Colloquium Series

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Genetic Algorithm Applications of Gaussian Process Kernels toward Mortality Surface Inference

Abstract: We develop a flexible Gaussian Process (GP) framework for learning the covariance structure of Age- and Year-specific mortality surfaces. Utilizing the additive and multiplicative structure of GP kernels, we design a genetic programming algorithm to search for the most expressive kernel for a given population. Our compositional search builds off the Age-Period-Cohort (APC) paradigm to construct a covariance prior best matching the spatio-temporal dynamics of a mortality dataset. We apply the genetic algorithm (GA) both on synthetic case studies to validate the ability of the GA to recover APC structure, and on real-life national-level mortality datasets from the Human Mortality Database. Our machine-learning based analysis provides novel insight into the presence/absence of Cohort effects in different populations, and into the relative smoothness of mortality surfaces along the Age and Year dimensions. Our modeling work is done with the PyTorch libraries in Python and provides an in-depth investigation of using GAs to aid in compositional kernel search for GP surrogates.

Keywords: Genetic Algorithm, Gaussian Process, Mortality Surface, Machine-Learning based Analysis.

Wednesday, March 8, 1:05 − 1:50 pm in 4-1-314