

Geometric Gaussian Mixture Learning of Curves in $\mathbb{R}^d$

Probability, Geometry

Topic

A deterministic space curve may/can be represented probabilistically by a Gaussian Mixture (GM). Such a representation provides 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 that is slow and not guaranteed to converge to the global optimum.

Problem

The central question of this project is:

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

The project will investigate geometry-induced Gaussian mixtures (GMs) and their ability to represent space curves through local Gaussian approximations.

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

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