

# Social Networks and Geometry: Insights for Data Collection and Analysis

**Tyler McCormick, PhD**

**Professor of Statistics & Sociology at the University of Washington**



The study of statistical models of network structure, pursued across numerous disciplines and contexts, is fundamentally challenging because of (often high-order) dependence between connections. A common approach assigns each person in the graph to a position on a low-dimensional manifold. Distance between individuals in this (latent) space is inversely proportional to the likelihood of forming a connection. The choice of the latent geometry (the manifold class, dimension, and curvature) has consequential impacts on the substantive conclusions drawn from the model. More positive curvature in the manifold, for example, encourages more and tighter communities; negative curvature induces repulsion among nodes. Currently, however, the choice of the latent geometry is an a priori modeling assumption and there is limited guidance about how to make these choices in a data-driven way. In this work, we present a method to consistently estimate the manifold type, dimension, and curvature from an empirically relevant class of latent spaces: simply connected, complete Riemannian manifolds of constant curvature. Our core insight comes by representing the graph as a noisy distance matrix based on the ties between groups of nodes: either cliques, or in the case where the researcher observes traits, trait-groups. Leveraging results from statistical geometry, we develop hypothesis tests to determine whether the observed distances could plausibly be embedded isometrically in each of the candidate geometries. The method applies when the researcher observes the full graph and also to empirically relevant cases where only partial data is observed.

**Tuesday, February 20, 2024, 3:30-4:30PM Eastern**

**2308 McGavran-Greenberg Hall**

Zoom Link:

<https://unc.zoom.us/j/94304183888?pwd=SW5kQmJ1bkVVOFN5U2ZiQzR0MThnQT09>

**Meeting ID: 943 0418 3888**

**Passcode: 050276**