

Model-Based Inference of Phylogeny: Overview

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Statistical Estimation of Phylogeny: An Outline

Generic statistical paradigm

pose a substantive question

develop a stochastic model with parameters that, if known, would answer the question

collect observations that are informative about model parameters

find the best estimate of model parameters (by some means) conditioned on (*i.e.*, given) the data at hand

Statistical phylogenetic paradigm

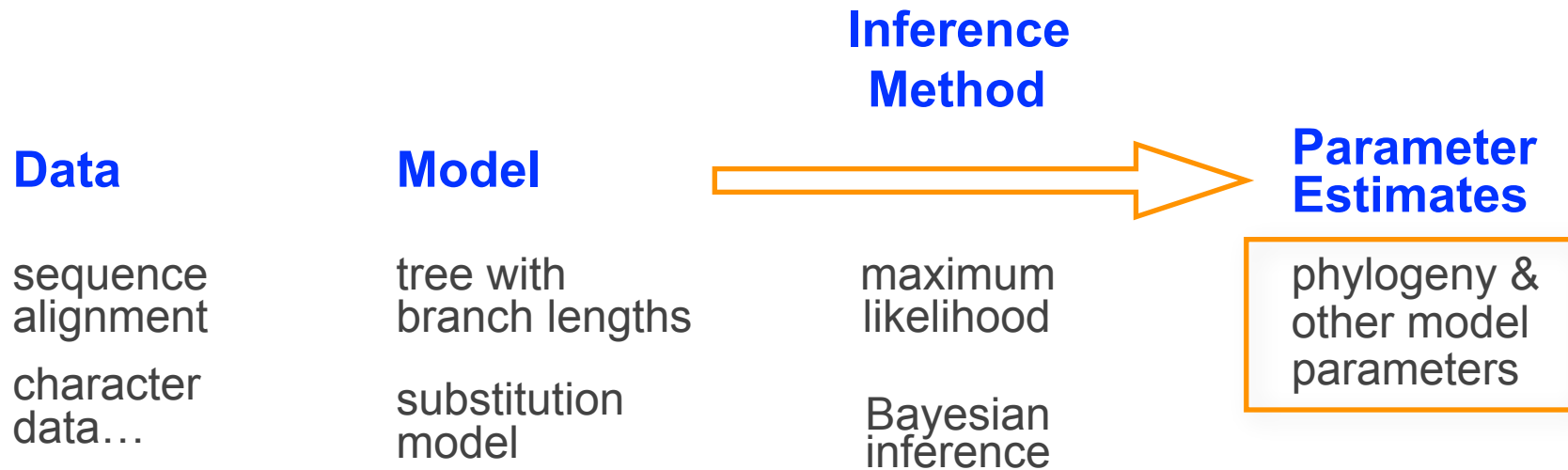
what is the phylogeny of my study group?

develop a phylogenetic model with a tree (and branch lengths) and a Markov model describing how traits change over the tree

assemble a data matrix (*e.g.*, of DNA sequences) sampled from members of your study group

find the best estimate of phylogeny (and other model parameters) using a likelihood-based method (maximum-likelihood or Bayesian inference)

Statistical Estimation of Phylogeny: An Outline



Statistical Estimation of Phylogeny: Course Goals

Why we are here

Develop a strong intuition for the theory of statistical phylogenetic methods
demystify principles of statistical inference and phylogenetic models

Develop skills to apply phylogenetic methods

how to perform common analyses under common phylogenetic models
how to specify models that are well suited to your specific questions

Statistical Estimation of Phylogeny: Curriculum

Develop
Question

Collect
Data

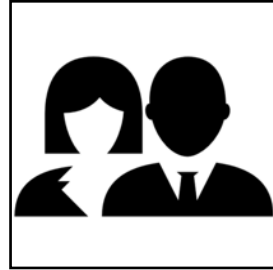
Align
Data



You!



You!



You!

Statistical Estimation of Phylogeny: Curriculum

Sunday: Introduction to phylogenetic models and RevBayes



Basic probability concepts

CTMC

Likelihood computation

John Huelsenbeck

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Sunday: Introduction to phylogenetic models and RevBayes



Graphical models
Introduction to RevBayes
How to specify models using Rev

Sebastian Hohna

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Sunday: Introduction to phylogenetic models and RevBayes



MCMC

assessing MCMC performance

Brian Moore

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Monday: Model specification



Model selection/hypothesis testing
Model adequacy

Bob Thomson

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Tuesday: Divergence-time estimation



Relaxed-clock models

Brian & Mike May

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Tuesday: Divergence-time estimation

Calibrating divergence times



John Huelsenbeck



Sebastian Hohna

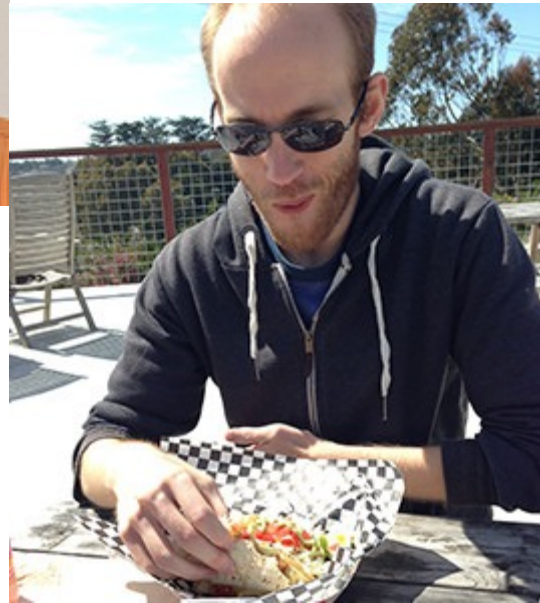
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Wednesday: Evolution of continuous characters

Diffusion models



Peter Wainwright



Mike May

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Thursday: Evolution of discrete characters



CTMCs

Michael Landis

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Thursday: Evolution of geographic range



Biogeographic models

Michael Landis

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Friday: Lineage diversification



Sebastian Hohna

Branching-process models
State-dependent models



Mike May

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Saturday: Project presentations!



You!

Statistical Estimation of Phylogeny: RevBayes

Why RevBayes?



Transparency

Flexibility

Modularity

Nice features

*But please ask if you are interested in other software

RevBayes!