

Algorithms for geometric approximation

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How to represent/process shapes in a computer ?

- ▶ Manufactured objects
- ▶ Natural objects: organs, molecules, cosmic web etc.
- ▶ Abstract shapes: configuration spaces, data analysis

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- ▶ Simplify/speed up algorithms
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What quality guarantees?

- ▶ Sampling theory for shapes
- ▶ Stability of approximations

Course overview

1. Metric structures for point sets
 - ▶ Convex hulls, Voronoi diagrams and triangulations (JDB)
 - ▶ Dimension reduction, approximate nearest neighbor search, k-means algorithm (FC)
 - ▶ Randomized algorithms and core sets (MY)
2. Simplicial approximation of manifolds
 - ▶ Mesh generation by Delaunay refinement (MY)
 - ▶ Restricted Delaunay triangulation and surface mesh generation (JDB)
 - ▶ Reconstruction of smooth manifolds in 3 and higher dimensions (JDB)
3. Geometric inference (F. Chazal)
 - ▶ Sampling theory for compact sets
 - ▶ Persistent homology and data analysis