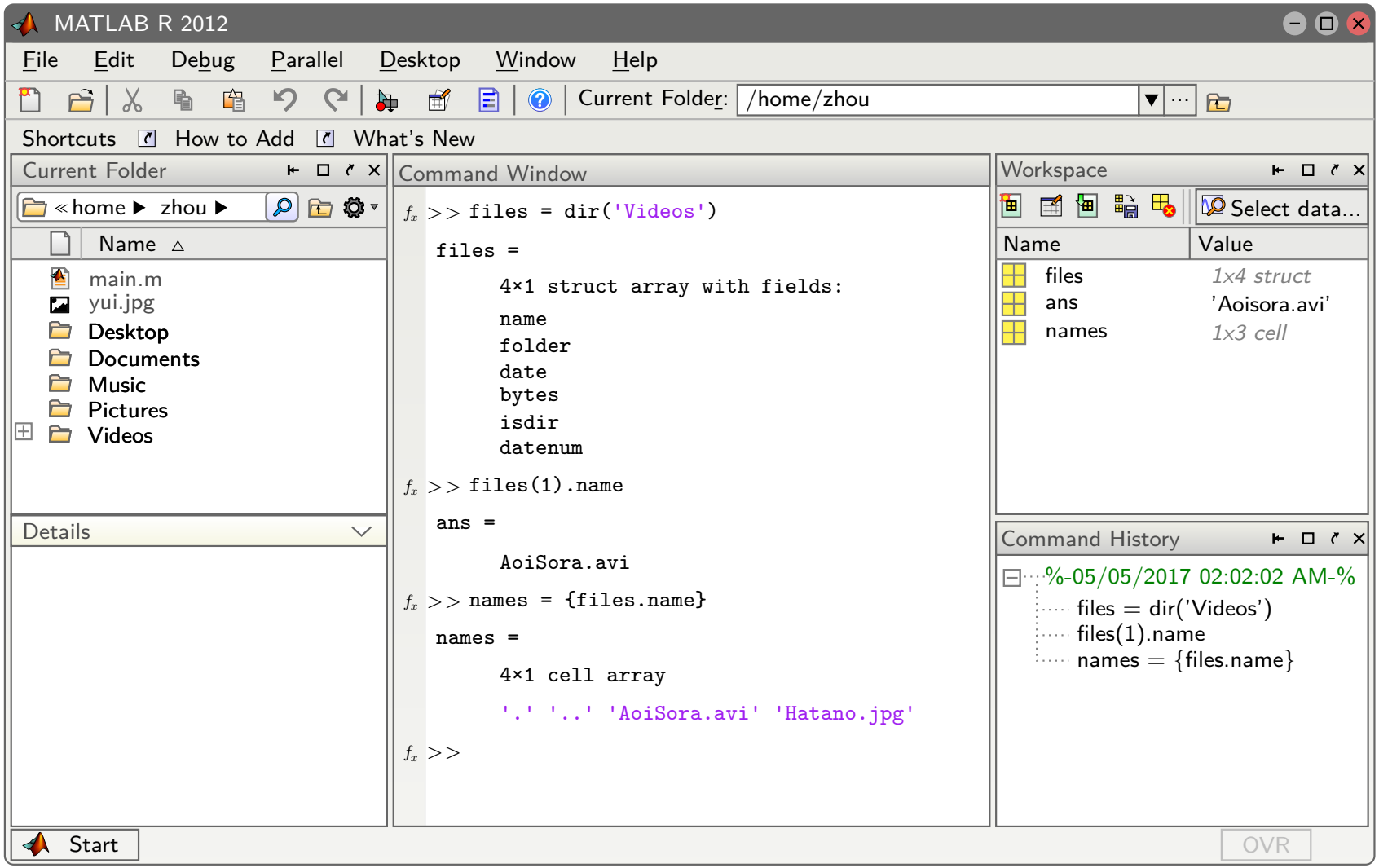
# 文件路径


MATLAB R 2012
File Edit Debug Parallel Desktop Window Help
Current Folder: /home/zhou
Shortcuts How to Add What's New
Current Folder
« home ▶ zhou ▶
Name
main.m
yui.jpg
Desktop
Documents
Music
Pictures
Videos
Details
Command Window
>> files = dir('Videos')
files =
4×1 struct array with fields:
name
folder
date
bytes
isdir
datenum
>>
Workspace
Select data...
Name
Value
files
1×4 struct
Command History
%-05/05/2017 02:02:02 AM-%
files = dir('Videos')
Start
OVR

# 文件路径


MATLAB R 2012
File Edit Debug Parallel Desktop Window Help
Current Folder: /home/zhou
Shortcuts How to Add What's New
Current Folder
« home ▶ zhou ▶
Name
main.m
yui.jpg
Desktop
Documents
Music
Pictures
Videos
Details
Command Window
>> files = dir('Videos')
files =
4×1 struct array with fields:
name
folder
date
bytes
isdir
datenum
>> files(1).name
ans =
AoiSora.avi
>>
Workspace
Select data...
Name
Value
files
1×4 struct
ans
'Aoisora.avi'
Command History
%-05/05/2017 02:02:02 AM-%
files = dir('Videos')
files(1).name
Start
OVR

# 文件路径


MATLAB R 2012
File Edit Debug Parallel Desktop Window Help
Current Folder: /home/zhou
Shortcuts How to Add What's New
Current Folder
« home ▶ zhou ▶
Name
main.m
yui.jpg
Desktop
Documents
Music
Pictures
Videos
Details
Command Window
>> files = dir('Videos')
files =
4×1 struct array with fields:
name
folder
date
bytes
isdir
datenum
>> files(1).name
ans =
AoiSora.avi
>> names = {files.name}
names =
4×1 cell array
'.' '..' 'AoiSora.avi' 'Hatano.jpg'
>>
Workspace
Select data...
Name Value
files 1x4 struct
ans 'Aoisora.avi'
names 1x3 cell
Command History
%-05/05/2017 02:02:02 AM-%
files = dir('Videos')
files(1).name
names = {files.name}
Start
OVR

# txt 文本数据读 I

Command Window

$f_x$ >>

score.txt

| % w | 章小天 | 刘强西 |
|---|---|---|
| 0.13 | 65 | 99 % 财富 |
| 0.05 | 90 | 80 % 权势 |
| 0.17 | 99 | 65 % 美貌 |
| 0.08 | 90 | 90 % 智商 |
| 0.09 | 90 | 99 % 情商 |
| 0.05 | 99 | 65 % 文艺 |
| 0.06 | 95 | 90 % 学历 |
| 0.08 | 81 | 98 % 阅历 |
| 0.08 | 98 | 88 % 体力 |
| 0.06 | 90 | 80 % 年龄 |
| 0.02 | 70 | 98 % 人际 |
| 0.13 | 88 | 99 % 撩技 |

# txt 文本数据读 I

Command Window

```
>> data = load('score.txt');
fx >>
```

score.txt

| % w | 章小天 | 刘强西 |
|---|---|---|
| 0.13 | 65 | 99 % 财富 |
| 0.05 | 90 | 80 % 权势 |
| 0.17 | 99 | 65 % 美貌 |
| 0.08 | 90 | 90 % 智商 |
| 0.09 | 90 | 99 % 情商 |
| 0.05 | 99 | 65 % 文艺 |
| 0.06 | 95 | 90 % 学历 |
| 0.08 | 81 | 98 % 阅历 |
| 0.08 | 98 | 88 % 体力 |
| 0.06 | 90 | 80 % 年龄 |
| 0.02 | 70 | 98 % 人际 |
| 0.13 | 88 | 99 % 撩技 |

# txt 文本数据读 I

Command Window

```
>> data = load('score.txt');
>> w = data(:,1);
fx >>
```

score.txt

| % w | 章小天 | 刘强西 |
|---|---|---|
| 0.13 | 65 | 99 % 财富 |
| 0.05 | 90 | 80 % 权势 |
| 0.17 | 99 | 65 % 美貌 |
| 0.08 | 90 | 90 % 智商 |
| 0.09 | 90 | 99 % 情商 |
| 0.05 | 99 | 65 % 文艺 |
| 0.06 | 95 | 90 % 学历 |
| 0.08 | 81 | 98 % 阅历 |
| 0.08 | 98 | 88 % 体力 |
| 0.06 | 90 | 80 % 年龄 |
| 0.02 | 70 | 98 % 人际 |
| 0.13 | 88 | 99 % 撩技 |

# txt 文本数据读 I

Command Window

```
>> data = load('score.txt');
>> w = data(:,1);
>> s = data(:,2:3);
fx >>
```

score.txt

| % w | 章小天 | 刘强西 |
|---|---|---|
| 0.13 | 65 | 99 % 财富 |
| 0.05 | 90 | 80 % 权势 |
| 0.17 | 99 | 65 % 美貌 |
| 0.08 | 90 | 90 % 智商 |
| 0.09 | 90 | 99 % 情商 |
| 0.05 | 99 | 65 % 文艺 |
| 0.06 | 95 | 90 % 学历 |
| 0.08 | 81 | 98 % 阅历 |
| 0.08 | 98 | 88 % 体力 |
| 0.06 | 90 | 80 % 年龄 |
| 0.02 | 70 | 98 % 人际 |
| 0.13 | 88 | 99 % 撩技 |

# txt 文本数据读 I

Command Window

```
>> data = load('score.txt');
>> w = data(:,1);
>> s = data(:,2:3);
>> r = w'*s

r =

    88.29    87.19

fx >>
```

score.txt

| % w | 章小天 | 刘强西 |
|---|---|---|
| 0.13 | 65 | 99 % 财富 |
| 0.05 | 90 | 80 % 权势 |
| 0.17 | 99 | 65 % 美貌 |
| 0.08 | 90 | 90 % 智商 |
| 0.09 | 90 | 99 % 情商 |
| 0.05 | 99 | 65 % 文艺 |
| 0.06 | 95 | 90 % 学历 |
| 0.08 | 81 | 98 % 阅历 |
| 0.08 | 98 | 88 % 体力 |
| 0.06 | 90 | 80 % 年龄 |
| 0.02 | 70 | 98 % 人际 |
| 0.13 | 88 | 99 % 撩技 |

# txt 文本数据读 II

Command Window

$f_x$ >>

swords.txt

刘正风
包惜弱
东方不败
张翠山
小龙女
天山童姥
贱宁公主
摩诃巴思

高颜超
清虚
无崖子
马夫人

# txt 文本数据读 II

Command Window

```
>> fid = fopen('swords.txt', 'r');
>>
```

swords.txt

刘正风
包惜弱
东方不败
张翠山
小龙女
天山童姥
贱宁公主
摩诃巴思

高颜超
清虚
无崖子
马夫人

# txt 文本数据读 II

Command Window

```
>> fid = fopen('swords.txt', 'r');
>> t1 = fgetl(fid)

t1 =
     刘正风

>>
```

swords.txt

刘正风
包惜弱
东方不败
张翠山
小龙女
天山童姥
贱宁公主
摩诃巴思

高颜超
清虚
无崖子
马夫人

# txt 文本数据读 II

Command Window

```
>> fid = fopen('swords.txt', 'r');
>> t1 = fgetl(fid)

t1 =

    刘正风

>> t2 = fgetl(fid)

t2 =

    包惜弱

fx >>
```

swords.txt

刘正风
包惜弱
东方不败
张翠山
小龙女
天山童姥
贱宁公主
摩诃巴思

高颜超
清虚
无崖子
马夫人

# txt 文本数据读 II

Command Window

```
>> fid = fopen('swords.txt', 'r');
>> t1 = fgetl(fid)

t1 =

    刘正风

>> t2 = fgetl(fid)

t2 =

    包惜弱

>> t3 = fgetl(fid)

t3 =

    东方不败

fx >>
```

swords.txt

刘正风
包惜弱
东方不败
张翠山
小龙女
天山童姥
贱宁公主
摩诃巴思

高颜超
清虚
无崖子
马夫人

# txt 文本数据读 II

Command Window

```
>> fid = fopen('swords.txt', 'r');
>> t1 = fgetl(fid)

t1 =

    刘正风

>> t2 = fgetl(fid)

t2 =

    包惜弱

>> t3 = fgetl(fid)

t3 =

    东方不败

>> t = [t1(1) t2(3) t3(1)]

t =

    刘弱东

fx >>
```

swords.txt

```
刘正风
包惜弱
东方不败
张翠山
小龙女
天山童姥
贱宁公主
摩诃巴思

高颜超
清虚
无崖子
马夫人
```

# txt 文本数据读 II

Command Window

```
>> fid = fopen('swords.txt', 'r');
>> t1 = fgetl(fid)

t1 =

    刘正风

>> t2 = fgetl(fid)

t2 =

    包惜弱

>> t3 = fgetl(fid)

t3 =

    东方不败

>> t = [t1(1) t2(3) t3(1)]

t =

    刘弱东

>> fclose(fid);
>>
```

swords.txt

```
刘正风
包惜弱
东方不败
张翠山
小龙女
天山童姥
贱宁公主
摩诃巴思

高颜超
清虚
无崖子
马夫人
```

# txt 文本数据读 III

| beltway.dat | 文件格式说明 |
| --- | --- |
| Beltway sniper data.<br>9/5/2002,38.7660314395259,-76.8857937525191<br>⋮ | 数据描述, 计算时忽略<br>月/日/年, 经度, 纬度 |

```
01 filename = 'beltway.dat';
02 fid = fopen(filename,'r');
03 tline = fgetl(fid); tline = fgetl(fid);
04 while ischar(tline)
05     data = regexp(tline, ',', 'split');
06     [date,lat,long] = data{:};
07     time = datenum(date, 'dd/mm/yyyy');
08     lat  = str2num(lat); long = str2num(long);
09     tline = fgetl(fid);
10 end
11 fclose(fid);
```

# txt 文本数据写

Command Window

$f_x$ >>

# txt 文本数据写

Command Window

```
>> fid = fopen('bill.txt');
>>
```

bill.txt

# txt 文本数据写

Command Window

```
>> fid = fopen('bill.txt');
>> fprintf(fid,'京西商城月账单\n\n');
>>
```

bill.txt

京西商城月账单

# txt 文本数据写

Command Window

```
>> fid = fopen('bill.txt');
>> fprintf(fid,'京西商城月账单\n\n');
>> fprintf(fid,'电子 -20000');
fx >>
```

bill.txt

京西商城月账单

电子　　−10000

# txt 文本数据写

Command Window

```
>> fid = fopen('bill.txt');
>> fprintf(fid,'京西商城月账单\n\n');
>> fprintf(fid,'电子 -20000');
>> fprintf(fid,'包包 %d', -1200);
fx >>
```

bill.txt

京西商城月账单

电子 −10000
包包 −1200

# txt 文本数据写

Command Window

```
>> fid = fopen('bill.txt');
>> fprintf(fid,'京西商城月账单\n\n');
>> fprintf(fid,'电子 -20000');
>> fprintf(fid,'包包 %d', -1200);
>> fprintf(fid,'%s %d\n\n', '服装', -24000);
fx >>
```

bill.txt

京西商城月账单

电子 −10000
包包 −1200
服装 −24000

# txt 文本数据写

Command Window

```
>> fid = fopen('bill.txt');
>> fprintf(fid,'京西商城月账单\n\n');
>> fprintf(fid,'电子 -20000');
>> fprintf(fid,'包包 %d', -1200);
>> fprintf(fid,'%s %d\n\n', '服装', -24000);
>> fprintf(fid,'账目细节\n');
fx >>
```

bill.txt

京西商城月账单

电子 −10000
包包 −1200
服装 −24000

账目细节

# txt 文本数据写

Command Window

```
>> fid = fopen('bill.txt');
>> fprintf(fid,'京西商城月账单\n\n');
>> fprintf(fid,'电子 -20000');
>> fprintf(fid,'包包 %d', -1200);
>> fprintf(fid,'%s %d\n\n', '服装', -24000);
>> fprintf(fid,'账目细节\n');
>> detail = -[845 832.5 836 872.2 825 844];
>>
```

bill.txt

京西商城月账单

电子 −10000
包包 −1200
服装 −24000

账目细节

# txt 文本数据写

Command Window

```
>> fid = fopen('bill.txt');
>> fprintf(fid,'京西商城月账单\n\n');
>> fprintf(fid,'电子 -20000');
>> fprintf(fid,'包包 %d', -1200);
>> fprintf(fid,'%s %d\n\n', '服装', -24000);
>> fprintf(fid,'账目细节\n');
>> detail = -[845 832.5 836 872.2 825 844];
>> fprintf(fid,'%-5d %5.1f\n',[1:6; detail]);
fx >>
```

bill.txt

京西商城月账单

电子 −10000
包包 −1200
服装 −24000

账目细节

1 −845.0
2 −832.5
3 −836.0
4 −872.2
5 −825.0
6 −844.0

# txt 文本数据写

Command Window

```
>> fid = fopen('bill.txt');
>> fprintf(fid,'京西商城月账单\n\n');
>> fprintf(fid,'电子 -20000');
>> fprintf(fid,'包包 %d', -1200);
>> fprintf(fid,'%s %d\n\n', '服装', -24000);
>> fprintf(fid,'账目细节\n');
>> detail = -[845 832.5 836 872.2 825 844];
>> fprintf(fid,'%-5d %5.1f\n',[1:6; detail]);
>> fclose(fid)
fx >>
```

bill.txt

京西商城月账单

电子 −10000
包包 −1200
服装 −24000

账目细节

1 −845.0
2 −832.5
3 −836.0
4 −872.2
5 −825.0
6 −844.0

# Excel 文本数据读

Command Window

$f_x$ >>

data.xls: Sheet1

| | A | B | C |
|---|---|---|---|
| 1 | | 81 | 32 |
| 2 | | 35 | 88 |
| 3 | 95 | 77 | 77 |
| 4 | 10 | 42 | 54 |
| 5 | 4 | 26 | 60 |
| 6 | 48 | 85 | 78 |
| 7 | 77 | 35 | 98 |
| 8 | 89 | 75 | 29 |
| 9 | 81 | 3 | 57 |
| 10 | 83 | 84 | 39 |
| 11 | 96 | 15 | 87 |
| 12 | 65 | 92 | 11 |

# Excel 文本数据读

Command Window

```
>> data = xlsread('data.xls','Sheet1','A3:C5')

data =

      95    77    77
      10    42    54
       4    26    60

fx >>
```

data.xls: Sheet1

| | A | B | C |
|---|---|---|---|
| 1 | | 81 | 32 |
| 2 | | 35 | 88 |
| 3 | 95 | 77 | 77 |
| 4 | 10 | 42 | 54 |
| 5 | 4 | 26 | 60 |
| 6 | 48 | 85 | 78 |
| 7 | 77 | 35 | 98 |
| 8 | 89 | 75 | 29 |
| 9 | 81 | 3 | 57 |
| 10 | 83 | 84 | 39 |
| 11 | 96 | 15 | 87 |
| 12 | 65 | 92 | 11 |

# Excel 文本数据读

Command Window

```
>> data = xlsread('data.xls','Sheet1','A3:C5')

data =
      95    77    77
      10    42    54
       4    26    60

>> data = xlsread('data.xls','Sheet1','A1:B3')

data =
     NaN    81
     NaN    35
      95    77

fx >>
```

data.xls: Sheet1

| | A | B | C |
|---|---|---|---|
| 1 | | 81 | 32 |
| 2 | | 35 | 88 |
| 3 | 95 | 77 | 77 |
| 4 | 10 | 42 | 54 |
| 5 | 4 | 26 | 60 |
| 6 | 48 | 85 | 78 |
| 7 | 77 | 35 | 98 |
| 8 | 89 | 75 | 29 |
| 9 | 81 | 3 | 57 |
| 10 | 83 | 84 | 39 |
| 11 | 96 | 15 | 87 |
| 12 | 65 | 92 | 11 |

# Excel 文本数据读

Command Window

```
>> data = xlsread('data.xls','Sheet1','A3:C5')

data =
      95    77    77
      10    42    54
       4    26    60

>> data = xlsread('data.xls','Sheet1','A1:B3')

data =
     NaN    81
     NaN    35
      95    77

>> data(isnan(data)) = 0

data =
       0    81
       0    35
      95    77

fx >>
```

data.xls: Sheet1

| | A | B | C |
|---|---|---|---|
| 1 | | 81 | 32 |
| 2 | | 35 | 88 |
| 3 | 95 | 77 | 77 |
| 4 | 10 | 42 | 54 |
| 5 | 4 | 26 | 60 |
| 6 | 48 | 85 | 78 |
| 7 | 77 | 35 | 98 |
| 8 | 89 | 75 | 29 |
| 9 | 81 | 3 | 57 |
| 10 | 83 | 84 | 39 |
| 11 | 96 | 15 | 87 |
| 12 | 65 | 92 | 11 |

# Excel 文本数据写

Command Window

$f_x$ >>

| | A | B | C |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |

# Excel 文本数据写

Command Window

```
>> xlswrite('RS.xls',{'T','W'},'Sheet1','B1:C1')
>>
```

RS.xls: Sheet1

| | A | B | C |
|---|---|---|---|
| 1 | | T | W |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |

# Excel 文本数据写

Command Window

```
>> xlswrite('RS.xls',{'T','W'},'Sheet1','B1:C1')
>> XYZ = {'X','Y','Z'; 6 6 4; 8 7 5};
>>
```

RS.xls: Sheet1

| | A | B | C |
|---|---|---|---|
| 1 | | T | W |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |

# Excel 文本数据写

Command Window

```
>> xlswrite('RS.xls',{'T','W'},'Sheet1','B1:C1')
>> XYZ = {'X','Y','Z'; 6 6 4; 8 7 5};
>> xlswrite('RS.xls',XYZ','A2:C4')
fx >>
```

RS.xls: Sheet1

| | A | B | C |
|---|---|---|---|
| 1 | | T | W |
| 2 | X | 6 | 8 |
| 3 | Y | 6 | 7 |
| 4 | Z | 4 | 5 |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |

# Excel 文本数据写

Command Window

```
>> xlswrite('RS.xls',{'T','W'},'Sheet1','B1:C1')
>> XYZ = {'X','Y','Z'; 6 6 4; 8 7 5};
>> xlswrite('RS.xls',XYZ','A2:C4')
>> xyz = [4 2 3; 8 9 1];
fx >>
```

RS.xls: Sheet1

| | A | B | C |
|---|---|---|---|
| 1 | | T | W |
| 2 | X | 6 | 8 |
| 3 | Y | 6 | 7 |
| 4 | Z | 4 | 5 |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |

# Excel 文本数据写

Command Window

```
>> xlswrite('RS.xls',{'T','W'},'Sheet1','B1:C1')
>> XYZ = {'X','Y','Z'; 6 6 4; 8 7 5};
>> xlswrite('RS.xls',XYZ','A2:C4')
>> xyz = [4 2 3; 8 9 1];
>> xlswrite('RS.xls',xyz,'A6:C7')
fx >>
```

RS.xls: Sheet1

| | A | B | C |
|---|---|---|---|
| 1 | | T | W |
| 2 | X | 6 | 8 |
| 3 | Y | 6 | 7 |
| 4 | Z | 4 | 5 |
| 5 | | | |
| 6 | 4 | 2 | 3 |
| 7 | 8 | 9 | 1 |
| 8 | | | |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |

# 图片数据读入

Command Window

$f_x$ >>

# 图片数据读入

Command Window

```
>> Yui = imread('Yui.jpg');
fx >>
```

# 图片数据读入

Command Window

```
>> Yui = imread('Yui.jpg');
>> size(Yui)

ans =

     374     374     3

fx >>
```

# 图片数据读入

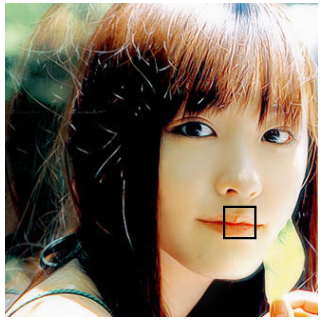
Command Window

```
>> Yui = imread('Yui.jpg');
>> size(Yui)

ans =

     374     374     3

>> image(Yui)
fx >>
```

# 图片数据读入

Command Window

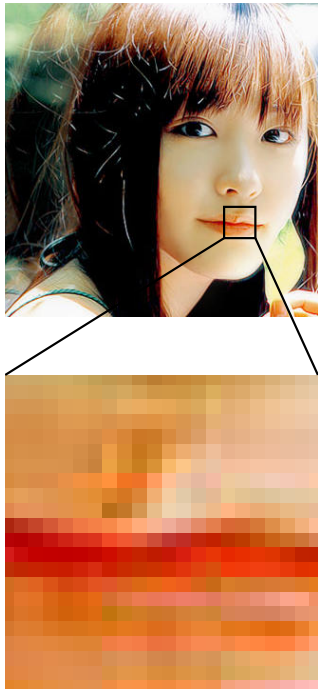
```
>> Yui = imread('Yui.jpg');
>> size(Yui)

ans =

     374    374     3

>> image(Yui)
>> lip = Yui(242:266, 255:279, :);
fx >>
```



# 图片数据读入

Command Window

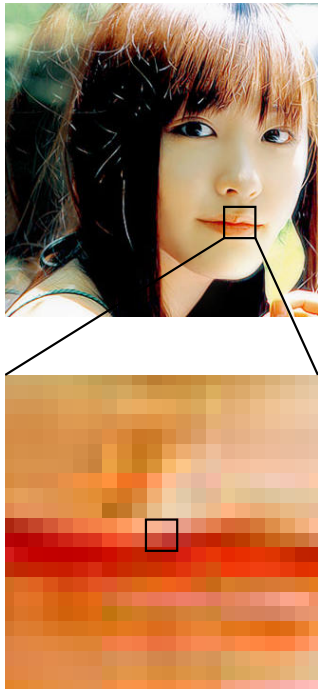
```
>> Yui = imread('Yui.jpg');
>> size(Yui)

ans =

     374    374     3

>> image(Yui)
>> lip = Yui(242:266, 255:279, :);
>> image(lip);
fx >>
```



# 图片数据读入

Command Window

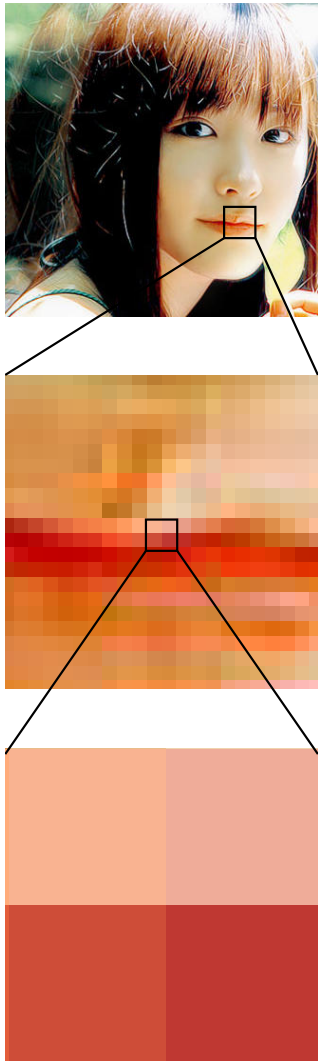
```
>> Yui = imread('Yui.jpg');
>> size(Yui)

ans =

     374    374     3

>> image(Yui)
>> lip = Yui(242:266, 255:279, :);
>> image(lip);
>> procheilon = lip(12:13, 12:13, :)

procheilon(:,:,1) =

     255    252
     228    206
procheilon(:,:,2) =

     175    178
     90     71
procheilon(:,:,3) =

     118    139
     51     42

fx >>
```



# 图片数据读入

Command Window

```
>> Yui = imread('Yui.jpg');
>> size(Yui)

ans =

     374    374     3

>> image(Yui)
>> lip = Yui(242:266, 255:279, :);
>> image(lip);
>> procheilon = lip(12:13, 12:13, :)

procheilon(:,:,1) =

     255    252
     228    206
procheilon(:,:,2) =

     175    178
     90     71
procheilon(:,:,3) =

     118    139
     51     42

>> image(procheilon);
fx >>
```



# 视频数据读入

Command Window

$f_x >>$

# 视频数据读入

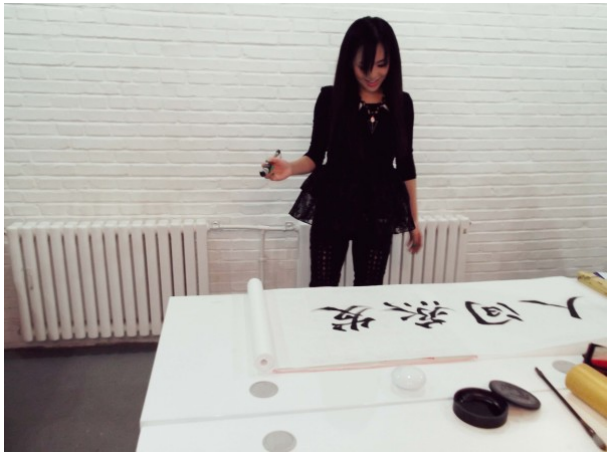
Command Window

```
>> obj = VideoReader('Videos/AoiSora.avi')

obj =

     VideoReader with properties:

     General Properties:
                Name: 'AoiSora.avi'
                Path: '/home/zhou/Videos'
            Duration: 724.9444
         CurrentTime: 0
                 Tag: ''
            UserData: []

     Video Properties:
               Width: 600
              Height: 447
           FrameRate: 18
        BitsPerPixel: 24
         VideoFormat: 'RGB24'

fx >>
```

# 视频数据读入

Command Window

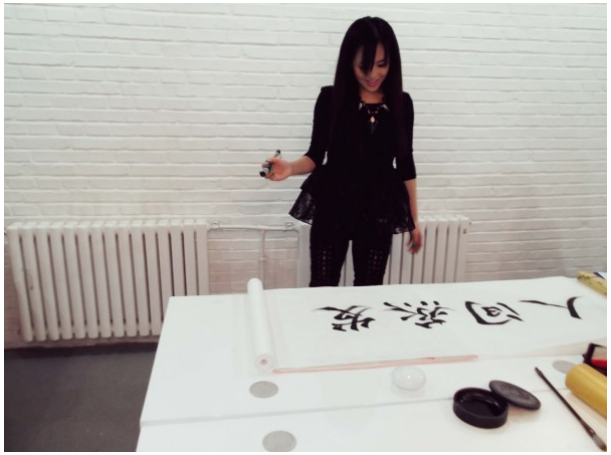
```
>> obj = VideoReader('Videos/AoiSora.avi')

obj =

     VideoReader with properties:

     General Properties:
                Name: 'AoiSora.avi'
                Path: '/home/zhou/Videos'
            Duration: 724.9444
         CurrentTime: 0
                 Tag: ''
            UserData: []

     Video Properties:
               Width: 600
              Height: 447
           FrameRate: 18
        BitsPerPixel: 24
         VideoFormat: 'RGB24'

>> frame = read(obj,25); imshow(frame);

fx >>
```



# 视频数据读入

Command Window

```
>> obj = VideoReader('Videos/AoiSora.avi')

obj =

    VideoReader with properties:

    General Properties:
                Name: 'AoiSora.avi'
                Path: '/home/zhou/Videos'
            Duration: 724.9444
         CurrentTime: 0
                 Tag: ''
            UserData: []

    Video Properties:
               Width: 600
              Height: 447
           FrameRate: 18
        BitsPerPixel: 24
         VideoFormat: 'RGB24'

>> frame = read(obj,25); imshow(frame);

>> frame = read(obj,99); imshow(frame);
```



# 线性方程组求解

Command Window

$f_x$ >>

## 定解方程组

$$\begin{cases} 2x+3y+1z=4 \\ 4x+2y+3z=17 \\ 7x+1y-1z=1 \end{cases}$$

## 不定方程组

$$\begin{cases} 4x+5y+1z=3 \\ 1x+2y+4z=15 \end{cases}$$

## 超定方程组

$$\begin{cases} 4x+5y=3 \\ 1x+2y=15 \\ 3x+1y=12 \end{cases}$$

# 线性方程组求解

Command Window

```
>> A = [2 3 1; 4 2 3; 7 1 -1];
fx >>
```

## 定解方程组

$$\begin{cases} 2x+3y+1z=4 \\ 4x+2y+3z=17 \\ 7x+1y-1z=1 \end{cases}$$

## 不定方程组

$$\begin{cases} 4x+5y+1z=3 \\ 1x+2y+4z=15 \end{cases}$$

## 超定方程组

$$\begin{cases} 4x+5y=3 \\ 1x+2y=15 \\ 3x+1y=12 \end{cases}$$

# 线性方程组求解

Command Window

```
>> A = [2 3 1; 4 2 3; 7 1 -1];
>> B = [4 17 1]';
fx >>
```

## 定解方程组

$$\begin{cases} 2x+3y+1z=4 \\ 4x+2y+3z=17 \\ 7x+1y-1z=1 \end{cases}$$

## 不定方程组

$$\begin{cases} 4x+5y+1z=3 \\ 1x+2y+4z=15 \end{cases}$$

## 超定方程组

$$\begin{cases} 4x+5y=3 \\ 1x+2y=15 \\ 3x+1y=12 \end{cases}$$

# 线性方程组求解

Command Window

```
>> A = [2 3 1; 4 2 3; 7 1 -1];
>> B = [4 17 1]';
>> A\B

ans =

    1.0000
   -1.0000
    5.0000

fx >>
```

## 定解方程组

$$\begin{cases} 2x+3y+1z=4 \\ 4x+2y+3z=17 \\ 7x+1y-1z=1 \end{cases}$$

## 不定方程组

$$\begin{cases} 4x+5y+1z=3 \\ 1x+2y+4z=15 \end{cases}$$

## 超定方程组

$$\begin{cases} 4x+5y=3 \\ 1x+2y=15 \\ 3x+1y=12 \end{cases}$$

# 线性方程组求解

Command Window

```
>> A = [2 3 1; 4 2 3; 7 1 -1];
>> B = [4 17 1]';
>> A\B

ans =

    1.0000
   -1.0000
    5.0000

>> A = [4 5 1; 1 2 4]; B = [3 15]';
fx >>
```

## 定解方程组

$$\begin{cases} 2x+3y+1z=4 \\ 4x+2y+3z=17 \\ 7x+1y-1z=1 \end{cases}$$

## 不定方程组

$$\begin{cases} 4x+5y+1z=3 \\ 1x+2y+4z=15 \end{cases}$$

## 超定方程组

$$\begin{cases} 4x+5y=3 \\ 1x+2y=15 \\ 3x+1y=12 \end{cases}$$

# 线性方程组求解

Command Window

```
>> A = [2 3 1; 4 2 3; 7 1 -1];
>> B = [4 17 1]';
>> A\B

ans =

    1.0000
   -1.0000
    5.0000

>> A = [4 5 1; 1 2 4]; B = [3 15]';
>> A\B

ans =

    0.0000
   -0.1667
    3.8333

fx >>
```

## 定解方程组

$$\begin{cases} 2x+3y+1z=4 \\ 4x+2y+3z=17 \\ 7x+1y-1z=1 \end{cases}$$

## 不定方程组

$$\begin{cases} 4x+5y+1z=3 \\ 1x+2y+4z=15 \end{cases}$$

## 超定方程组

$$\begin{cases} 4x+5y=3 \\ 1x+2y=15 \\ 3x+1y=12 \end{cases}$$

# 线性方程组求解

Command Window

```
>> A = [2 3 1; 4 2 3; 7 1 -1];
>> B = [4 17 1]';
>> A\B

ans =

    1.0000
   -1.0000
    5.0000

>> A = [4 5 1; 1 2 4]; B = [3 15]';
>> A\B

ans =

    0.0000
   -0.1667
    3.8333

>> A = [4 5;1 2;3 1]; B = [3 15 12]';
fx >>
```

## 定解方程组

$$\begin{cases} 2x+3y+1z=4 \\ 4x+2y+3z=17 \\ 7x+1y-1z=1 \end{cases}$$

## 不定方程组

$$\begin{cases} 4x+5y+1z=3 \\ 1x+2y+4z=15 \end{cases}$$

## 超定方程组

$$\begin{cases} 4x+5y=3 \\ 1x+2y=15 \\ 3x+1y=12 \end{cases}$$

# 线性方程组求解

Command Window

```
>> A = [2 3 1; 4 2 3; 7 1 -1];
>> B = [4 17 1]';
>> A\B

ans =

    1.0000
   -1.0000
    5.0000

>> A = [4 5 1; 1 2 4]; B = [3 15]';
>> A\B

ans =

    0.0000
   -0.1667
    3.8333

>> A = [4 5;1 2;3 1]; B = [3 15 12]';
>> A\B

ans =

    3.0000
   -0.6000

fx >>
```

## 定解方程组

$$\begin{cases} 2x+3y+1z=4 \\ 4x+2y+3z=17 \\ 7x+1y-1z=1 \end{cases}$$

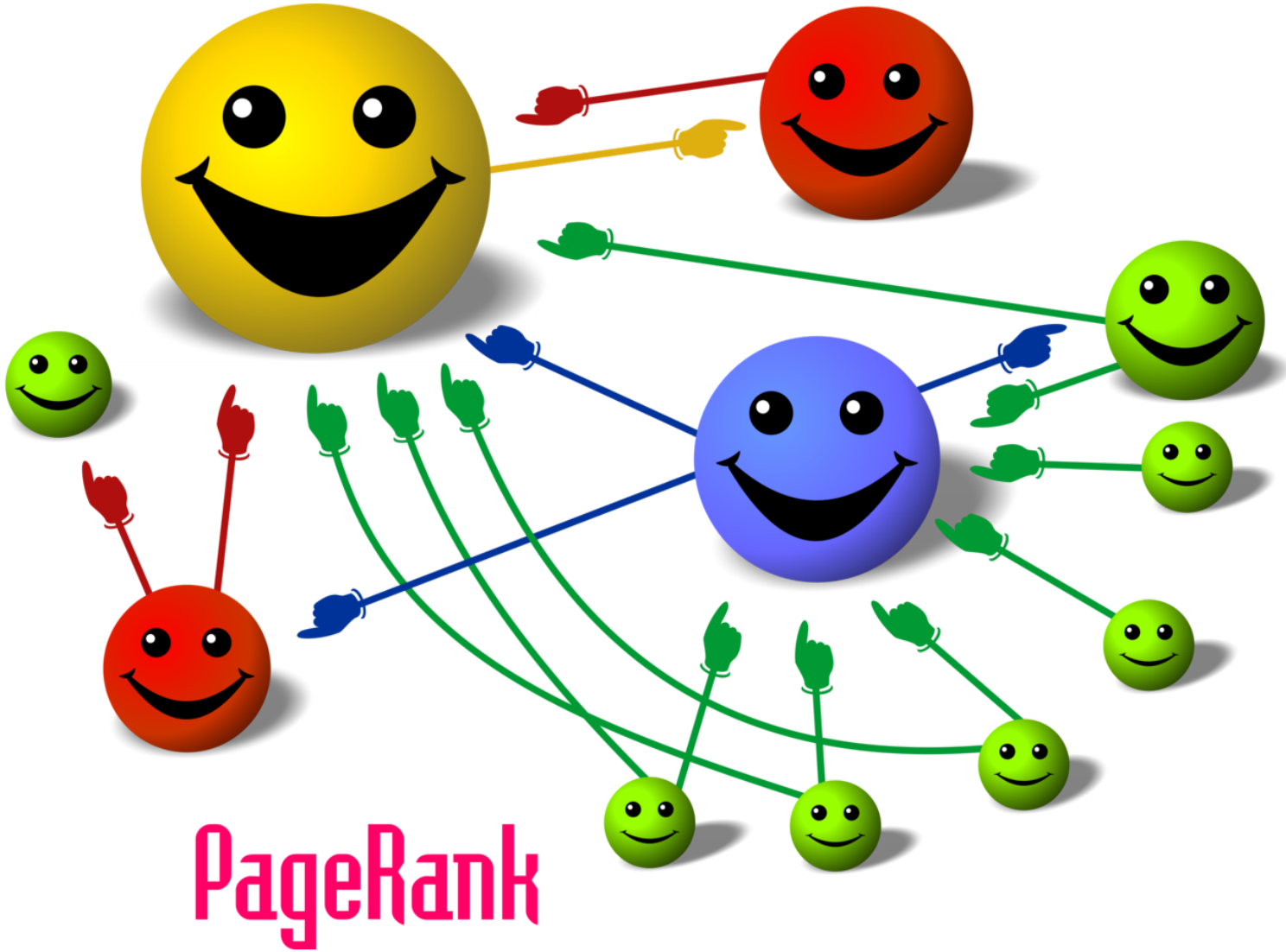
## 不定方程组

$$\begin{cases} 4x+5y+1z=3 \\ 1x+2y+4z=15 \end{cases}$$

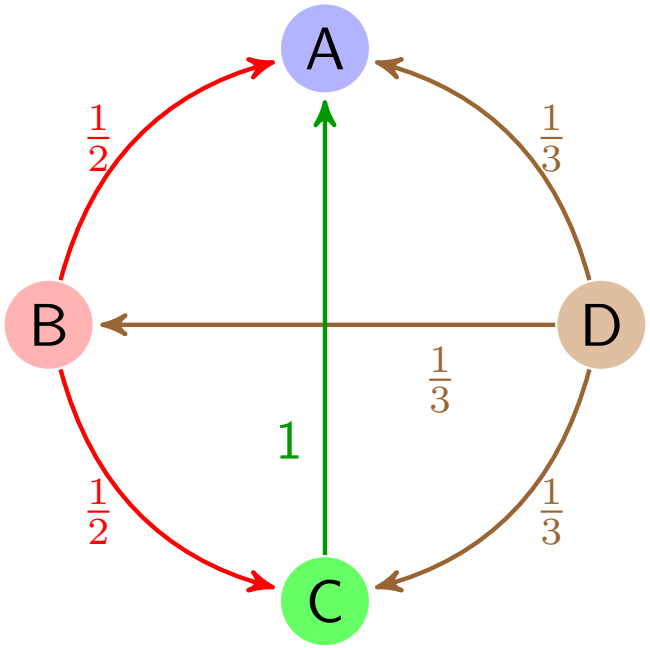
## 超定方程组

$$\begin{cases} 4x+5y=3 \\ 1x+2y=15 \\ 3x+1y=12 \end{cases}$$

# PageRank 算法的实现：示意图



# PageRank 算法的实现：数学形式




$$R(A) = \frac{R(B)}{2} + \frac{R(C)}{1} + \frac{R(D)}{3}$$

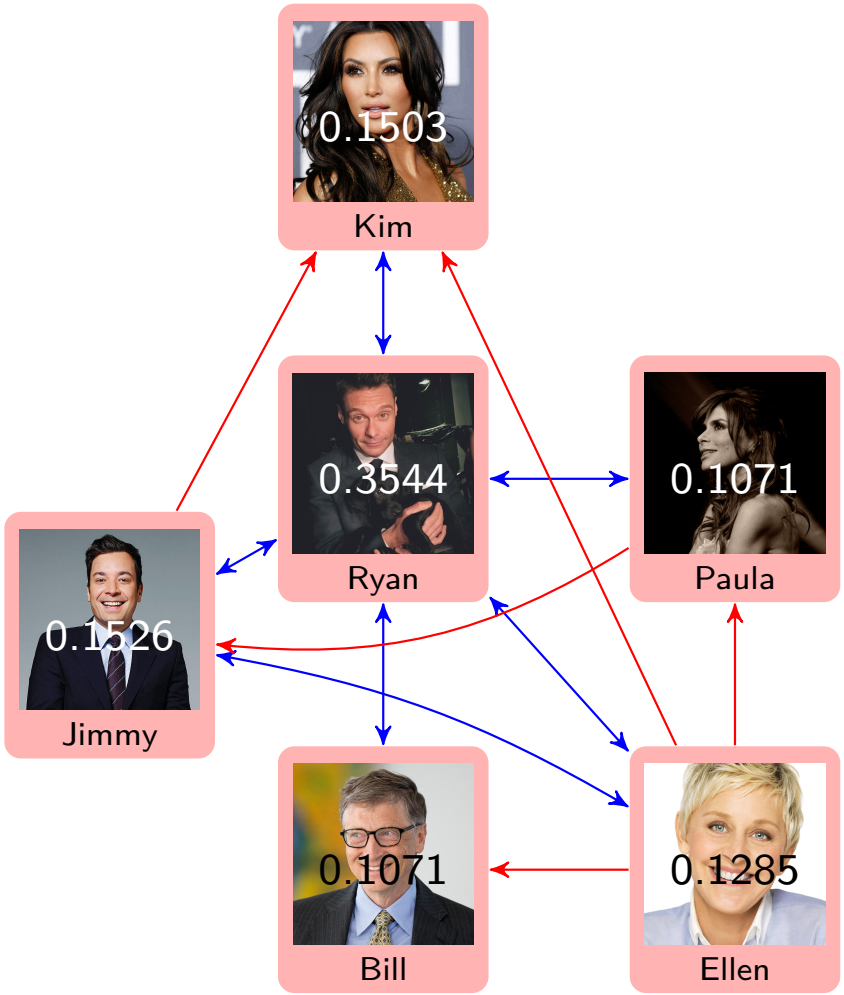
## 指标形式

$$R(p_i) = \frac{1-d}{N} + d \sum_{p_j \in M(p_i)} \frac{R(p_j)}{L(p_j)}$$

## 矩阵形式

$$\mathbf{R} = \begin{bmatrix} \frac{1-d}{N} \\ \vdots \\ \frac{1-d}{N} \end{bmatrix} + d \begin{bmatrix} l_{1,1} & \cdots & l_{1,n} \\ \vdots & \ddots & \vdots \\ l_{n,1} & \cdots & l_{n,n} \end{bmatrix} \mathbf{R}$$

# PageRank 算法的实现：程序




## celebrity.m

```
01 d = 0.85;
02 n = 6;
03
04 C = (1-d)/n*ones(n,1);
05
06 L=[0 1/5  0  0  0  1/5 %bill
07    0  0  1/3 0  0  1/5 %ellen
08    0 1/5  0  0 1/2 1/5 %jimmy
09    0 1/5 1/3 0  0  1/5 %kim
10    0 1/5  0  0  0  1/5 %paula
11    1 1/5 1/3 1 1/2  0];%ryan
12
13 I = eye(n);
14
15 R = (I - d*L)\C % R = C+d*L*R
```

# 线性和非线性拟合

Command Window

$f_x$ >>

# 线性和非线性拟合

Command Window

```
>> x = [1.0, 1.5, 2.0, 2.5, 3.0]';
fx >>
```

# 线性和非线性拟合

Command Window

```
>> x = [1.0, 1.5, 2.0, 2.5, 3.0]';
>> y = [0.9, 1.7, 2.2, 2.6, 3.0]';
fx >>
```

# 线性和非线性拟合

Command Window

```
>> x = [1.0, 1.5, 2.0, 2.5, 3.0]';
>> y = [0.9, 1.7, 2.2, 2.6, 3.0]';
>> a = polyfit(x,y,1)

a =

      1.0200    0.0400
```

# 线性和非线性拟合

Command Window

```
>> x = [1.0, 1.5, 2.0, 2.5, 3.0]';
>> y = [0.9, 1.7, 2.2, 2.6, 3.0]';
>> a = polyfit(x,y,1)

a =

    1.0200    0.0400

fx >>
```

# 线性和非线性拟合

Command Window

```
>> x = [1.0, 1.5, 2.0, 2.5, 3.0]';
>> y = [0.9, 1.7, 2.2, 2.6, 3.0]';
>> a = polyfit(x,y,1)

a =

    1.0200    0.0400

>> xi = 1:0.1:3;
>>
```

# 线性和非线性拟合

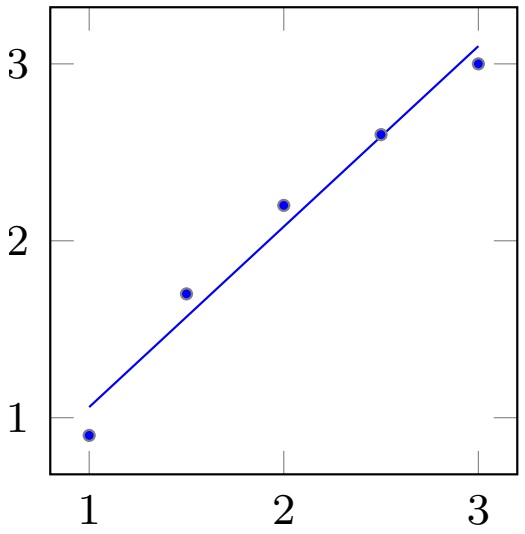
Command Window

```
>> x = [1.0, 1.5, 2.0, 2.5, 3.0]';
>> y = [0.9, 1.7, 2.2, 2.6, 3.0]';
>> a = polyfit(x,y,1)

a =

      1.0200    0.0400

>> xi = 1:0.1:3;
>> yi = polyval(a,xi);
fx >>
```

# 线性和非线性拟合

Command Window

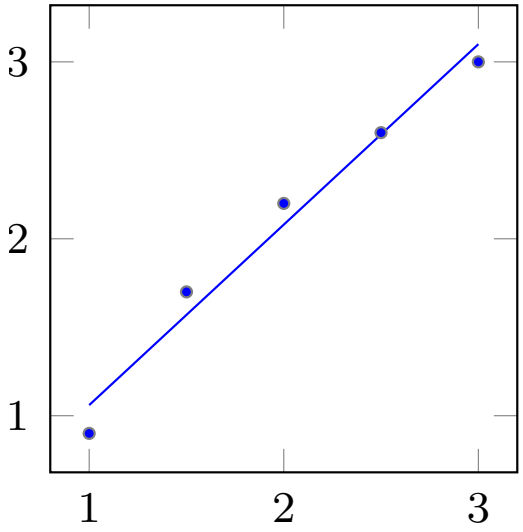
```
>> x = [1.0, 1.5, 2.0, 2.5, 3.0]';
>> y = [0.9, 1.7, 2.2, 2.6, 3.0]';
>> a = polyfit(x,y,1)

a =

      1.0200    0.0400

>> xi = 1:0.1:3;
>> yi = polyval(a,xi);
>> plot(x,y,'o',xi,yi);
fx >>
```



# 线性和非线性拟合

Command Window

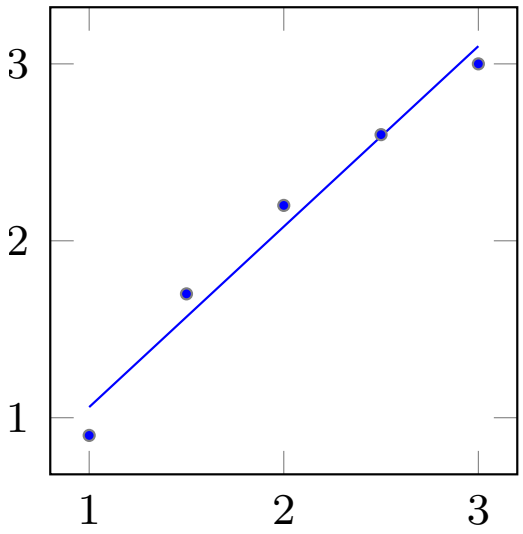
```
>> x = [1.0, 1.5, 2.0, 2.5, 3.0]';
>> y = [0.9, 1.7, 2.2, 2.6, 3.0]';
>> a = polyfit(x,y,1)

a =

      1.0200    0.0400

>> xi = 1:0.1:3;
>> yi = polyval(a,xi);
>> plot(x,y,'o',xi,yi);
>> p = fittype('a*x+b*sin(x)+c');
fx >>
```



# 线性和非线性拟合

Command Window

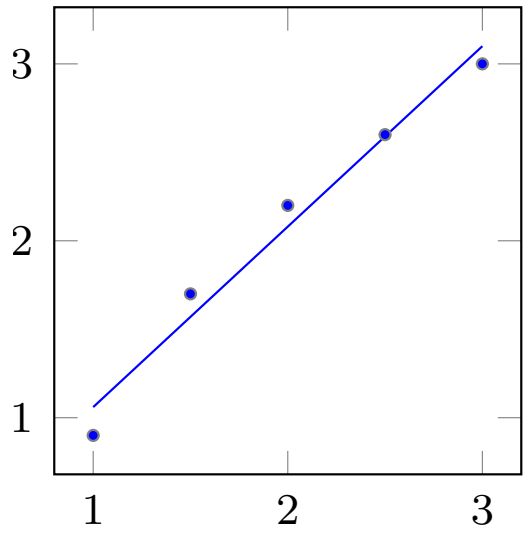
```
>> x = [1.0, 1.5, 2.0, 2.5, 3.0]';
>> y = [0.9, 1.7, 2.2, 2.6, 3.0]';
>> a = polyfit(x,y,1)

a =

      1.0200    0.0400

>> xi = 1:0.1:3;
>> yi = polyval(a,xi);
>> plot(x,y,'o',xi,yi);
>> p = fittype('a*x+b*sin(x)+c');
>> f = fit(x,y,p)

f =
   General model:
   f(x) = a*x+b*sin(x)+c
   Coefficients (with 95% confidence bounds):
   a = 1.249 (0.9856, 1.512)
   b = 0.6357 (0.03185, 1.24)
   c = -0.8611 (-1.773, 0.05094)

fx >>
```

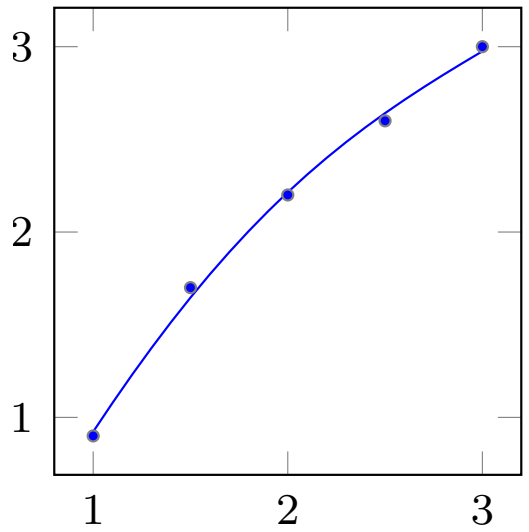


# 线性和非线性拟合

Command Window

```
>> x = [1.0, 1.5, 2.0, 2.5, 3.0]';
>> y = [0.9, 1.7, 2.2, 2.6, 3.0]';
>> a = polyfit(x,y,1)

a =

      1.0200    0.0400

>> xi = 1:0.1:3;
>> yi = polyval(a,xi);
>> plot(x,y,'o',xi,yi);
>> p = fittype('a*x+b*sin(x)+c');
>> f = fit(x,y,p)

f =
   General model:
   f(x) = a*x+b*sin(x)+c
   Coefficients (with 95% confidence bounds):
   a = 1.249 (0.9856, 1.512)
   b = 0.6357 (0.03185, 1.24)
   c = -0.8611 (-1.773, 0.05094)

>> plot(f,x,y);
```



# 美国人口指数增长模型拟合

## 1790-1900 年美国人口数

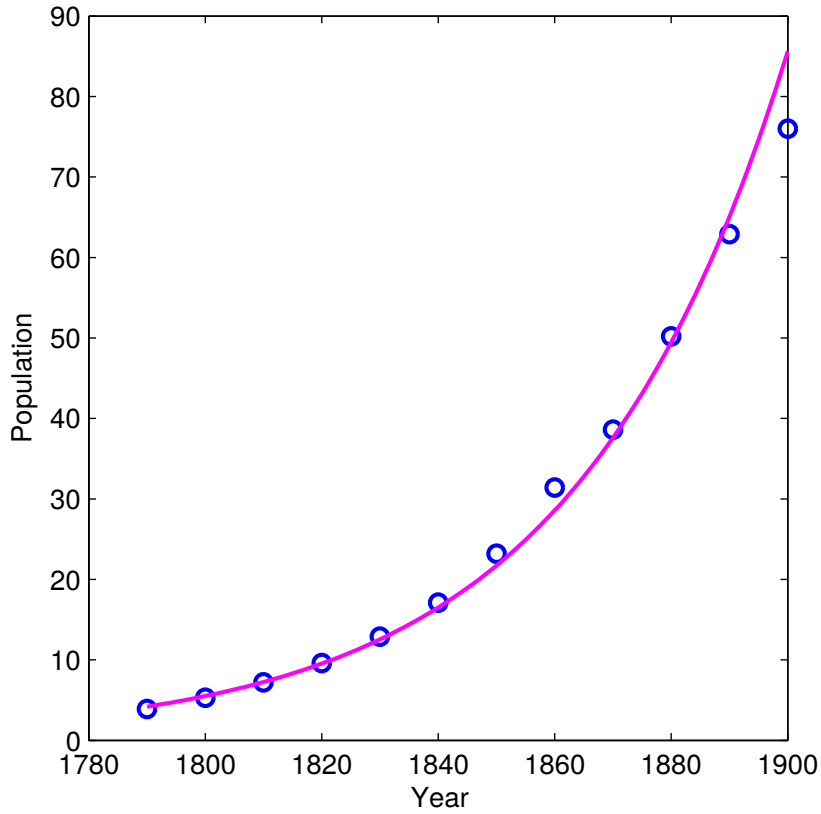
| | | | | | |
|---|---|---|---|---|---|
| 1790 | 3.9 | 1840 | 17.1 | 1890 | 62.9 |
| 1800 | 5.3 | 1850 | 23.2 | 1900 | 76.0 |
| 1810 | 7.2 | 1860 | 31.4 | | |
| 1820 | 9.6 | 1870 | 38.6 | | |
| 1830 | 12.9 | 1880 | 50.2 | | |

## 指数增长模型: 指数方程转化为线性方程

$$
\begin{aligned}
x(t) &= x_0 \mathrm{e}^{rt} \\
&\Downarrow \\
\ln x(t) &= rt + \ln x_0 \\
&\Downarrow \\
Y &= a_1 t + a_2
\end{aligned}
$$

# 美国人口指数增长模型拟合

```
01 t = 1790:10:1900;
02 p = [3.9  5.3  7.2  9.6 ...
03     12.9 17.1 23.2 31.4 ...
04     38.6 50.2 62.9 76.0];
05
06 Y = log(p); X = t;
07 a = polyfit(X,Y,1);
08 x0 = exp(a(2)); r = a(1);
09 ti = 1790:1900;
10 pti= x0*exp(r*ti);
11 plot(t,p,'o',ti,pti,'m')
12 xlabel('Year')
13 ylabel('Population')
```



# 插值和线性回归

## 插值: interp1

- 自学一维插值函数 interp1

## 线性回归: regress

$$Y = b_0 + b_1 x_1 + b_2 x_2 + \cdots + b_k x_k$$

```
[B,Bint,R,Rint,Stats] = regress(Y,X)
```

- B: 回归得到的自变量系数.
- Bint: B 的 95% 的置信区间矩阵

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# Runge-Kutta 法求解微分方程

## 一阶微分方程求解: $y' = \cos t$

```
01 f = @(t,y) cos(t);                % 定义函数 f(t,y) = cos(t)
02 tspan = [0, 2*pi];                % 时间范围
03 y0 = 2;                           % 初值
04 [t, y] = ode23(f, tspan, y0);     % 注意调用格式
```

## 高阶微分方程求解: $y'' = -\sin y + \sin 5t,\ y(0) = 1,\ y'(0) = 0$

```
01 % 将高阶转为一阶: y1 = y , y2 = y'
02 %                 y1'= y2, y2'= -sin(y1) + sin(5t)
03 f = @(t,y) [y(2); -sin(y(1))+sin(5*t)];
04 tspan = [0, 20];                  % 时间范围
05 y0 = [1; 0];                      % 初值
06 [t, y] = ode23(f, tspan, y0);     % 注意调用格式
```

# 传染病模型

## SIR 模型

$$dS/dt = -\beta SI, \quad dI/dt = \beta SI - \gamma I, \quad dR/dt = \gamma I$$

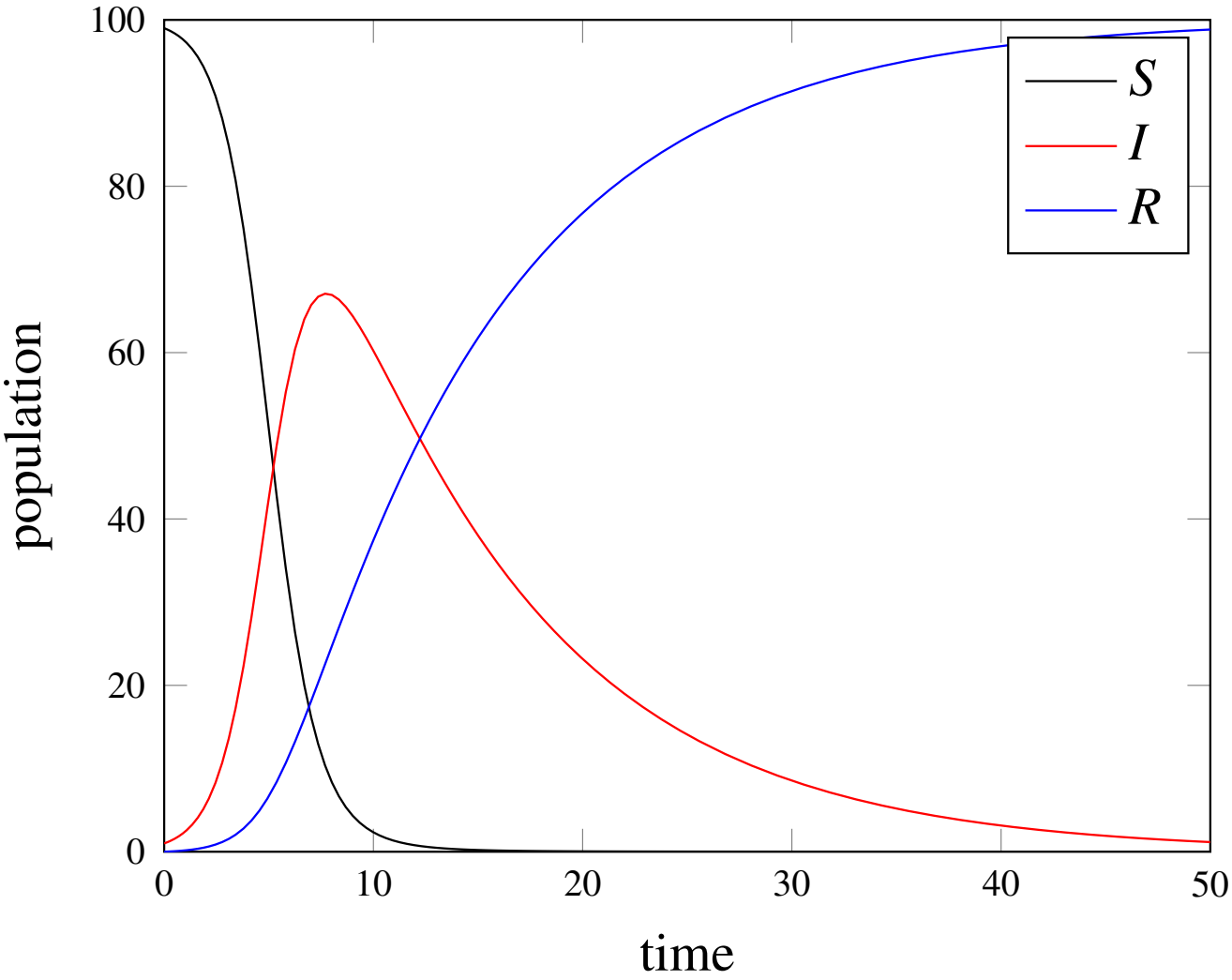
## 函数 odesir

```
01 function dy = odesir(t, y, beta, gamma)
02 dy = [ -beta*y(1)*y(2);                  % dS/dt
03         beta*y(1)*y(2) - gamma*y(2); % dI/dt
04                          gamma*y(2)];% dR/dt
```

## sir

```
05 N = 100; beta = 0.01; gamma = 0.1;
06 tspan = [0, 50]; y0 = [99 1 0];
07 [t y] = ode45(@odesir,tspan,y0,[],beta,gamma);
08 plot(t, y);
09 xlabel('time'); ylabel('population');
10 legend('S', 'I', 'R')
```

# 传染病模型求解结果



Thank You!!!