Approximating the Fisher Information for a Partially-Observable Growing Population

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In this presentation, we deliver our theoretical and numerical results on the Fisher Information for the birth rate of a partially-observable simple birth process involving n observations. Our goal is to estimate the rate of growth, λ, of a population governed by a simple birth process. We may choose n time points at which to count the number of individuals present, but due to detection difficulties, or constraints on resources, we are able only to observe each individual independently with fixed probability p. We discuss the optimal times at which to make our n observations in order to maximize the Fisher Information for the birth rate λ. Finding an analytical form of the Fisher Information in general appears intractable. Nonetheless, we find a very good approximation for the Fisher Information by exploiting the probabilistic properties of the underlying stochastic process. Both numerical and theoretical results strongly support the latter approximation and confirm its high level of accuracy.