Simulation Journal for the *augSIR* package

August 1, 2015

7/24/2015 - Simulations to assess the effect of population size and binomial sampling probability on mixing

Simulation parameters

- Population size: 50, 100, 150, 200, 300, 400, 500
- R_0: 2, 5, 10
- ρ : 0.05, 0.2, 0.5
- $\beta = \frac{R_0}{\text{population size}}$, $\mu = 1$
- Census interval = 0.2
- Three initializations for each scenario, diffuse priors for model parameters

Measures of interest

- Proportion of proposed trajectories accepted
- Posterior distributions of model parameters
- Complete data log-likelihood

Summary of results

- In small populations (50-200ish) the mcmc mixed well and all three initializations settled around roughly the same log-likelihood. The parameters were better recovered in smaller populations.

- In larger populations, the chains mixed poorly and were stuck in different modes of the likelihood.

Next steps and other notes

- It was thought that the priors, while perhaps appropriate for each parameter separately, could jointly pull the value of R_0 away from the true value. Will explore reparameterizing the model in terms of R_0 and sampling parameters using M-H.

- Will run simulations to determine if problems persist with parameters fixed at the true values.

- Will include posterior samples of R_0 in future simulations.

7/30/2015 - Simulations to assess overshooting behavior with fixed parameters

Simulation parameters

- Population size: 50, 150, 300

- R_0: 4, 8

- ρ : 0.1, 0.4

- $\beta = \frac{R_0}{\text{population size}}$, $\mu = 1$

- Census interval = 0.05, 0.2

- Ten different initializations for each scenario

Measures of interest

- Correspondence between true trajectory and augmented population level trajectories

Summary of results

- Overshooting behavior is more apparent in larger populations, and when the observation times are further apart from one another.

Next steps and other notes

- The fact that observation times and population size lead to overshooting behavior suggests that the method is sensitive to the amount of missing data.
- Will run Geweke style simulations alternating between simulating X—Y and Y—X, to compare the distribution of X via our method to the distribution of X simulated via Gillespie.

7/30/2015 - Simulations to assess whether reparameterizing model in terms of R0 affects parameter posteriors

Simulation parameters

- Population size: 50, 150, 300
- R_0: 4, 8
- ρ : 0.1, 0.4
- $\beta = \frac{\mathrm{R}_0}{\text{population size}}$, $\mu = 1$
- Census interval = 0.05, 0.2
- Three initializations for each scenario. $\log R_0 \sim N(0, 1.8)$, diffuse priors for other parameters.

Measures of interest

- Posterior distributions of model parameters
- Overshooting behavior of latent trajectories

Summary of results

- Parameters are better recovered than in naively parameterized model.
- There is generally upward bias in R_0.
- Latent trajectories still overshoot the true trajectory.