Bayesian Stats Course

Day 1 - 5/20/13

Tom Introduction

* Design-based inference traditional

Kiona

* In this course, “stochastic” will be used as something that is unknown (not in the traditional theoretical ecology context of randomness).
* So stochastic and random will be used interchangeably
* When start out – want to use priors that are *uninformative*  - as uninformative as possible. But as go forward, want to use informative priors (from posteriors of past studies).
  + First example – want uninformative to see that it matches the maximum likelihood.
* If no prior information – want to use max likelihood – but still have to make a choice of the probability distribution that is informed.

Break: Wei – student Jennifer Frey applied for GIS position

Maria

* Deterministic models

Lab 1 –

Exercise 2: Formulate a model of carbon balance in the forest floor

Carbon enters the forest floor at a constant rate, *L*

Carbon leaves through 2 routes, respiration and humification

Day 2 - 5/21/13

Maria

* There is the process model, the deterministic model (the scientific model), and the probability model.
* Use the MLE of parameters to generate fake data and see how well it matches to the observed data.

Day 3 - 5/22/13

Review of questions:

Priors in likelihood:

* Edwards 1992 Likelihood. John Hopkins University Press. (seminal book on the topic)
* Pawitan 2001. In All Likelihood: Statistical Modeling and Inference Using Likelihood.
* Miller, Hobbs, and Tavener 2006: Dynamics of prion disease transmission in mule deer. Eco App 16:2208-2214
* Also see hemlock light example posted on web. Alpha has prior information.

Definition of likelihood: P (y|theta) = cL (theta|y)

* In many texts, the c is no longer there – it doesn’t necessarily matter what c is – declare it to be 1. You will occasionally see a likelihood profile where the peak is equal to 1. Don’t know the area unless you know the units on the x axis. So the c allows for rescaling.

Joint probability? distribution

* Not a joint probability – it’s a joint distribution - a probability density function
* It doesn’t become a probability until you normalize it because then it sums to one
* For continuous data, probability is only defined over an interval. Probability density function returns probability density – therefore to get a probability you need to define an interval (bc it’s a density). Only discrete probability mass functions will return a probability because the interval is defined.
* In the likelihood framework – we use probability density and probability in the same way because of the existence of c.

Disjoint vs. independent?

* When a and b are conditional – the prob of b given a is the intersection divided by a
* When a and b are independent – the knowledge that a has happened gives us no knowledge of b. Therefore the probability of b given a is just the prob of b (B/Sample space).
* When a and b are disjoint – then the prob of b given a is 0.

Dispersion of data in likelihood and in data was different in yesterday’s lab

* The distribution of the parameter will be narrower than the distribution of the data from which the parameter is estimated.

Have been traditionally taught:

* Yi = g(theta, x) + ei, where ei is normal (0, sigma^2)
* What goes into ei? All of the uncertainty including our sloppy job of sampling.

Support –

* The space where the random variable lives.
* The formal definition is the log of the ratio of the likelihoods or the difference between the log likelihoods

Likelihood

* The point of likelihood is the pick the value of the parameter that maximizes the likelihood of seeing the data.

5/23/13

JAGS

**\*\*\*\*You may not put a derived quantity into the coda list if you want to use the Gelman statistic.**

They must include only the parameters – no derived quantities – if you want to use the Gelman

5/27/13

Violin plots

Package = vioplot

Function = vioplot with the window function

Or

UsingR

Violinplot()

5/31/13

Acknowledge: DEB 000347455

Books:   
1. Gelman and Hill 2009 – Data analysis using regression and multilevel/hierarchical models. (black book)

Review paper: Ogle and Barber 2008 Progress in Botany 69

Gelman et al. 2004 Bayesian Data Anlaysis. Chapman and Hall/CRC, London (red book)