

University of California, Irvine
Statistics Seminar Series

COMBINING MULTIPLE SOURCES OF INFORMATION TO ESTIMATE THE PROBABILITY OF A RARE EVENT: FROM INSECTIVORY TO MUTATION

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I discuss two examples of incorporating auxiliary information to improve the estimation of the probability of a rare event. The first concerns the probability that an insectivorous plant, *Darlintonia californica*, will capture a visiting wasp. The traditional estimate, based on watching plants for many hours and counting the number of visits and the number of captures, is not very precise. There is additional data on the total number of captures in a set time period, but the number of visits is unknown. I develop a model to combine the two sources of information. When the capture probability is close to zero, using multiple sources of information greatly reduces the variance. The model is then extended to incorporate covariates.

The second example concerns the mutation probability of the PRRS virus in repeated passages through pigs. Mutations are identified by DNA sequencing, which is expensive. In the motivating study, only 15 viruses are sequenced per passage. One consequence is that a mutation may go extinct before it is detected. I develop a Bayesian hierarchical model for the appearance, growth, and disappearance of mutations. This is used to estimate the marginal distribution of the probability of detecting a mutation. At one passage, a mutation is likely to be missed. However, because mutations are likely to persist for multiple passages, the probability of failing to detect a mutation is small. Correction for non-detection increases the estimated mutation rate by about 4%.

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