The University of Montana

MATHEMATICAL SCIENCES

Doctoral Dissertation Defense

"Comparison of Trend Detection Methods"

by

Kathy Gray

Trend estimation is important in many fields, though arguably the most important applications appear in ecology. Trend is difficult to quantify; in fact, the term itself is not well-defined. Often, trend is quantified by estimating the slope coefficient in a regression model where the response variable is an index of population size, and time is the explanatory variable. Linear trend is often unrealistic for biological populations; in fact, many critical environmental changes occur abruptly as a result of very rapid changes in human activities. My PhD research has involved formulating methods with greater flexibility than those currently in use.

Penalized spline regression provides a flexible technique for fitting a smooth curve. This method has proven useful in many areas including environmental monitoring; however, inference is more difficult than with ordinary linear regression because so many parameters are estimated. My research has focused on developing methods of trend detection and comparing these methods to other methods currently in use. Attention is given to comparing estimated Type I error rates and power across several trend detection methods. This was accomplished through an extensive simulation study. Monte Carlo simulations and randomization tests were employed to construct an empirical sampling distribution for the test statistic under the null hypothesis of no trend. A likelihood ratio test for trend was shown to be more powerful than other methods for detecting trend.

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