

STATS 700-002 Class 10.  
Variational phylodynamic inference

Aaron King and Edward Ionides

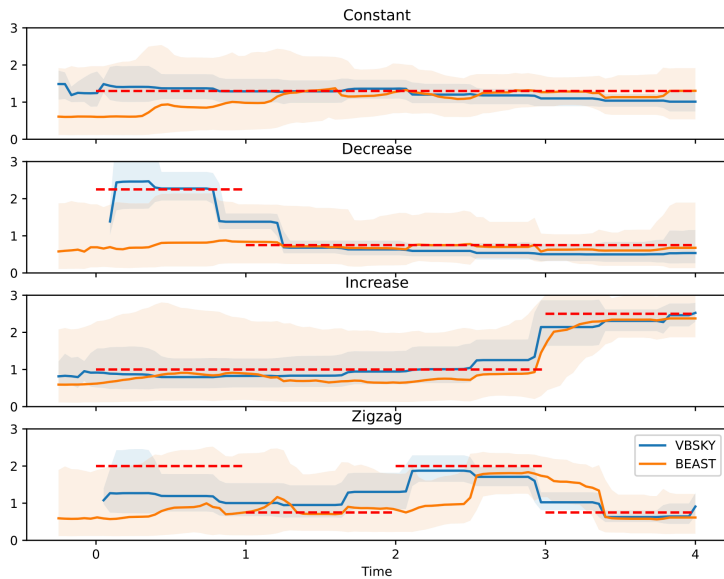
October 30, 2025

## Outline

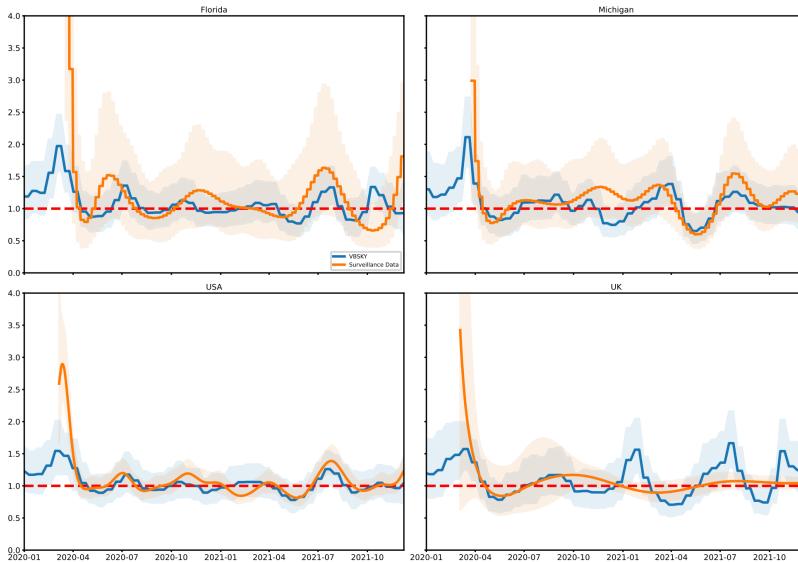
Ki, & Terhorst (2022). Variational phylodynamic inference using pandemic-scale data. *Molecular Biology and Evolution*, 39(8), msac154.

<https://doi.org/10.1093/molbev/msac154>.

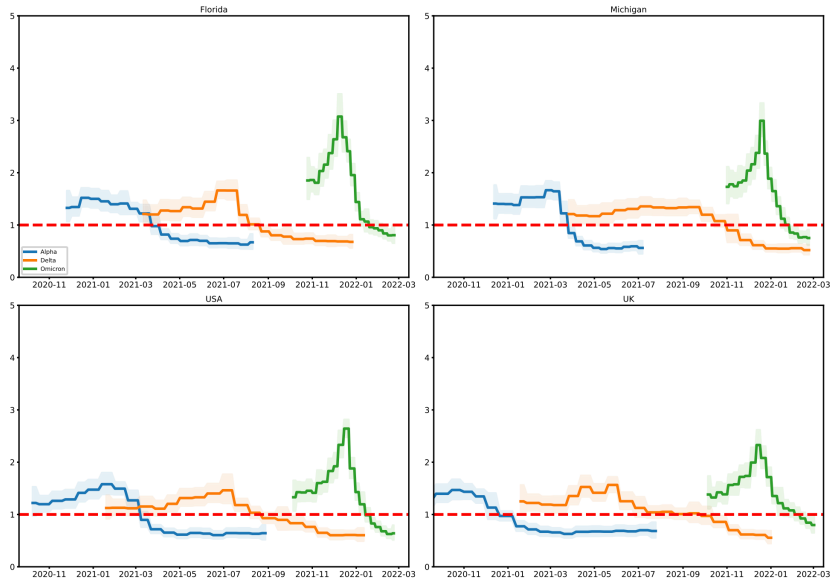
1. How is variational inference applied to phylodynamic models?
2. The role of automatic differentiation.



**FIG. 1.** Median of the medians and the equal-tailed 95% credible intervals of the posteriors of the effective reproductive number over time of the 10 simulations for each scenario using VBSKY and BEAST. The dotted line is the true effective reproductive number over time.



**FIG. 2.** Posterior of  $R$  for Florida, Michigan, and the USA using biased sampling and a strong prior on  $s$ . For each method the posterior median and equal-tailed 95% credible interval are shown. The dotted line is  $R = 1$ .



**FIG. 3.** The posterior median and equal-tailed 95% credible interval of  $R$  for the Alpha, Delta, Omicron variants.