



Department of  
Biomedical Engineering

UNIVERSITY OF WISCONSIN-MADISON

Celebrating 25 Years

Spring 2025  
Seminar Series

# Harnessing Geometry and Topology in Machine Learning for Biomedical Discovery

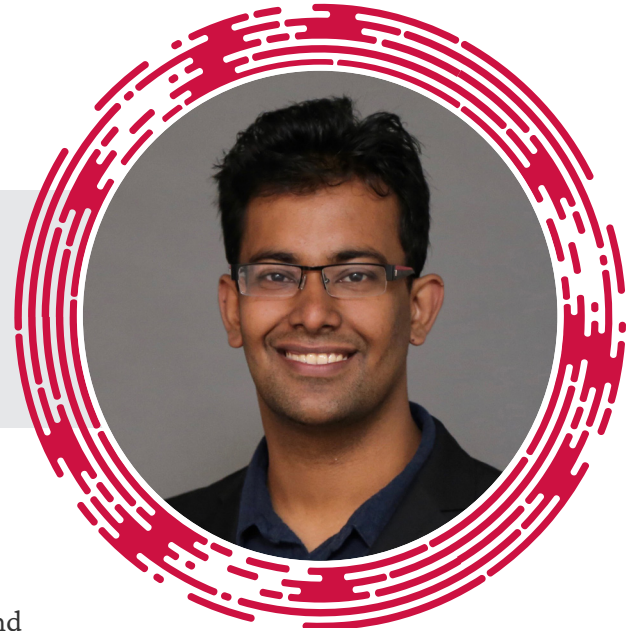
**Dhananjay Bhaskar, PhD**

Postdoctoral Researcher, Yale University

Yale - Boehringer Ingelheim Fellow

Kavli Institute for Neuroscience Fellow

Visiting Scholar in Engineering, Brown University



Understanding the shape of data through geometry and topology offers a powerful perspective with the potential to drive breakthroughs in biomedical science and engineering. This talk explores how these mathematical frameworks, integrated with machine learning, can drive innovation in drug discovery, understanding cellular communication, and unraveling the dynamics of brain activity.

I will introduce learnable geometric scattering, a novel machine learning framework that overcomes the key limitations of conventional graph neural networks. By capturing nuanced structural features, this approach opens new frontiers in drug discovery and protein conformational analysis. Building on this, I will demonstrate how combining geometric scattering with topological data analysis uncovers hidden patterns in cell signaling and neural activity, shedding light on wound healing mechanisms and schizophrenia diagnosis. Finally, I will highlight how these tools can deepen our understanding of learning in artificial neural networks, paving the way for the development of biologically inspired, more expressive, and robust machine learning models.

This talk will emphasize the practical applications of these approaches and their transformative potential for addressing real-world challenges in health and medicine.

## ABOUT the SPEAKER

Dhananjay Bhaskar is a postdoctoral researcher at Yale University and a visiting scholar in Engineering at Brown University. His interdisciplinary research integrates agent-based modeling, geometry, topology, and machine learning to understand in complex systems, from molecular interactions to brain activity. He has been recognized with prestigious fellowships, including the Boehringer Ingelheim Biomedical Data Science Fellowship, the Kavli Institute for Neuroscience Postdoctoral Fellowship, the German Academic Exchange Fellowship for Generative Models in Machine Learning, and the Eric and Wendy Schmidt AI in Human Health Fellowship.

Dhananjay earned his PhD in Biomedical Engineering and Master's in Data Science from Brown University. He completed his undergraduate studies at the University of British Columbia, where he majored in Computer Science and Mathematics. Beyond research, he is an advocate of inclusivity in science, earning the Yale Postdoctoral Association's Outstanding Contribution Award for advancing diversity and professional development initiatives. In his free time, Dhananjay enjoys painting and hiking. His proudest accomplishment is decoding brain activity into visual art, which is now exhibited at Yale's Wu Tsai Institute.

**Monday, February 17 at Noon**  
**1003 Engineering Centers (Tong Auditorium)**

