

Gaussian Equivalent of Primitive Geometries

Probability, Geometry

Topic

Tessellations and mathematical tilings refer to covering a space using geometric primitives without gaps or overlaps in a certain sense. If uniform probability density functions over primitive geometries can be represented by appropriate Gaussian probability density functions, these representations could be combined into Gaussian Mixtures describing larger geometric structures while retaining useful probabilistic properties.

Problem

Interpret the space occupied by a primitive geometry as a uniformly distributed random variable. The central question is:

What Gaussian distribution best represents a uniform probability density function over geometric primitives under an appropriate dissimilarity measure?

The project will investigate suitable dissimilarity measures and characterize Gaussian equivalents of primitive geometries, with particular interest in representations that can be combined into Gaussian Mixture Models.

Prerequisites

- Firm grasp of Multivariable Integration and Linear Algebra
- PYTORCH or an equivalent NUMPY-like framework
- Some exposure to Monte Carlo Methods and Elementary Geometry is advantageous

References

- 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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