Mathematical Biology Seminar

Monday, March 4, 2024

3 pm MDT - 457 CAB (in person)

Join Zoom Meeting

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Reproductive value, prevalence, and perturbation theory of Perron vectors

In a linear population model that has a unique "largest" eigenvalue and is suitably irreducible, the corresponding left and right (Perron) eigenvectors determine the long-term relative prevalence and reproductive value of different types of individuals, as described by the Perron-Frobenius theorem and generalizations. It is therefore of interest to study how the Perron vectors depend on the generator of the model. Even when the generator is a finite-dimensional matrix, there are several approaches to the corresponding perturbation theory. We explore an approach that hinges on stochasticization (re-weighting the space of types to make the generator stochastic) and interprets formulas in terms of the corresponding Markov chain. The resulting expressions have a simple form that can also be obtained by differentiating the renewal-theoretic formula for the Perron vectors. The theory appears well-suited to the study of infection spread that persists in a population at a relatively low prevalence over an extended period of time, via a fast-slow decomposition with the fast/slow variables corresponding to infected/non-infected compartments, respectively.
This is joint work with MSc student Tareque Hossain.

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