Comp3302 Curve-fitting Part 1

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Purpose	(i) To learn about how to fit mathematical curves to empirical data. (ii) In particular, to learn how to fit the *exponential, power law* and *sigmoid ('Logistic')* functions.
Files Required	The Octave (CGI) program is installed on the Lab machines, and is open source. All Script files are provided on the web-pages.
PP Contribution	PP4
Send to Me	Nothing this week.
Homework	

Activities

Setting up Octave.

(a) Download the Script and Data files "OctaveRelease" from the web-pages, unzip and put into a location of your choice.

(b) Open up the folder, click in the navigation bar, then hit Ctrl-C to copy the folder chain.

(c) Open up Octave-GUI, and choose the "Command Window" tab. You should see the ">>" prompt. Left click in this window.

(d) Now type "cd" then a space and Ctrl-V to paste the folder location. Hit return.

(e) At the Octave command line type **pkg load statistics** If you get an error, the type the following **pkg install statistics -forge** and then try the load.

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2 **Getting to know some functions**

Here we will use the script **FuncPlot** to get to know the exponential and the sigmoid functions, in particular how their shape is determined by their parameters.

(a) At the command line type **FuncPlot** and select choice 1 for exponential. You will be asked to enter values for parameters A and B. The following choices, in order, will hopefully help you learn what A and B do.

A	B
2	-1
2	-2
2	-0.5
2	0.5
5	-1

Press ctrl-c to break out of the script when you are done.

(b) Now explore the sigmoid function for these values

A	B	C
10	2	2.5
10	3	2.5
10	5	2.5
10	5	3.5
10	5	1.5
10	5	1.5

1 **The Exponential Function Manual Fit.** Here we are going to fit the exponential function to a data set manually.

(a) Look at the handout to remind you of what the exponential function looks like and its parameters A and B.

First let's do a ***manual*** fit of the exponential curve to a data set.

(b) In the command window type "ExpManual" and when prompted for a file name, type in 'expData1.csv' **including the '**

Octave will give you two Figure windows, though you will need to separate them.
Now we shall start an iterative process to fit the curve to the data by changing A and B.

(c) Look at the raw data plot and choose an estimate for parameter A. Enter this at the command prompt. Now choose a value for B (negative since the exponential is falling). Look at the fit.

(d) Change parameter A to improve the fit while keeping B the same. Look at the change in fit and decide whether you changed A in the right direction. Repeat changing A until the fit is acceptable. **Never change two parameters simultaneously**, you will get lost.

(e) Keeping A the same, now change B and look at the effect on the curve. Has your change improved or made things worse? Decide on how to iteratively change B to get a better fit.

(f) When you are happy with your fit **write down the values of A and B** to use in the next activity. Close the graph windows and type Ctrl-C to kill the script, the type "clear all" in the command window.

2 **The Exponential Function Automatic Fit.** Let's use the estimates of A and B you obtained to get an optimal fit using the non-linear least-squares algorithm.

(a) Open up the script file ExpAuto.m by double-clicking in the top left window. Look for the line of script to insert your estimated parameter values A and B and put these numbers in that line:

startingVals = [A,B];

(b) Look for the line where you must specify the range of x-values and put them in. I chose to start at 0 and end at 4 and split this range into 100 intervals, like this

xgrid = linspace(0,4,100);

(c) Hit Ctrl-S to save your changes, then select the command window tab.

(d) Now in the command window type ExpAuto and then the filename 'expData1.csv' when prompted.

(e) Eyeball the graph and comment on the qualitative fit.

(f) Cut and paste the following lines of output (I've suppressed the numbers)

```
Estimated Coefficients
 xxxxx
 xxxxx
95% confidence intervals for parameters
  xxxxx  xxxxx
  xxxxx  xxxxx
rms error =
  xxxxx

r2 value =
 xxxxx
```

(g) Look at these numbers and explain how they show you whether or not you have obtained a good fit. Use the handout and grab your Tutor.