

Persistent Feature Extraction Using Topological Data Analysis

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Abstract: Topological data analysis (TDA) is rapidly emerging as one of the most general-purpose methods for feature extraction in a variety of predictive data analytics applications. Based on the core idea of characterizing topological structures in noisy and high-dimensional data sets using their persistence information, TDA provides a robust framework to yield suitable features. In this talk, I will discuss several successful demonstrations of this idea for challenging computer vision problems, including multi-way classification of 3D meshes and textured images, visual object recognition by an indoor ground robot, and in-process inspection of composite parts during automated fiber placement. For all these problems, TDA consistently yields a relevant set of features to explain the outcomes in an accurate, compact, and efficient manner. I will conclude by pointing out future research directions.

Bio: Ashis G. Banerjee is an Associate Professor of Industrial & Systems Engineering and Mechanical Engineering at the University of Washington, Seattle. Prior to joining the UW faculty, he was a Research Scientist in the Complex Systems Engineering Laboratory at General Electric Global Research (GEGR). Before joining GEGR, he was a Research Scientist and Postdoctoral Associate at the Massachusetts Institute of Technology. He obtained his Ph.D. and M.S. in Mechanical Engineering from the University of Maryland, College Park, and B.Tech. in Manufacturing Science and Engineering from the Indian Institute of Technology, Kharagpur.

Dr. Banerjee has published more than fifty articles in peer-reviewed journals and conference proceedings. He has received several honors including the 2021 IAOTP Top Engineer of the Decade Award, 2019 Amazon Research Award, 2012 Most Cited Paper Award from the Computer-Aided Design journal, 2009 Best Dissertation Award from the Department of Mechanical Engineering, and 2009 George Harhalakis Outstanding Systems Engineering Graduate Student Award from the Institute for Systems Research at the University of Maryland. His research interests span predictive analytics, autonomous and human-in-the-loop multi-robot systems, and smart manufacturing.