VIRGINIA TECH DEPARTMENT OF STATISTICS COLLOQUIUM

BAYESIAN HIERARCHICAL MODELING TO QUANTIFY UNCERTAINTY AMID MULTIPLE COMPUTER MODEL RUNS

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IN-PERSON SEMINAR

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Abstract

In the face of spatially correlated data, Gaussian process regression is a common modeling approach. However, when a computer model provides a complete grid of forecasted values with unknown error, standard kriging will not apply. To develop an approach to quantify uncertainty of computer model output in this setting, we leverage information from a collection of computer model runs (e.g., historical forecast and observation pairs for tropical cyclone precipitation) through a Bayesian hierarchical framework. This allows us to combine information and account for the spatial correlation within and across computer model output. Using maximum likelihood estimates and the corresponding Hessian matrices for Gaussian process parameters, these are input to a Gibbs sampler which provides posterior distributions for parameters of interest. These samples are used to generate predictions which quantify uncertainty for a given computer model run (e.g., tropical cyclone precipitation forecast). Extensions using deep Gaussian processes in the context of cosmological computer simulations are also introduced.

Bio

Stephen A. Walsh is a PhD candidate in the Department of Statistics at Virginia Tech. He has research interests in Bayesian hierarchical modeling, Gaussian processes and spatial statistics. His applications are motivated by problems in environmental science and cosmology. Most recently, his work has focused on developing statistical methods to leverage information across multiple computer model output for purposes of uncertainty quantification using deep Gaussian processes.