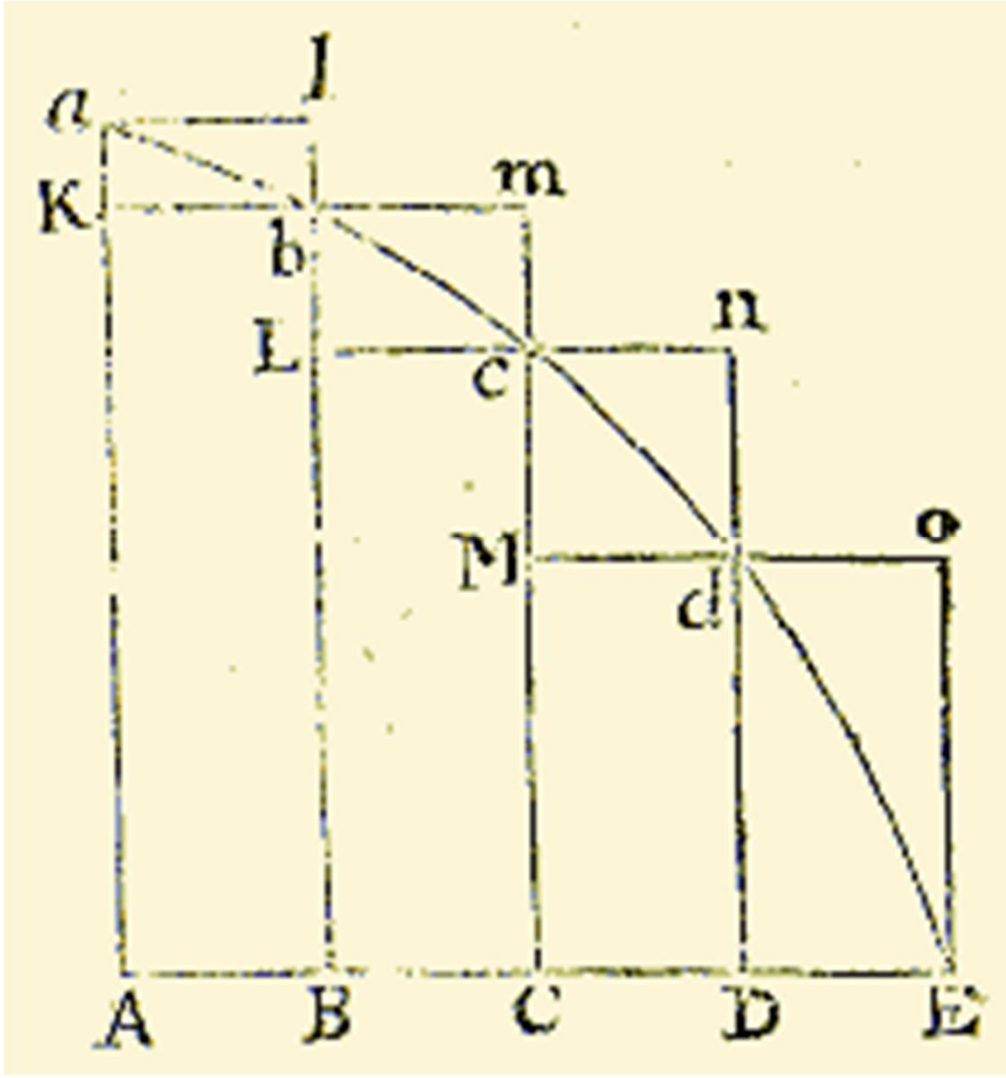
MATLAB Programming

Visualization

Good science requires good visualizations.



Why use MATLAB for plots?

- Produces publication quality plots and images
- Coupled with computation program.

Proper visualization might take exploration.

Simplest plot is a line plot:

```
>> plot(M)
```

Plot each column of M as a separate line.

Sample data sets:

dow.txt : Daily closing value of Dow Jones Industrial Average, an index of the price of 30 stocks on the New York Sock Exchange

sp.txt : Daily closing value of the Standard and Poors 500, a broader index containing 500 stocks.

Data looks like:

Year	Month	Day	Value
1950	01	03	198.89
1950	01	04	200.20
1950	01	05	200.57
1950	01	06	200.96
1950	01	07	201.90

é

Load data:

```
>> dow = importdata('dow.txt');
>> sp = importdata('sp.txt');
```

Simple plot:

```
>> plot(dow(:,4))
```

```
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```

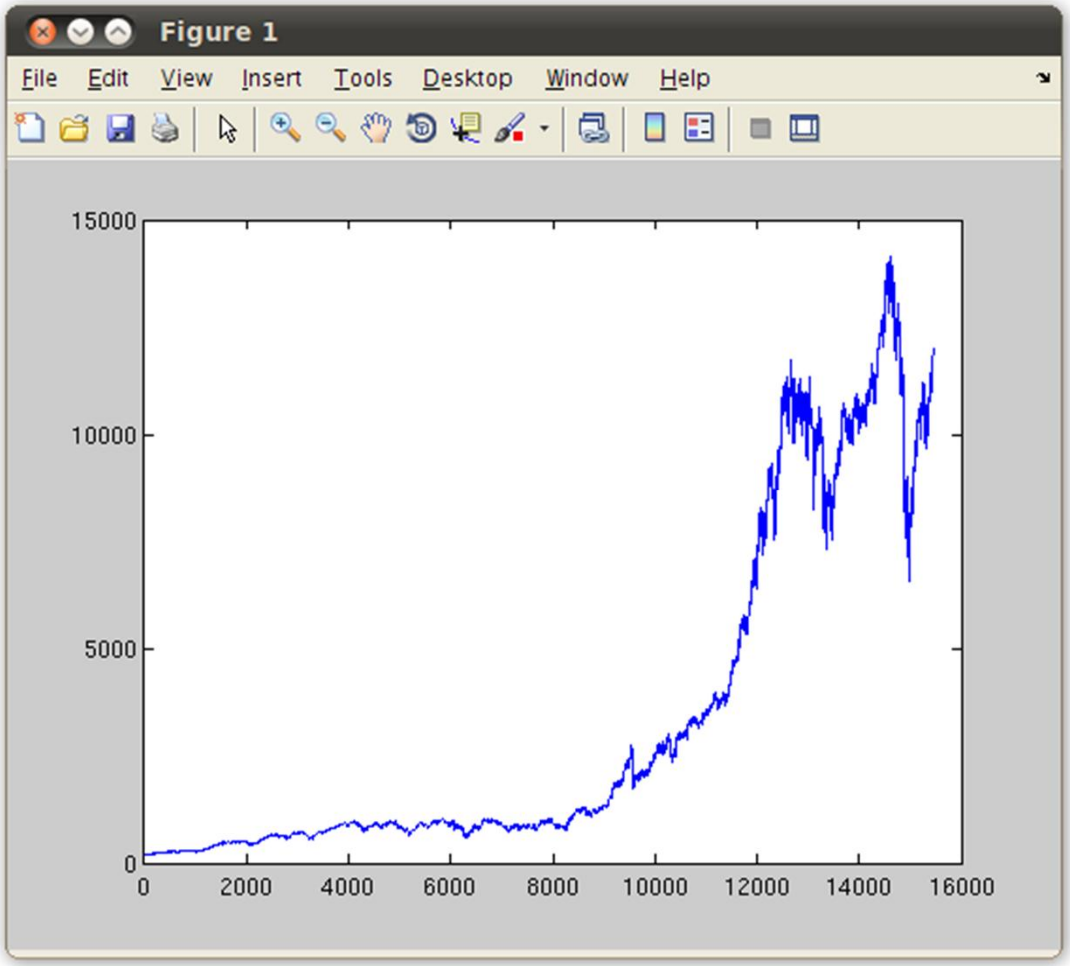


Figure 1
File Edit View Insert Tools Desktop Window Help
15000
10000
5000
0
0 2000 4000 6000 8000 10000 12000 14000 16000

```
>> plot(dow(:,4))
```

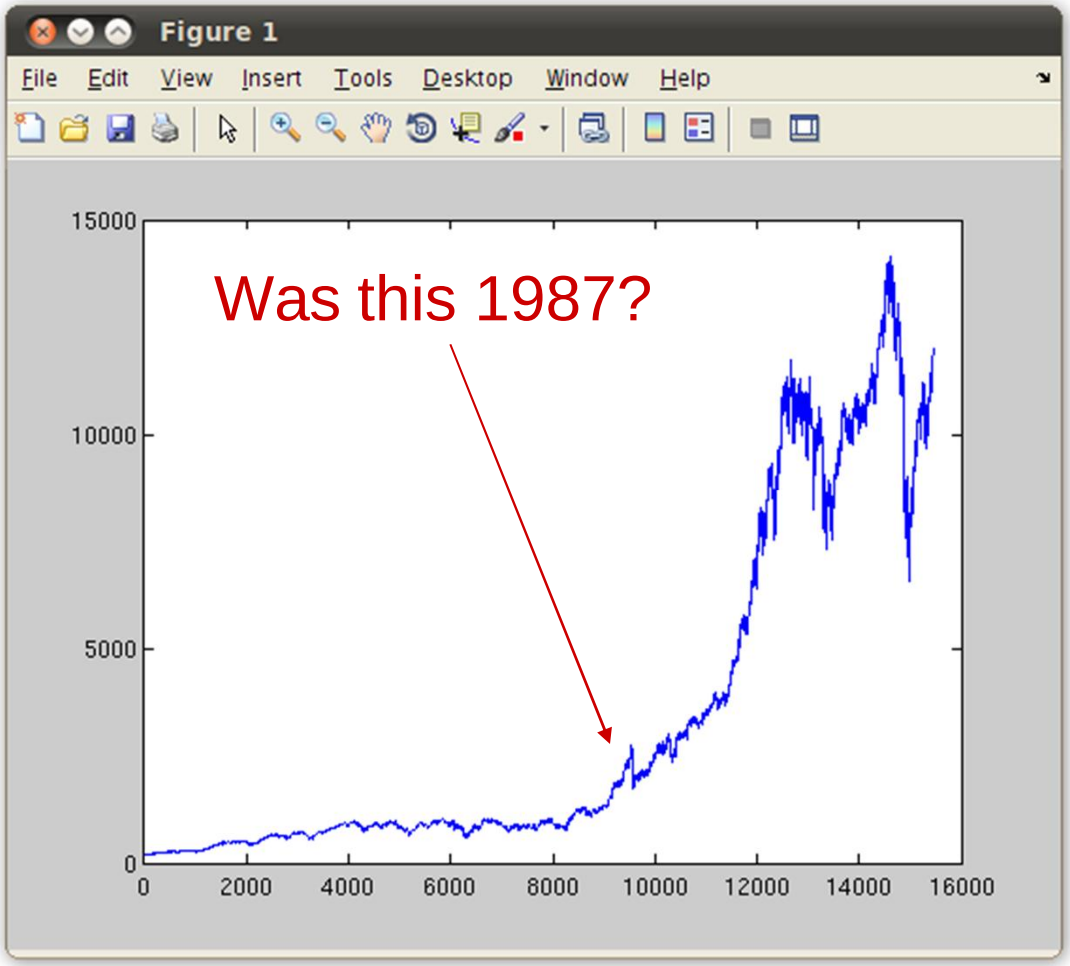


Figure 1
File Edit View Insert Tools Desktop Window Help
Was this 1987?
15000
10000
5000
0
0
2000
4000
6000
8000
10000
12000
14000
16000

```
>> plot(dow(:,4))
```

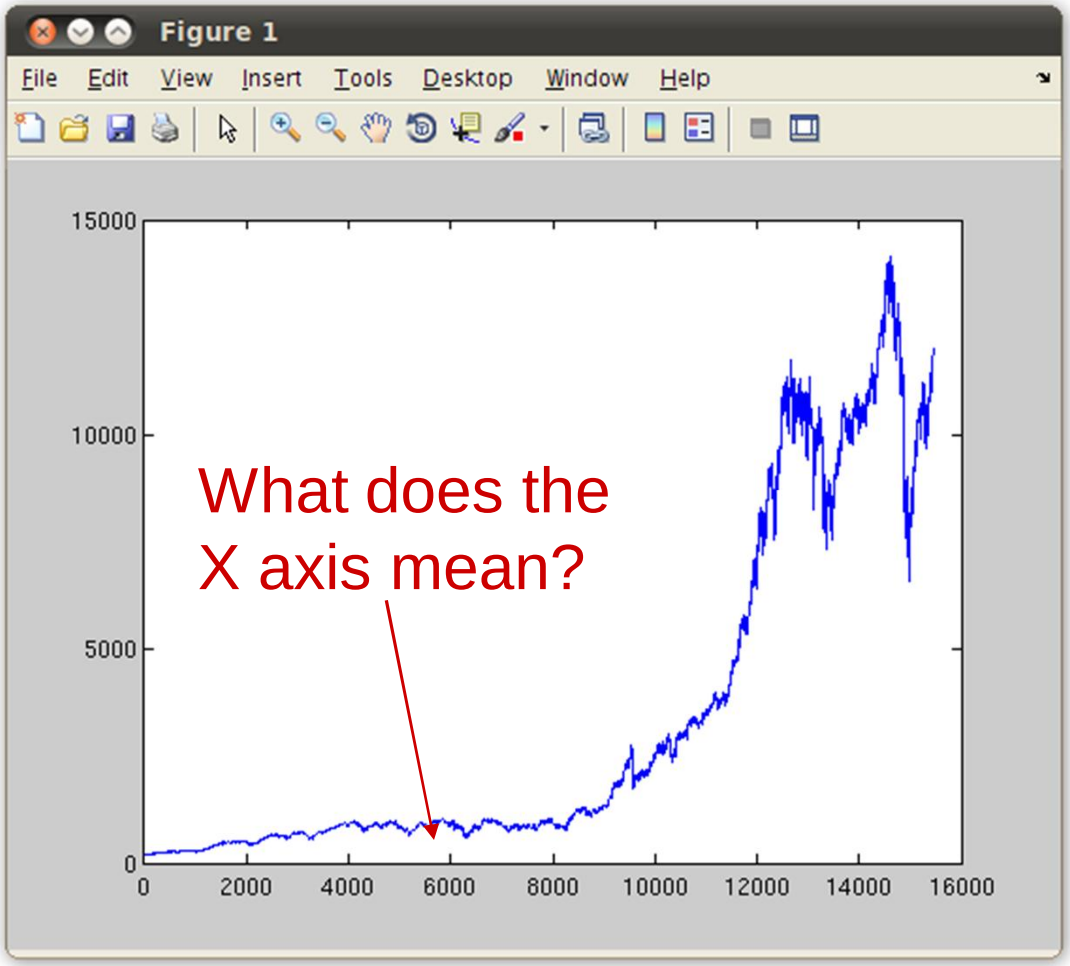
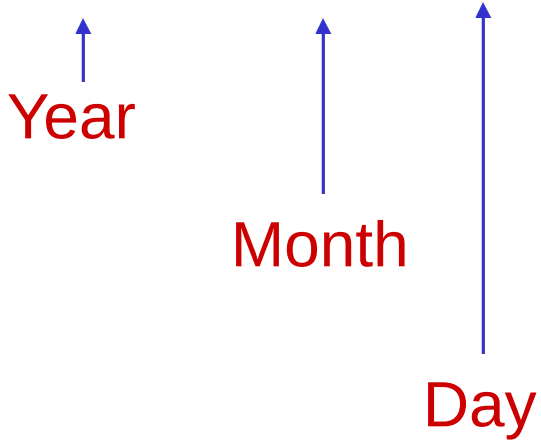


Figure 1
File Edit View Insert Tools Desktop Window Help
15000
10000
5000
0
0 2000 4000 6000 8000 10000 12000 14000 16000
What does the
X axis mean?

```
>> dow(1,1:3)

ans =

    1950     1     3
```

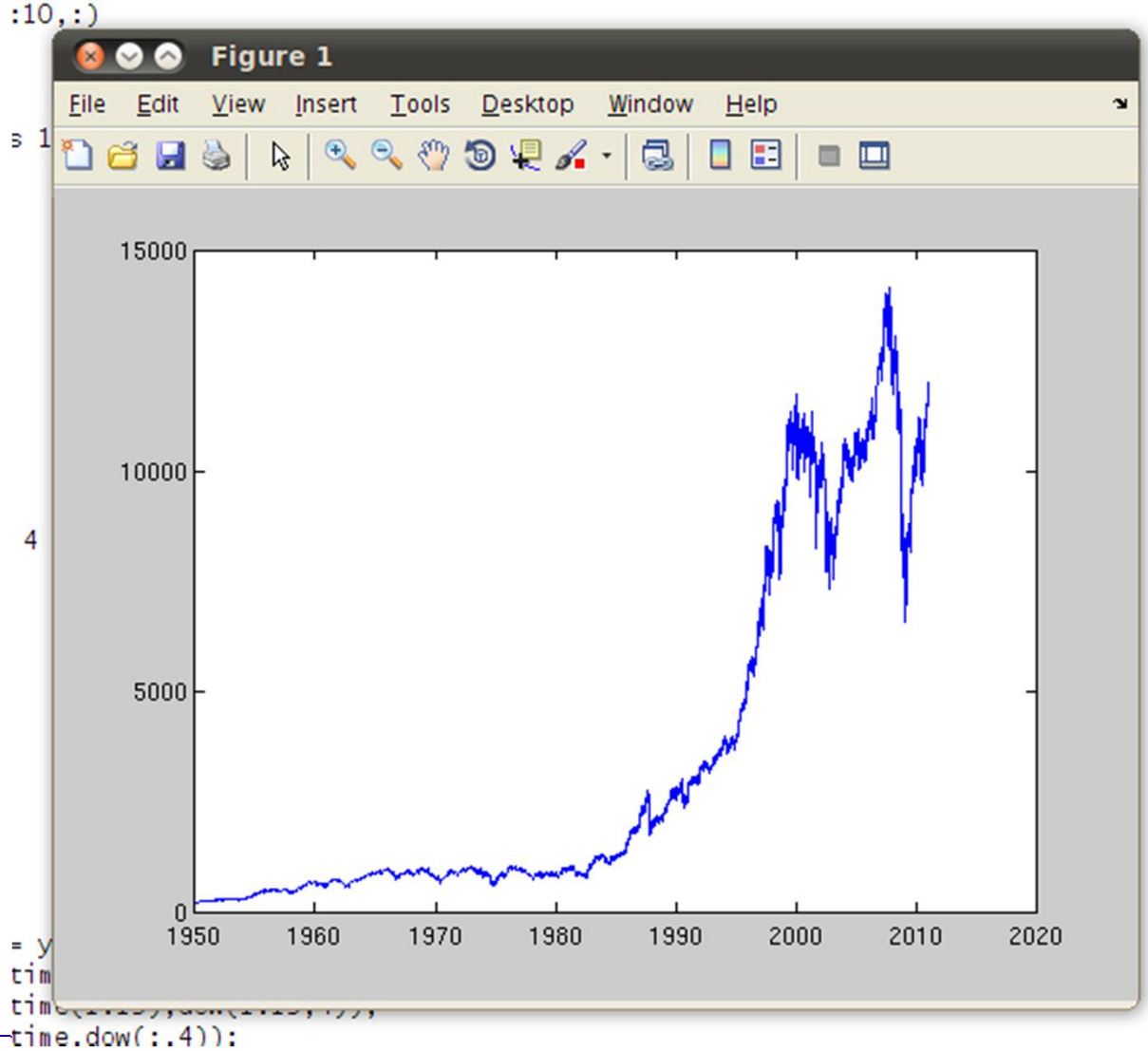


```
>> time = dow(1,:) + (dow(2,:)-1) / 12 +
   (dow(3,:)-1) / 30 / 12
```

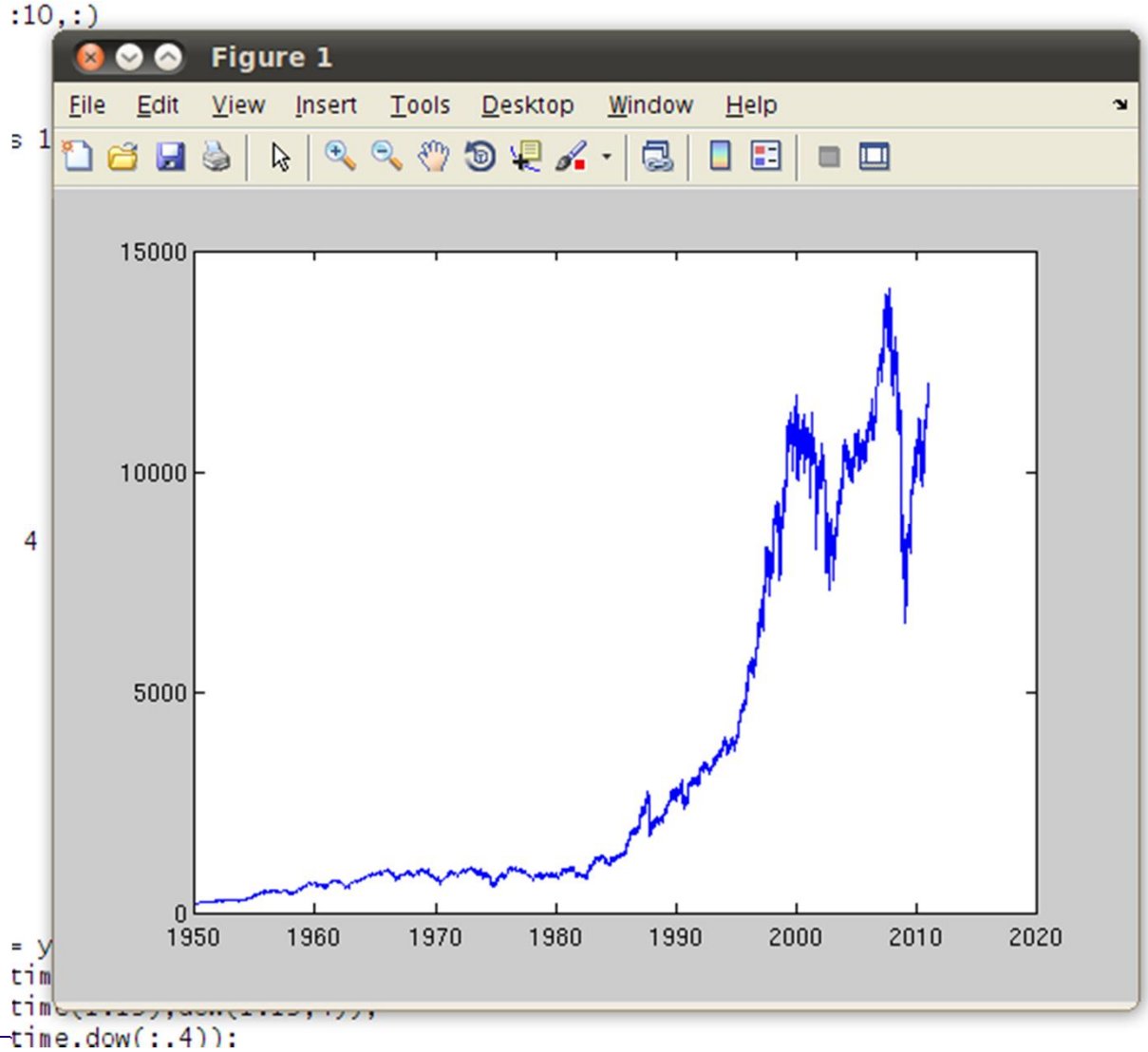
Plot the Dow's value versus time:

```
>> plot(time, dow(:,4))
```

>> plot(time, dow(:,4))



What if we want to edit the plot?



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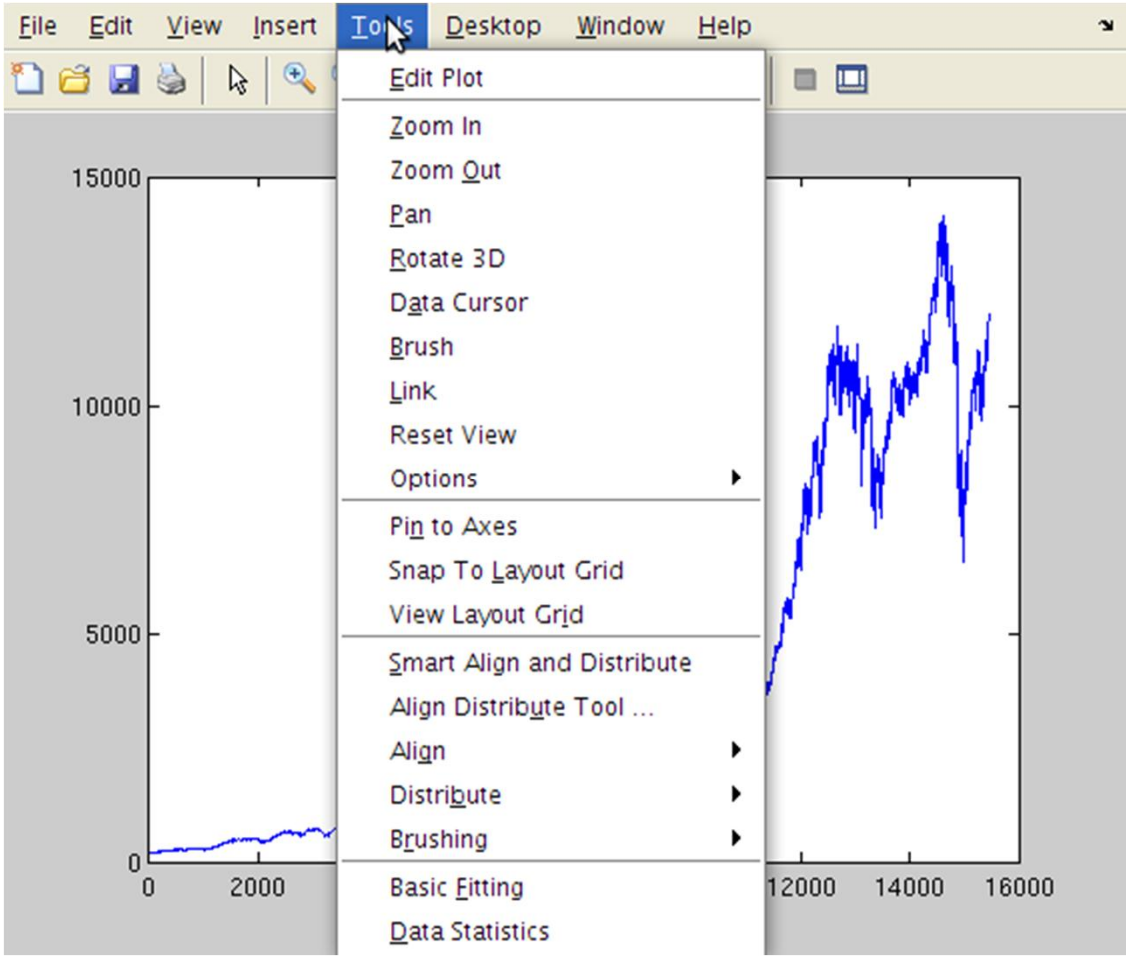

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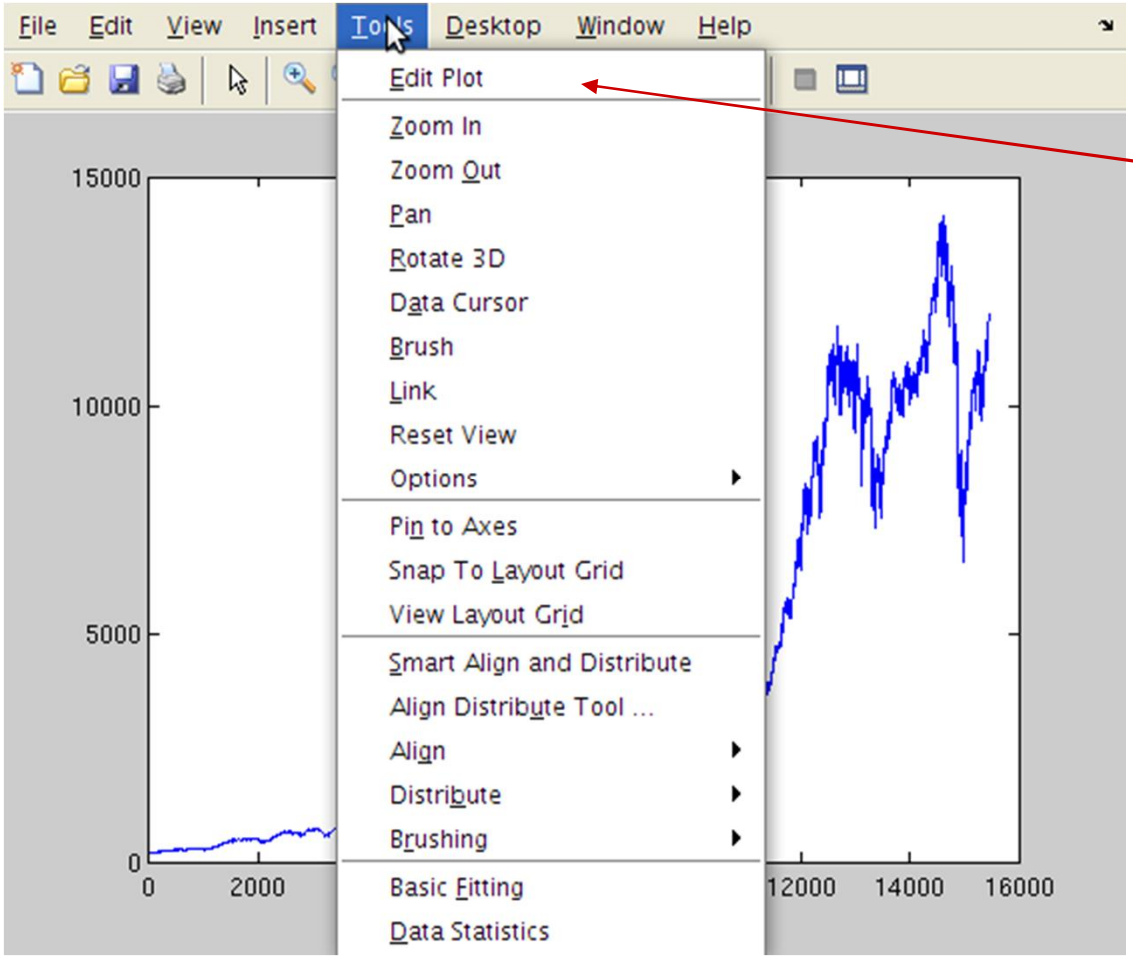
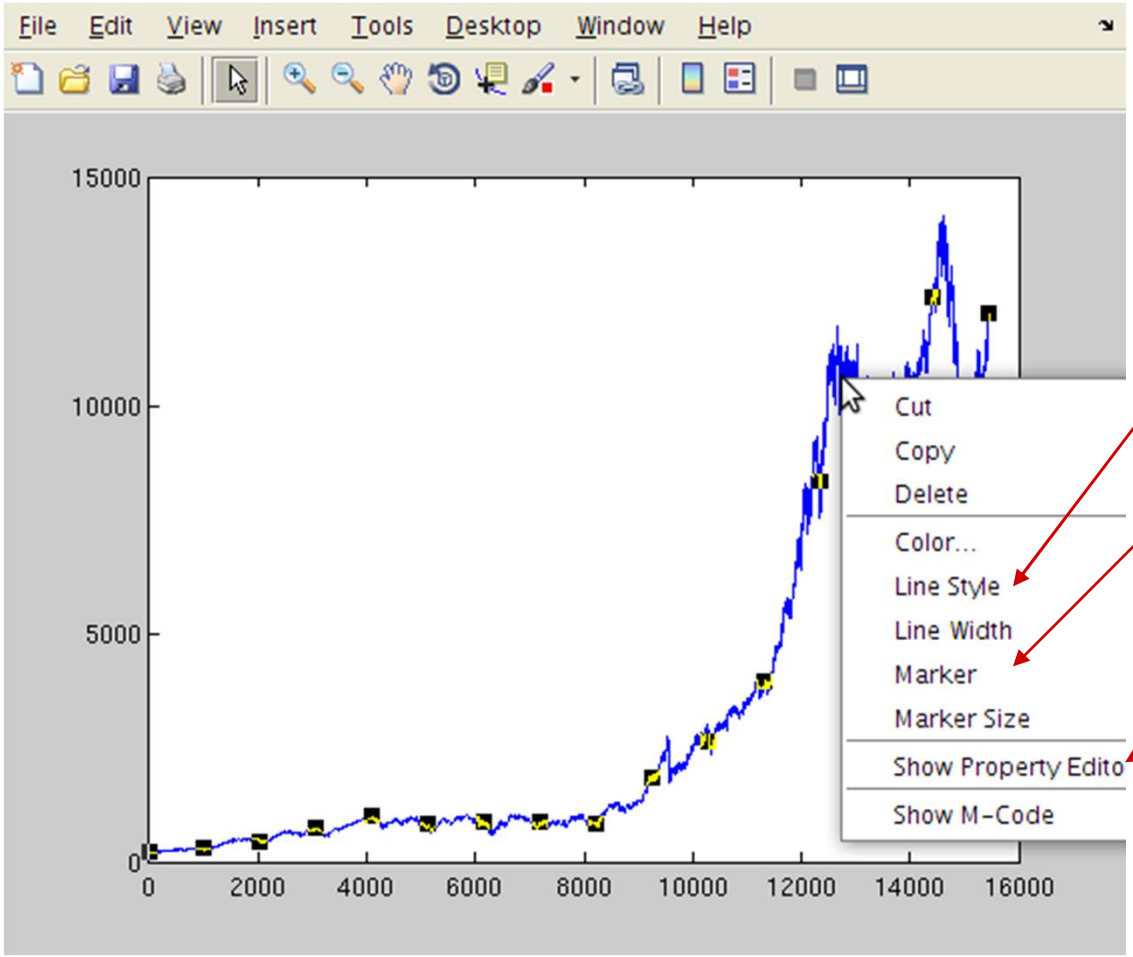


Provides access to plot details

What if we want to edit the plot?



Change line

Add markers

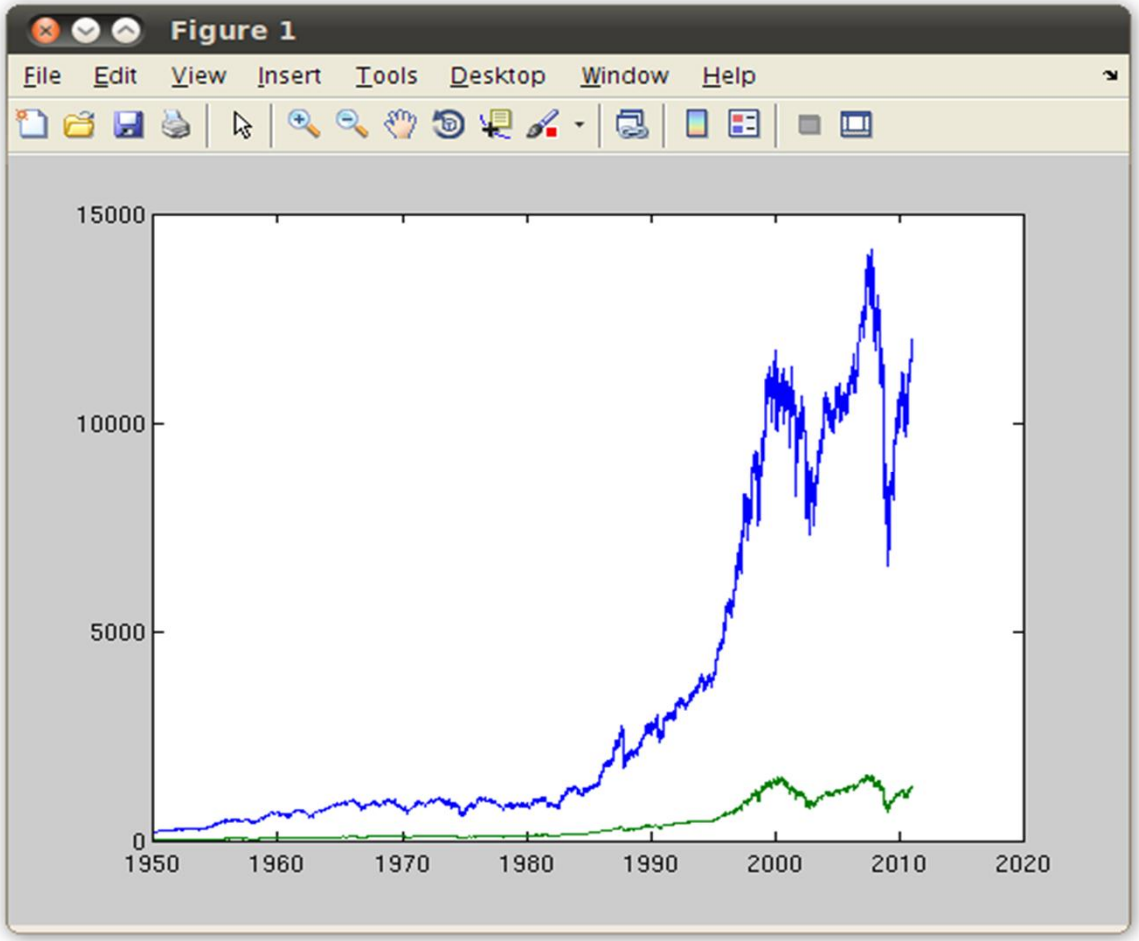
Many other options.

Compare the Dow to the S&P:

```
>> stocks = [dow(:,4) sp(:,4)];
>> plot(time, stocks);
```

Plotting a matrix (stocks) against a vector(time) plots each column of the matrix with the shared X-axis.

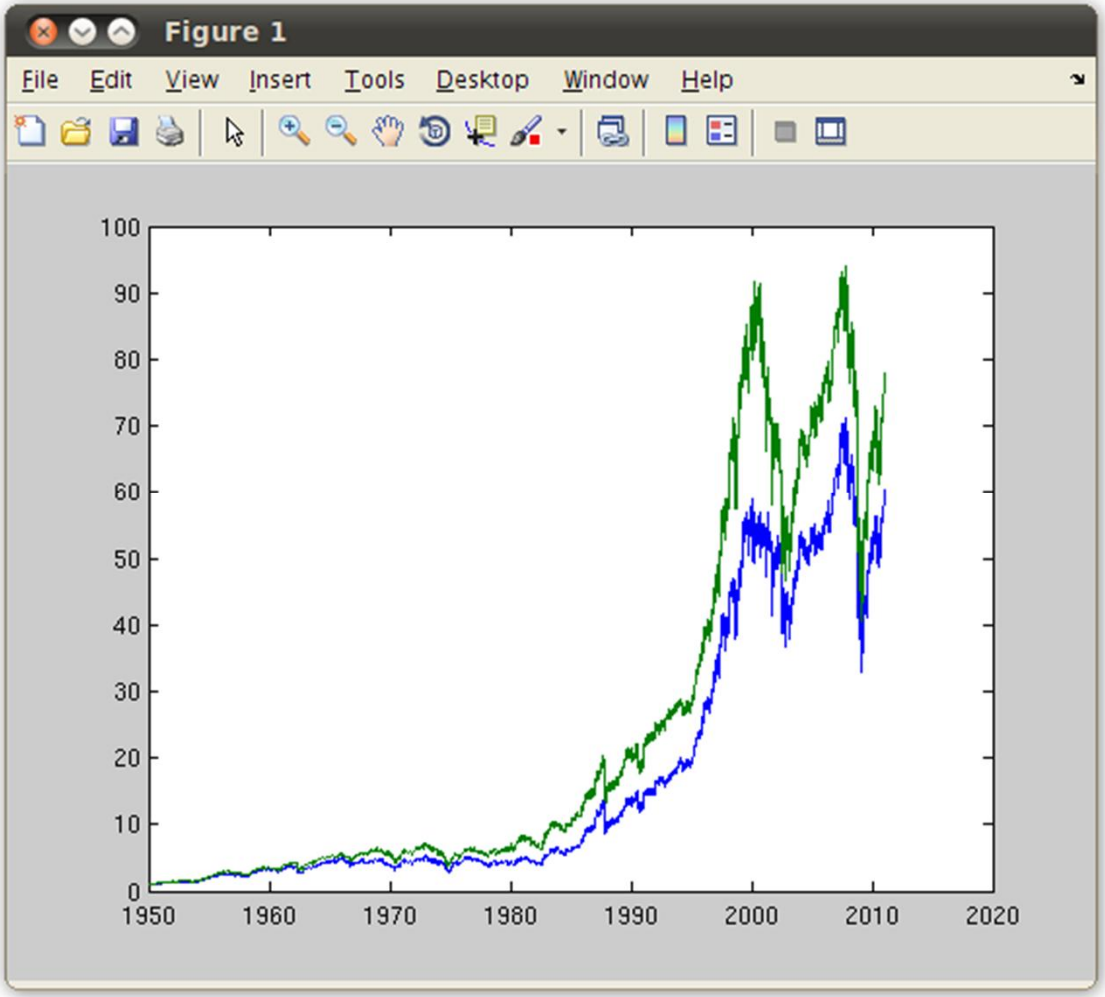
```
>> plot(time, stocks);
```



Rescale the indices to start at the same place:

```
>> d2 = dow(:,4) / dow(1:4);
>> s2 = sp(:,4) / sp(1,4);
>> plot(time, [d2 s2]);
```

```
>> plot(time, [d2 s2]);
```



MATLAB has utilities to plot many kinds of data:

- hist: histograms
  - pie: pie charts
    - bar, barh: bar charts

Even many kinds of 3D charts:

- pie3
  - bar3
    - pareto

A lot of data is one dimensionalé

é what about 2-D data?

Example: geographically oriented data.

Ever wondered where people tweet the most?

Question: what places in Toronto are the most popular locations for people to send a geo-located tweet?

Data collection:

Record all geolocated tweets for 2 months.

Divide the city into a grid and count the number of tweets in each cell of the grid.

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>> image(data);

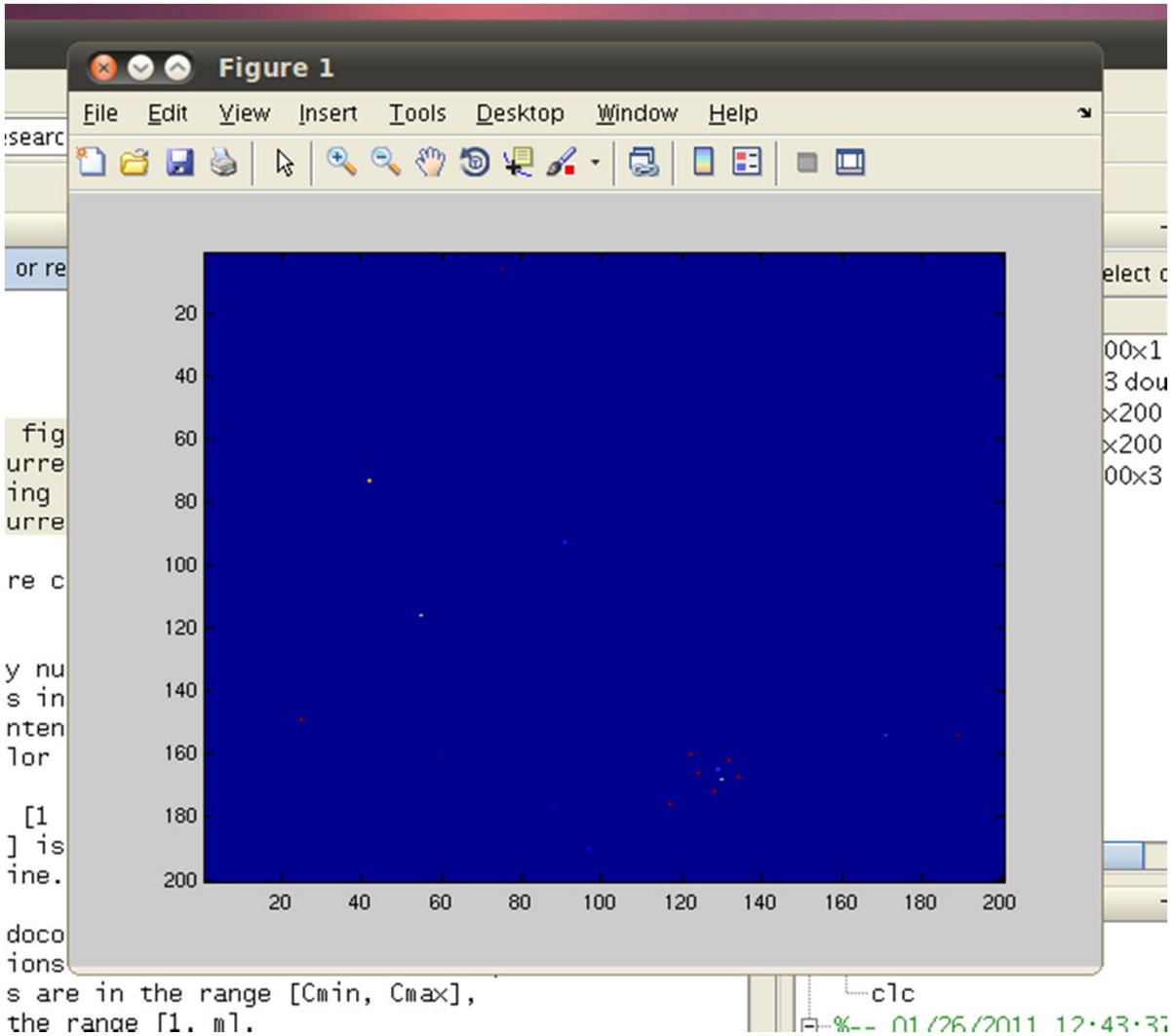
Figure 1
File Edit View Insert Tools Desktop Window Help
20
40
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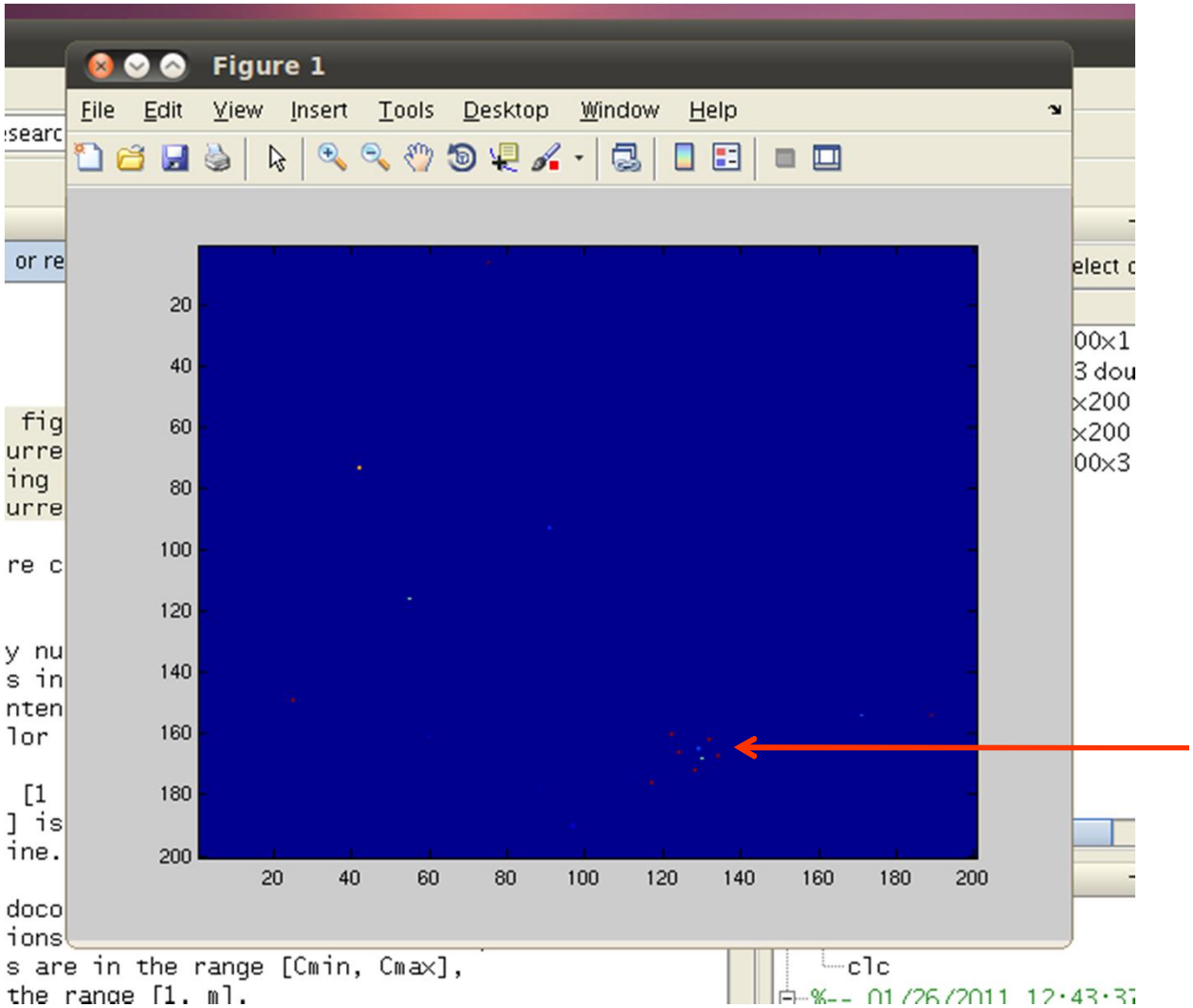
180
200
20 40 60 80 100 120 140 160 180 200
s are in the range [Cmin, Cmax],
clc

>> image(data);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File Edit View Insert Tools Desktop Window Help
20
40
60
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20 40 60 80 100 120 140 160 180 200

image():

Take either an N X M or N X M X 3 array.

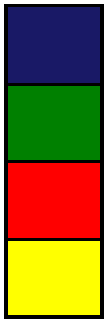
Third dimension is for three channels of a color image.

Map each location a color using a colormap.

Data

45	**1**	**1**	**1**
46	1	1	1
46	1	1	1
46	45	45	45

Colormap



Only use first column
because Data is 4x4

Image

A colormap is a color guide that maps the values 0.0 to 64.0 to colors.

Many colormapsé

Just checké

>> help colormaps

é for all the options.

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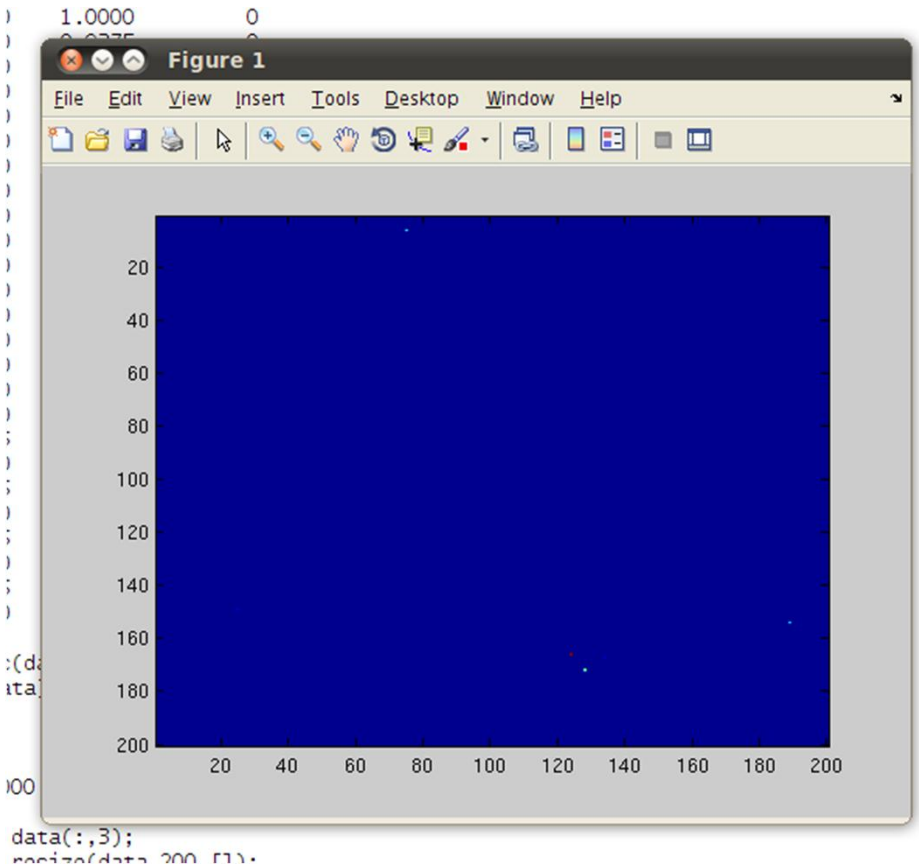
What if our matrix has a different range?

```
>> imagesc(data);
```

Scales the matrix to use the entire colormap.



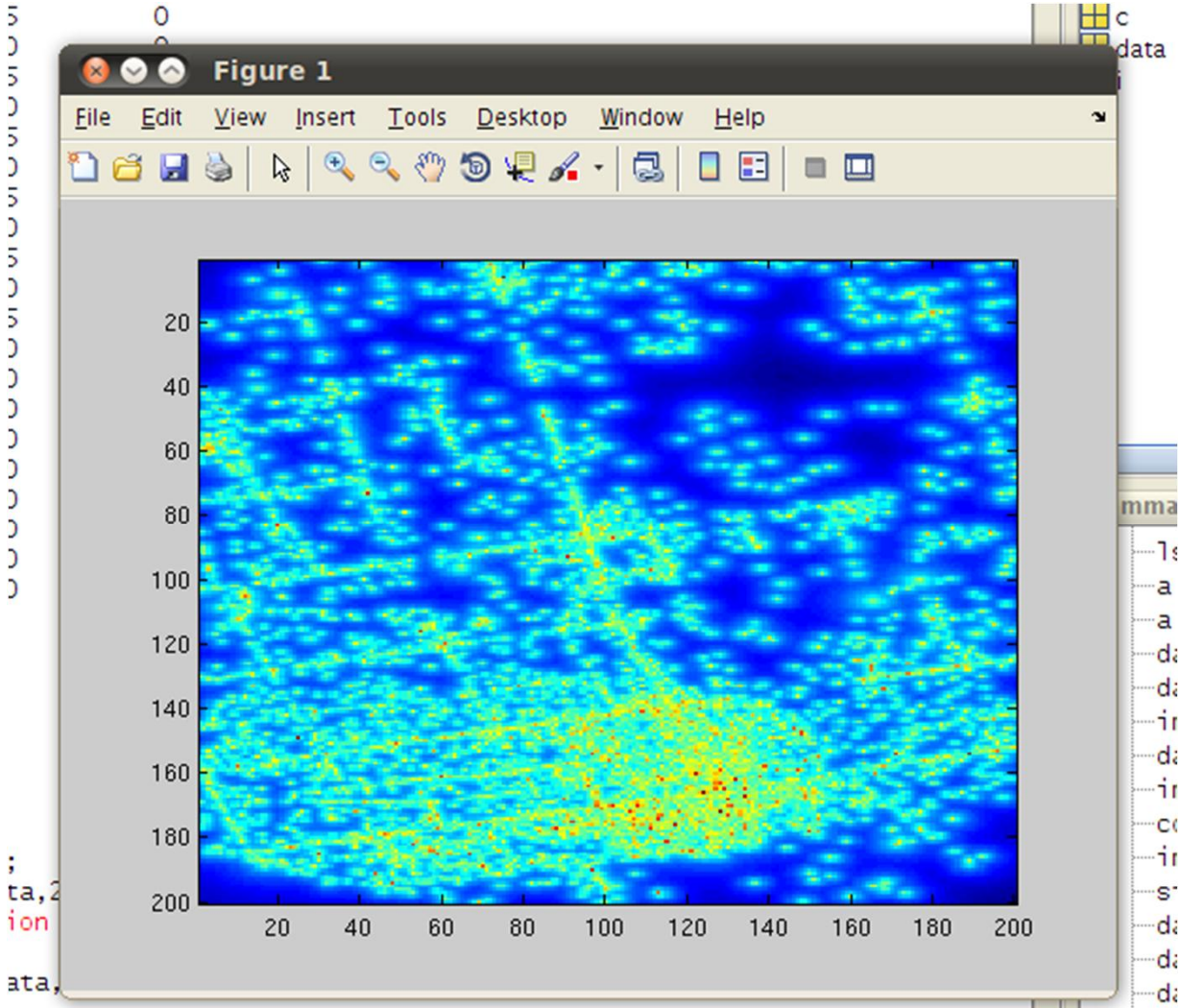
Key: imagesc scales the data linearly.

Our data:

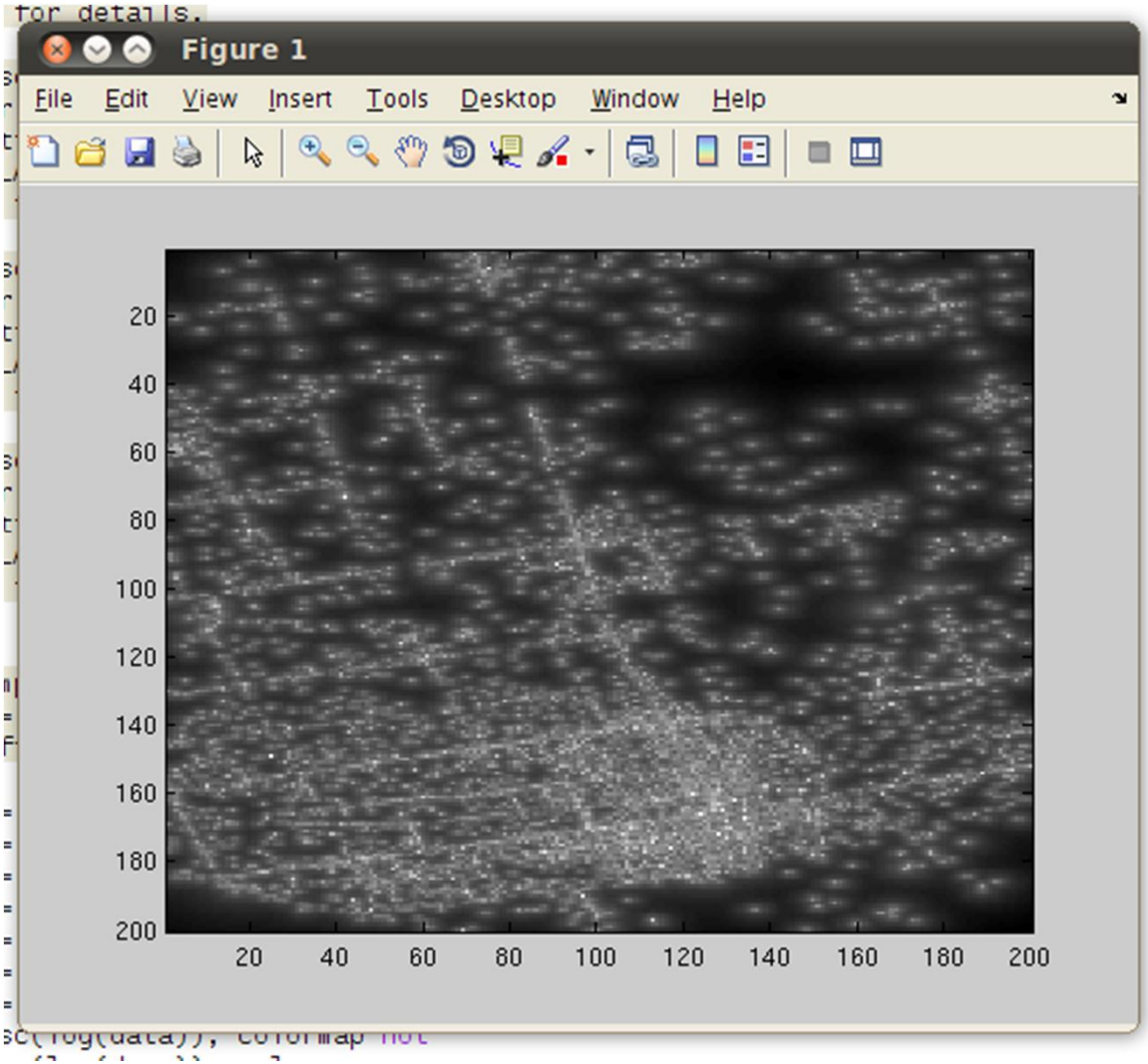
```
>> max(max(data))
1.93 e+04
>> min(min(data))
2.05 e-24
>> mean(mean(data))
1.1190
```

Our data is scaled exponentiallyé

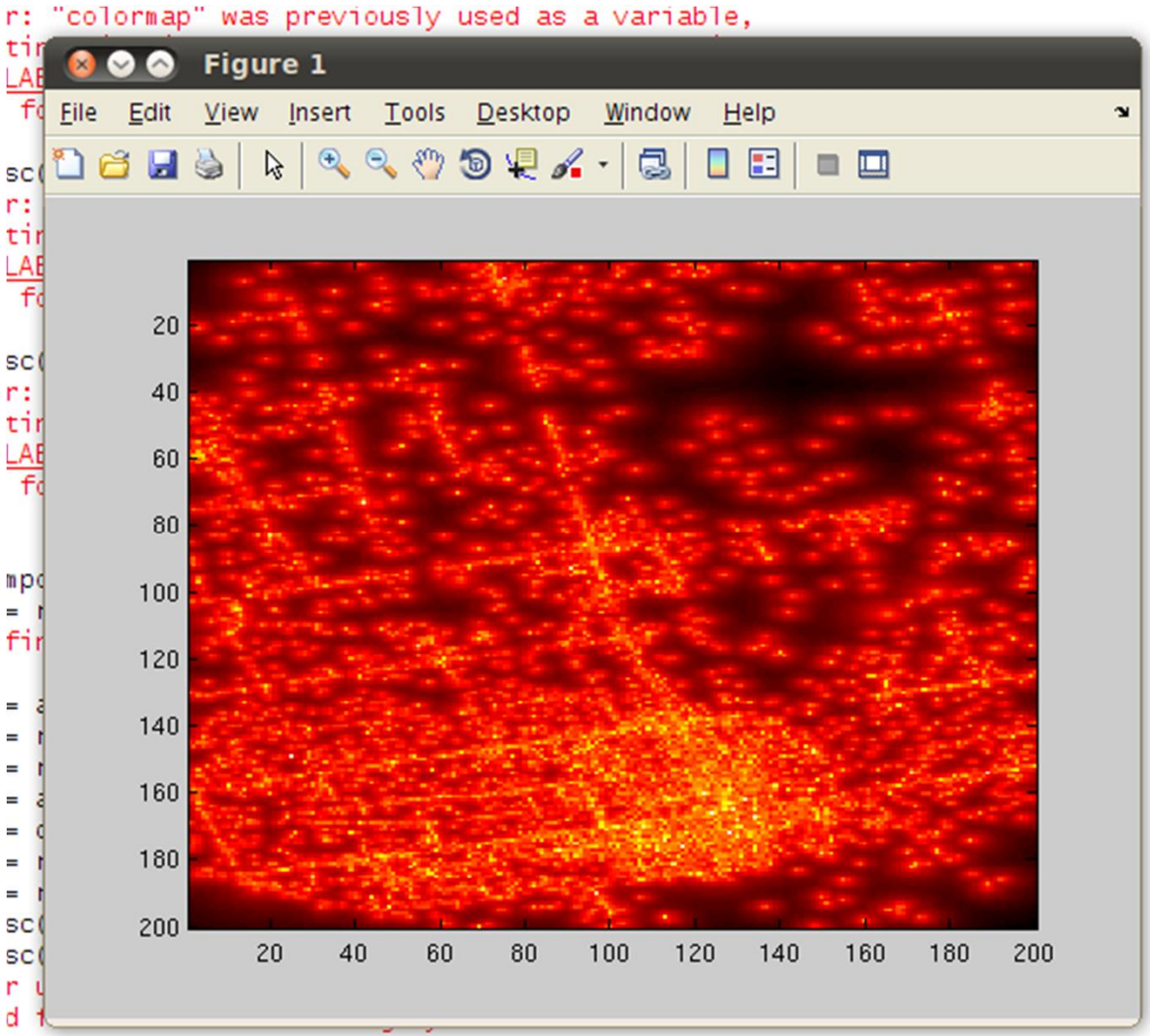
```
>> imagesc(log(data));
```



```
>> imagesc(log(data)), colormap gray;
```



>> imagesc(log(data)), colormap hot;



Conclusion:

Imaging is a powerful way to explore dataé

é but be sure to take full advantage of the pattern in that data.

created by

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