

# A Foray into Topological Learning from an Engineering Perspective

## BIOGRAPHY



Ashis G. Banerjee is an Associate Professor of Industrial & Systems Engineering and Mechanical Engineering at the University of Washington (UW). Prior to joining UW, he was a Research Scientist at GE Global Research and a Postdoctoral Associate at MIT. He obtained his Ph.D. and M.S. in Mechanical Engineering from the University of Maryland (UMD), College Park, and B.Tech. in Manufacturing Science and Engineering from IIT Kharagpur. Dr. Banerjee has published more than sixty five articles on a broad range of research topics spanning predictive analytics, AI-enabled robotics, and smart manufacturing. He has received several honors including the 2019 Amazon Research Award, 2012 Most Cited Paper Award from the Computer-Aided Design journal, and 2009 Best Mechanical Engineering Dissertation Award at UMD. He is an elected Senior Member of the IEEE, and serves as a Senior Editor for the IEEE Robotics and Automation Letters.

## ABSTRACT

Topological learning (TL), referring to a synergy of computational topology and machine learning, has recently emerged as an effective pattern recognition framework for noisy, high-dimensional problems. The recognition happens by first identifying the topological structures that encode the shape and connectedness information among the observations (samples), and then characterizing the structures based on their relative persistence over a wide range of spatial and/or temporal scales. In this talk, I will discuss successful demonstrations of TL for challenging 3D shape classification and mobile robot perception problems. Our novel adaptations of TL require substantially less training effort and generalize better than state-of-the-art statistical or deep learning methods. I will conclude by pointing out future research directions.