

**DEPARTMENT OF MANAGEMENT SCIENCE AND STATISTICS
RESEARCH SEMINAR SERIES**

**Friday, Sept. 22
2 – 3 p.m. (CST)**

Virtual meeting: <https://utsa.zoom.us/j/5826540450>



Dr. Chul Moon

Assistant Professor

Southern Methodist University

***“Using Persistent Homology Topological Features to Characterize
Medical Images: Case Studies on Lung and Brain Cancers”***

Abstract

Tumor shape is a key factor that affects tumor growth and metastasis. In this talk, we introduce a topological feature computed by persistent homology to characterize tumor progression from digital pathology and radiology images and examine its effect on the time-to-event data. The proposed topological features are invariant to scale-preserving transformation and can summarize various tumor shape patterns. The topological features are represented in functional space and used as functional predictors in a functional Cox proportional hazards model. The proposed model enables interpretable inference about the association between topological shape features and survival risks. Two case studies are conducted using consecutive 133 lung cancer and 77 brain tumor patients. The results of

both studies show that the topological features predict survival prognosis after adjusting clinical variables, and the predicted high-risk groups have worse survival outcomes than the low-risk groups. Also, the topological shape features found to be positively associated with survival hazards are irregular and heterogeneous shape patterns, which are known to be related to tumor progression.

Bio

Dr. Moon is an Assistant Professor in the Department of Statistics and Data Science at Southern Methodist University. He completed his Ph.D. in Statistics at the University of Georgia in 2018. Research interests focus on Topological Data Analysis, fMRI Data Analysis, Network Analysis, Geophysical Statistics, and Forensic Statistics. He was awarded NIH grant as the PI in 2023 with the proposal on "Topology-based tumor analysis for medical images."