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12:00-1:00 pm

Biotech Center Auditorium *or* via Zoom:

<https://uwmadison.zoom.us/j/99879638765?pwd=wbtqxoucEFllPVCVc9SFbvKB1Av7Xk.1>

Passcode: 343271

Do You Interpret Your t-SNE Embeddings Correctly? A Perspective from Map-Continuity and Leave-One-Out

Abstract: Neighbor embedding methods such as t-SNE, UMAP, and LargeVis are widely used for visualizing high-dimensional data. A common belief is that these methods serve as nonlinear dimension reduction tools which, similar to PCA, learn low-dimensional manifold structures from the data.

In this talk, I will present evidence to show that this view is inaccurate: the embedding maps of t-SNE, UMAP, and LargeVis can exhibit discontinuity points, leading to unintended topological distortions. A key challenge in analyzing these visualization methods is that the embedding points are obtained by solving highly complicated optimization problems. To address this, I'll introduce the leave-one-out (LOO) surrogate, or LOO-map, which captures the properties of the embedding maps. Our analysis identifies two types of discontinuity patterns: (1) global discontinuities, which promote artificial cluster structures, and (2) local discontinuities, which promotes subclusters. To mitigate these issues, I'll propose two diagnostic pointwise scores that help detect out-of-distribution samples in deep learning and assisting hyperparameter tuning in single-cell data analysis.

This talk is based on a joint work with Zhexuan Liu (3rd-year Stats PhD student) and Rong Ma (Harvard Biostatistics): arXiv:2410.16608.

Bio: Yiqiao Zhong is currently an assistant professor at the University of Wisconsin—Madison, Department of Statistics. His research focuses on the scientific foundations of large language models, including model evaluation, interpretability, adaptation, and theory. Prior to joining UW Madison, Yiqiao was a postdoc at Stanford University, advised by Prof. Andrea Montanari and Prof. David Donoho. Yiqiao Zhong obtained his Ph.D. in 2019 from Princeton University, where he was advised by Prof. Jianqing Fan.

