

Geometric Gaussian Mixture Learning of Surfaces

Probability, Geometry

Topic

A deterministic surface may/can be represented probabilistically by a Gaussian Mixture (GM), providing access to the probabilistic tools and uncertainty measures associated with GMs.

Conventionally, GMs are learned from sampled data using Expectation Maximization (EM), requiring both sampling and an iterative fitting procedure which is slow and is not guaranteed to converge to the global optimum. This project investigates whether the geometry of a surface can instead be used to construct its corresponding GM directly.

Problem

The central question of this project is:

Can a Gaussian Mixture (GM) representation of a surface be constructed directly from its geometry, without sampling and Expectation Maximization (EM)?

The project will investigate geometry-induced Gaussian Mixtures (GMs) for surface representations, including local geometric approximations and their probabilistic interpretation.

Prerequisites

- Firm grasp of Linear/Multilinear Algebra and Analysis
- PYTORCH or an equivalent NUMPY-like framework
- Some exposure to Functional Analysis and Differential Geometry is advantageous

References

- A Geometric Gaussian Mixture Representation of Plane Curves by Ali Darijani, Benedikt Stratmann, Jürgen Beyerer
- Closed-Form Gaussian Mixture Representations of d-Dimensional Triangulated Domains by Ali Darijani, Benedikt Stratmann, Uwe D. Hanebeck, Ratan Bahadur Thapa, Jürgen Beyerer, Nehal Afifi

Contact:

Ali Darijani

ali.darijani@iosb.fraunhofer.de

ali.darijani@kit.edu

ali.darijani@rwth-aachen.de

KIT/Fraunhofer Building 70.16, R124