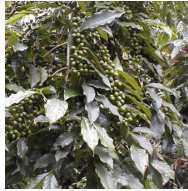


Statistics and Simple Plots



Outline

- Announcements:
 - Homework II: due Wed. by 5, by e-mail
- Cookie Challenge
- Statistics
- Simple plots
- Tutorial 4

Homework II

- myfft.m
 - Inputs:
 - x , t (a signal)
 - Outputs:
 - a , b , (Fourier coefficients)
 - f (Frequencies)
- FourierMat.m
 - Inputs:
 - a , b , f (Fourier coefficients & frequencies)
 - t (a vector of times)
 - Outputs:
 - x (signal at times in t)

Homework Policy

- You may discuss problems sets with others in the class
- BUT--write-up should be done alone

Cookie Challenge

Statistics

- Descriptive
 - summarize properties of data
- Comparative
 - compare data sets
 - test hypotheses

Descriptive Stats

- Most common descriptive stats are in "datafun" toolbox
 - mean, median, min/max, std
 - vectorized, operate on columns
 - Ex: x & y are column vectors with data
 - `m=mean([x,y])`
 - `m(1)=mean of x, m(2)=mean of y`
 - Can force mean to work on rows:
 - `m=mean([x,y],2);%mean along 2nd dimension`

Descriptive Stats

- The descriptive stats functions don't like nans
 - `mean([nan;x])` returns NaN
- The statistics toolbox has `nanmean`, `nanmin`, `nanstd`, etc. that ignore nans
 - Simple to write your own versions

Basic Comparative Stats

- Curve fitting with `polyfit`
 - `coefs=polyfit(x,y,n);%fits n-th order polynomial to data`
 - `[x.^n, x.^n-1,...,x,1]*coefs ~ y`
 - Correlation coefficient (r) with `corrcoef`
 - `r=corrcoef([x,y]);`
 - `r=[r(x,x), r(x,y); r(y,x), r(y,y)]`
 - will also return probability

“Advanced” Comparative Stats

- Statistics toolbox has functions for
 - statistical distributions
 - parameter estimation
 - statistical tests
- A useful function:
 - regress--like polyfit, but get stats (p, R2)
 - Fits any linear model (anything you can write as a matrix-vector product
 - $b = \text{regress}(y, X)$ finds b s.t.
 - $X*b \sim y$

Fitting Polynomials with \

- x, y are (column) vectors of observations
 - $X = [x.^3 \ x.^2 \ x.^1 \ x.^0]; \%matrix$
 - If we know b :
 - $y = X*b$;
 - Instead, we know y :
 - $b = X \setminus y$
 - Matrix division--Matlab computes the inverse of the matrix
 - \setminus is very smart--can deal with a variety of matrices in a very intelligent manner.

Summary of Matlab Stats

- Matlab has basic stats built-in
- Can expand with the stats toolbox
- Most statistical tests are easy to program
 - Can program Matlab to deal with your data!
 - look for vector-products!

Simple plots

- Plot 1D functions (2D data) with plot
 - plot(x,y) plots (x,y) with a blue line
 - plot(y) is plot([1:length(y)],y)
 - plot(x,[y1,y2,y3]) plots (x,yX) each in a different color

Customizing plot

- plot(x,y,'r') is a red line
- plot(x,y,'o') plots circles rather than lines
- plot(x,y,'p') plots yellow pentagrams
- Type help plot to get more options

Specialized 1D graphics

- bar--bar chart
- pie--pie chart
- polar--polar coordintes
- semilogy, semilogx, loglog--plotting with log-scales

2D basics

- Assume data Z is on a regular grid defined by X and Y
- pcolor, imagesc, contour plot in 2D
- surf, mesh plot in 3D (perspective)

2D basics

- 2D graphics use colors to represent data
- Color of z is defined by a colormap and caxis
- several built-in colormaps--help graph3d
- Used in Lecture 01

Generic graphics functions

- xlabel, ylabel, title label your plots
- hold on--allows multiple plots on same axes
- clf clears the figure window
- axis([xmin,xmax,ymin,ymax]) controls axis limits

Multiple plots

- subplot(m,n,j) creates the jth plot in an m-by-n matrix of plots

n=col

	1	2	3	4
m=row	1	2	3	4
	5	6	7	8
	(row-1)*n+col	10	11	12

Axes & Figures

- Matlab plots into figures
 - figure(n) makes n the current figure or creates a figure numbered n
- Figures contain axes
 - If no axes exist in current figure, then any graphics call will create one
 - Can explicitly create with subplot or axes

Printing figures

- print will send(gcf to printer (or use GUI)
- print -depsc fname.eps will save graphics in EPS format
- print -djpeg fname.jpg will save into JPG format

Summary of Matlab Graphics

- Matlab has most standard plots built in
- Also has advanced tools for visualization of high dimensional data
 - colors, light, isosurfaces, slices
- The best thing about Matlab graphics are that they can be programmed
 - put graphics statements in functions for display or debugging
- Take CIS 402!

Tutorial 4: Temp. on NW Atlantic Shelf

- Data consist of yearly mean temperatures between 150-250m depth from 4 locations on NW Atlantic Shelf:
- Are the temp's independent?
- Practice working with data, simple stats and graphics

