Introduction to Applied Bayesian Modeling

ICPSR

Day 3

Are we all Bayesians?

- Bayesian modeling treats probability in the way we naturally think about probability.

- Not reliant on asymptotic properties to make inferences about quantities of interest.

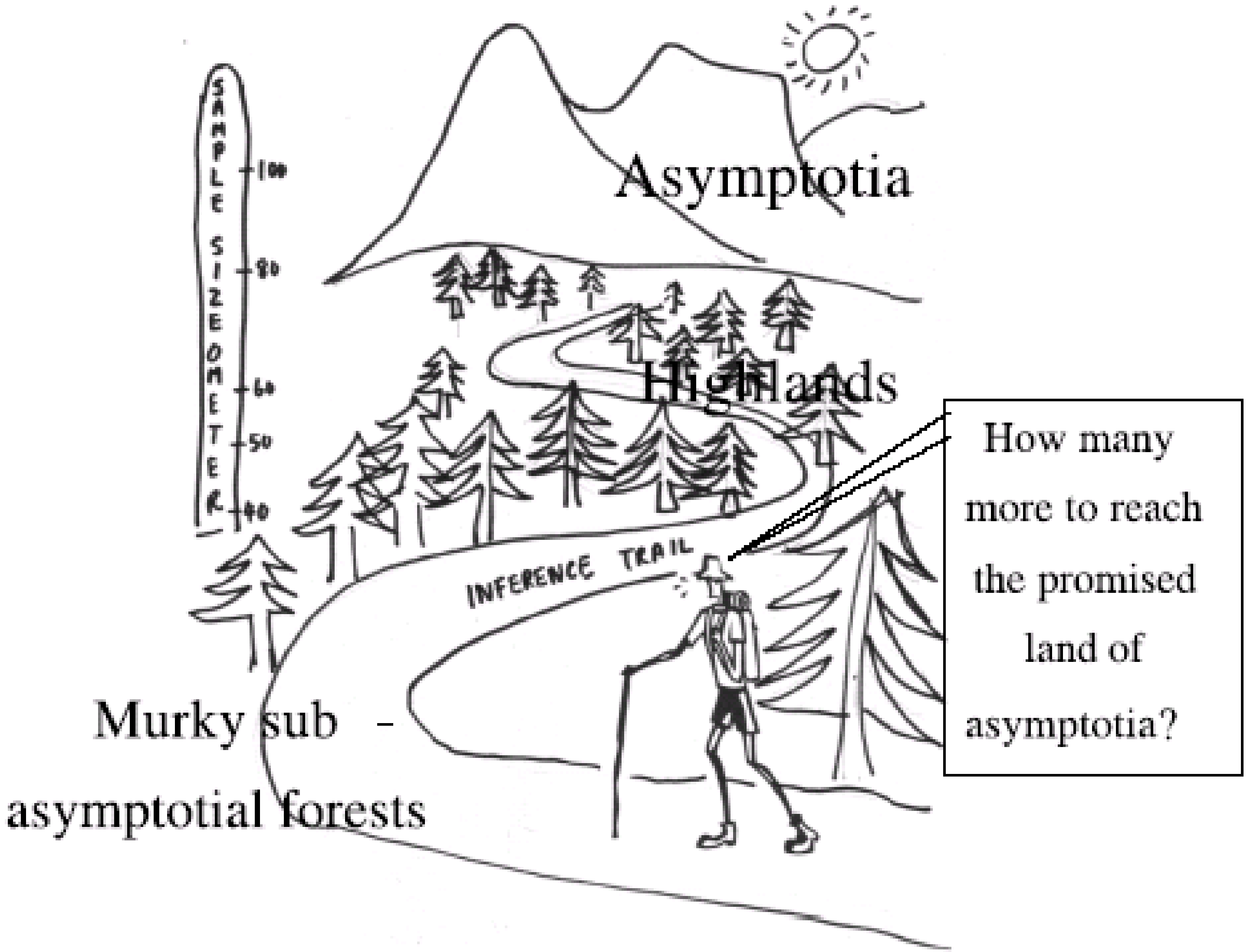

Figure 2. How large a sample is needed to reach the land of asymptotia?

- We don’t replicate our data (usually)
- The data, once collected, are fixed.
- The parameter(s) are the random quantities.

    --we use priors to specify our uncertainty about these quantities.

- We summarize results with distributions rather than point estimates.

- This makes good sense in that we often think in terms of distributions.

Thinking with Distributions

- Think about moving to a new city and getting a new job.

- How do you plan your commute to work?
  - You may know how far you live from work
  - You may know the speed limit on the roads.
  - BUT…

- It may take longer to get to work than you planned.
- So…you update your information.
- Maybe you find a shortcut…

Expedia
Microsoft MapPoint
LAKE
60
12
53
Deer Park
Lake Cook Rd
End
I L L I N O I S
Forest Preserve
59
14
68
12
N Hicks Rd
N Quentin Rd
Inverness
C O O K
Start
S Barrington Rd
Hoffman Estates
W Palatine Rd
14
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or, an alternative mode of transport

Thinking with distributions…

- Or, maybe you leave at a different time

Regardless, you realize that on any given day, it may take longer or shorter to get to work.

How often have you said, “it depends on traffic” ?

updating

- As just discussed, we also update our beliefs as we collect new data.
- The highway is for suckers, so I take the helicopter.
- We’ve been updating since we were first aware of our surroundings.
- Ever touch a hot stove?
- Did you do it again?

The world’s first Bayesian?

Time for some chalk…

- Now we'll combine a prior and a likelihood to derive a posterior.

- You MUST internalize the following:

$$\mathrm{P}(\theta|X) \propto p(\theta)L(\theta|X)$$

The posterior is proportional to the prior times the likelihood

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- Pay attention now as this example will help you GREATLY in doing your homework.

- I mean it….