## **Statistics Former Student Network (SFSN)**

Texas A&M University Webinar Series



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# NEW CLASSES OF MULTIVARIATE COVARIANCE FUNCTIONS



### **ABSTRACT:**

Multivariate spatial fields arise in many applications, including environmental monitoring, geology, finance, and medical imaging. One common approach to modeling multivariate spatial fields is to assume a multivariate Gaussian process, which is characterized by a mean vector and a covariance matrix. The covariance matrix of a multivariate spatial field contains the pairwise covariances between all pairs of variables at all pairs of spatial locations. To represent a valid covariance structure of a random vector, a valid covariance matrix must satisfy certain properties.

We introduce parametric families of covariance functions that offer flexibility, computational efficiency, and interpretability, including Matern, power exponential, and Cauchy. While we published results on the multivariate Matern in 2006, the valid representations for the other two families have remained an open problem for over 15 years. In this talk, we focus on the Cauchy family, which enables the simultaneous modeling of long-range and short-range dependence.

We introduce a valid parametric family of cross-covariance functions for multivariate spatial random fields, where each component has a covariance function from the Cauchy family. We present conditions on the parameter space that result in valid models with varying degrees of complexity, and discuss practical implementations, including parameterizations to reflect these conditions. We demonstrate the performance of our approach in terms of estimation and co-cokriging through various Monte Carlo simulation experiments. Finally, we illustrate the application of the proposed multivariate Cauchy model on a dataset from the field of Satellite Oceanography.

BIO: Dr. Tatiyana (Tanya) Apanasovich is an Associate Professor of Statistics at George Washington University. She earned her Ph.D. in Statistics from Texas A&M University in 2004, under the advisement of Dr. Raymond J. Carroll. Prior to joining the George Washington University in 2012, she held positions at Cornell and Thomas Jefferson Universities. Dr. Apanasovich's research interests include functional data analysis, statistical genetics, measurement error modeling, and spatial statistics. Her research has been funded by the National Instute of Health and the National Science Foundation.

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Online webinar only. No meeting room.

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