Bayesian Clinical Trial Designs and Their Implementation
June 3, Full day; Hybrid

Instructor:
Dr. Ying Yuan, Bettyann Asche Murray Distinguished Professor and Deputy Chair in the Department of Biostatistics at University of Texas MD Anderson Cancer Center
Dr. Yong Zang, Associate Professor in the Department of Biostatistics and Health Data Science at Indiana University

This course covers Bayesian clinical trial designs for early phase trials, including phase I dose-finding trial designs, with a focus on model-assisted designs and dose-finding design for dose optimization. It also covers phase II trial designs, including Bayesian optimal phase II design, biomarker-based designs, and basket and platform trial designs.

Spatial Data Science Using R
June 3, Full day; Hybrid

Instructor:
Dr. Paula Moraga, Assistant Professor of Statistics at King Abdullah University of Science and Technology (KAUST) and Principal Investigator of the GeoHealth group

This course covers statistical methods, modeling approaches, and visualization techniques to analyze spatial data using R. We will also learn how to create interactive dashboards and Shiny web applications. Topics covered include areal, geostatistical, and point pattern data, R packages for retrieval, manipulation and visualization of spatial data, and Bayesian spatial models using INLA and SPDE.
Introduction to the Analysis of Neural Electrophysiology Data
June 3, Half day - AM Session; Hybrid

Instructor:
Dr. Uri Eden, Professor of Mathematics and Statistics and director of the Statistics program at Boston University
Dr. Mark Kramer, Professor of Mathematics and Statistics and associate director of the Center for Systems Neuroscience at Boston University

This course covers fundamental concepts and techniques for analyzing electrophysiological data from the brain, including spike train and LFP data. Topics include spike sorting, receptive field modeling, latent process models, neural decoding, spectral estimation, and coherence analysis. This course also provides modeling foundations for a succeeding short course on Advanced Method for the Analysis of Neural Electrophysiology Data.

Advanced Topics in the Analysis of Neural Electrophysiology Data: Decomposing Rhythmic and Broadband Components
June 3, Half day - PM Session; Hybrid

Instructor:
Dr. Emily P. Stephen, Assistant Professor of Statistical Neuroscience at Boston University
Dr. Thomas Donoghue, Postdoctoral research scientist in the Department of Biomedical Engineering at Columbia University

This short course will introduce statistical tools to model and decompose neural electrophysiological signals into physiologically informed features of interest, including rhythmic and broadband components. The presenters will present brief lectures on (1) using frequency-domain spectral decomposition to estimate and separate rhythmic peaks from broadband power spectral signatures, and (2) using state space models to capture time-domain rhythms and their interactions.

Causal Mediation Analysis: The Old and the New
June 4, Full day; Hybrid

Instructor:
Dr. Judith Lok, Associate Professor of Mathematics and Statistics at Boston University
Dr. Ilya Shpitser, John C. Malone Associate Professor in Computer Science at Johns Hopkins University

This short course will introduce and compare different approaches to causal mediation analysis. We will argue that pure indirect effects and organic indirect effects relative to “no treatment” are very relevant for drug development. We illustrate the benefits of these approaches by estimating the indirect effect of HIV treatments and COVID-19 treatments that target despr1 neutrophil nets. We will also cover general identification of direct, indirect, and path- specific effects, and present estimation methods, including the influence function-based methods which achieve semiparametric efficiency.
Geometric Methods for Functional and Shape Data Analysis
June 4, Full day; Hybrid

Instructor:
Dr. Karthik Bharath, Professor of Statistics at the University of Nottingham
Dr. Sebastian Kurtek, Professor of Statistics at The Ohio State University

With a focus on decoupling and modelling different sources of variation, this course will present an overview of the use of geometry-driven methods to carry out metric-based statistical analysis of functional data. To demonstrate the broad applicability of the geometric tools, we will ground the mathematical descriptions in concrete statistical tasks arising from various application settings (e.g., biomedical, environmental); these will include amplitude-phase separation and modelling of univariate functions under sparse and dense sampling settings; mean computation, PCA and visualisation of variations of shapes of 2D and 3D curves; classification and regression with functions and curves.

Conformal Inference Methods in Deep Learning
June 4, Full day; Hybrid

Instructor:
Dr. Matteo Sesia, Assistant Professor of Data Sciences and Operations at the University of Southern California (USC) Marshall School of Business, Assistant Professor (by courtesy) of Computer Science at the USC Viterbi School of Engineering

This short course provides a hands-on introduction to modern techniques for uncertainty estimation in deep learning with a focus on conformal inference. Participants will learn how to leverage conformal inference ideas to construct reliable and interpretable uncertainty estimates for the predictions of deep neural network models in both multi-class classification and regression problems. The course also covers techniques for computing conformal inferences that can automatically adapt to possible heteroscedasticity and skewness in the data, addressing fairness issues, and mitigating over-confidence in neural networks.