



THE UNIVERSITY OF GEORGIA  
DEPARTMENT OF STATISTICS

## *Colloquium Series*

4/5/2024

4:00 PM, Room 204, Caldwell Building

### **Bimal Sinha**

UMBC Presidential Research Professor

#### **Confidence ellipsoids of a multivariate normal mean vector based on noise perturbed and synthetic data with applications**

We discuss at length the problem of constructing a confidence ellipsoid of a multivariate normal mean vector based on a random sample from it. The central issue at hand is the sensitivity of the original micro data and hence the data cannot be directly used/analyzed. We consider a few perturbations of the original data, namely, noise addition and creation of synthetic data based on the plug-in sampling (PIS) method and the posterior predictive sampling (PPS) method. We review some theoretical results under PIS and PPS which are already available based on both frequentist and Bayesian analysis and derive the necessary results under noise addition. A theoretical comparison of all the methods based on expected volumes of the confidence ellipsoids is provided. A measure of privacy protection (PP) is discussed and its formulas under PIS, PPS and noise addition are derived, and the different methods are compared based on PP. Applications include 1) analysis of a publicly available bivariate dataset from the most recent Annual Social and Economic Supplement (ASEC) conducted by the US Census Bureau in 2023, and 2) analysis of a trivariate renal dataset.

#### **About the Speaker**

Professor Sinha is the Founder of the Statistics Graduate Program at UMBC. A 1973 PhD in statistics from the University of Calcutta/India, Professor Sinha is an ex-faculty of the Indian Statistical Institute and the University of Pittsburgh. A Professor of Statistics at UMBC since 1985, Professor Sinha's research activities span topics in theoretical and applied statistics, including multivariate analysis, linear models, ranked set sampling, environmental statistics, statistical meta-analysis, and data analysis under confidentiality protection. He has co edited several volumes, and co authored four books (John Wiley, Springer, Academic). He is a Fellow of the American Statistical Association and the Institute of Mathematical Statistics, and an elected member of the International Statistical Institute. His research has been funded by the US Environmental Protection Agency for about twenty years. Professor Sinha's research contribution in the area of environmental statistics has been recognized through a Distinguished Achievement Award from the Environmental Statistics Section of the American Statistical Association. In acknowledgment of his research productivity, Professor Sinha was named a Presidential Research Professor in 2008. Furthermore, he received the University System of Maryland Board of Regents Excellence in Research award in 2012. Professor Sinha has served on the editorial board of several national and international statistics journals, and mentored over 35 PhD students.



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