

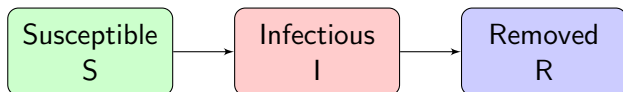
A Spatio-Temporal Infectious Disease Model in the Presence of Uncertainty from Multiple, Imperfect Diagnostic Tests

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Background

- Individual Level Models (ILMs) are used to study infectious disease dynamics while incorporating individual level characteristics
- ILMs are more realistic models of disease transmission
- ILMs use ideas from standard compartmental modeling (e.g. SIR, SEIR, SIS)



- Current infectious disease models assume all individuals that test positive on one or more diagnostic(s) are infected
- Diagnostics tests are not perfect, but their accuracy can be characterized by their sensitivity and specificity

Proposed Model

- Our proposed model seeks to incorporate diagnostic testing information into the ILM framework
- We incorporate data models on the testing mechanism (whether or not an individual is tested) and the test results
- We assume there are infectious individuals that are not tested, and of those tested there are false positives
- The model is formulated in the Bayesian hierarchical framework, and computation of the posterior is done via MCMC methods
- The model is motivated by a mumps outbreak in Iowa from 2006

| Serum | Swab | | | Total |
|----------|----------|----------|---------|-------|
| | Positive | Negative | No Test | |
| Positive | 72 | 898 | 378 | 1348 |
| Negative | 114 | 0 | 0 | 114 |
| No Test | 35 | 0 | 0 | 35 |
| Total | 221 | 898 | 378 | 1497 |