Geometric Deep Learning for Inverse Graphics

by

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Abstract

Gometric methods in deep learning try to exploit various geometric features in the modeled phenomena, like curvature or symmetries. This thesis investigates the idea of learning representations in curved spaces for data that does not *explicitly* exhibit features typically associated with curved metric spaces (like hierarchical structures are associated with hyperbolic spaces). Specifically, we develop two convolutional models for hyperbolic embeddings of data, evaluated on image classification and pointcloud classification – although the same method could potentially be useful for segmentation problems, or detection and description tasks. We then discuss the conceptual "type mismatch" of these models, possible amendments, and connections to equivariant neural networks. The major theme in the thesis is pointing out inconsistencies in current methods. Thus we spend some space discussing in explicit differential-geometric language the current state of Riemannian optimization for DL (the mistakes we chose to make in Geoopt) and hyperbolic deep learning.