Abstracts

Contents

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Smeariness: Central Limit Theorem and Examples

We review the general framework of asymptotic theory based on empirical process theory and highlight how smeariness arises from the properties of the loss function. Heuristically, a flat and broad minima region, characterized by a vanishing second derivative of the loss function, causes smeariness. In the well-studied case of the intrinsic mean, we highlight possible causes of a vanishing second derivative. If time permits, we will introduce the concept of finite sample smeariness, which affects data analysis of finite samples, where smeariness proper does not occur.

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Stephan Huckemann
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Tutorial I: Motivation and Generalized Fréchet Means

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https://ims.nus.edu.sg/wp-content/uploads/2024/10/Stephan-Huckemann_Foundations-of-Statistics-on-Non-Euclidean-Spaces.pdf

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Tutorial II: "Classical" Fréchet Means

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Tutorial III: Some Asymptotics for Generalized Fréchet Means

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Tutorial IV: Some Statistics on Stratified Spaces: Manifold Stability, Stickiness and Smeariness

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Geometric central limit theorems on singular spaces

This tutorial covers geometry and probability of central limit theorems (CLTs) for Fréchet means on singular spaces. Specific topics include metric spaces with curvature bounded above

("CAT(k) spaces"); stratification of these by subspaces that are manifolds; random tangent fields; escape vectors (singular versions of influence functions); continuous mapping theorem for random variables; Gaussians on singular spaces; and various ways of understanding ordinary linear CLTs in ways that enable generalization to singular spaces.

Lecture 1: Overview

Lecture 2: Geometry and measure on CAT(k) spaces

Lecture 3: Shadows and tangential collapse

Lecture 4: Convergence to Gaussian objects

Lecture 5: Singular CLT: proof techniques

The intent is to balance accessibility and depth. Due to the broad range of subject matter, it is not expected that any individual participant will have more than maybe half of the prerequisites. But those with background in probability should be open to learning the relevant geometry, and vice versa.

Ideal background would include basic probability and geometry.

In more detail, helpful probability would be along the lines of random variables taking values in more or less arbitrary state spaces and the ordinary multivariate central limit theorem in a vector space. Helpful geometry includes manifolds, tangent spaces, and exponential maps. Topics that combine probability and geometry, such as pushforward measures, will be especially useful. The tutorial is based on a series of four papers <https://ddec1-0-en-ctp.trendmicro.com:443/wis/clicktime/v1/query?url=http%3a%2f%2farxiv.org%2fabs%2f2311.0945x&umid=aebba303-691a-4fc8-970d-b5b8986a36ab&auth=8d3ccd473d52f326e51c0f75cb32c9541898e5d5-09dd03b8aa5653e814fe923a3389f3b77dabee25> for x = 1, 3, 4, 5, in case participants want to get a head start or see in utmost detail where things are going..

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