CS271 Computer Graphics II

Lecture 1

Introduction of Computer Graphics

What is CG?

- Creation, Manipulation, and Storage of geometric objects (modelling) and their images (rendering).

- Display those images on screens or hardcopy devices.

- The overall methodology depends heavily on the underlying sciences of geometry, optics, physics, and perception.

Research Tasks of Computer Graphics

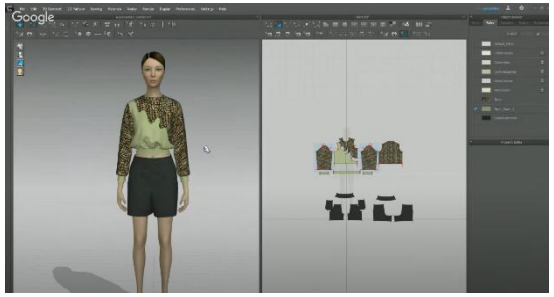
- Geometry
- Modeling
- Generation
- Simulation/Animation
- Image/Video
- Point cloud
- Rendering
- Visualization
- Interaction/VR
- Fabrication
- Sound Graphics
- …

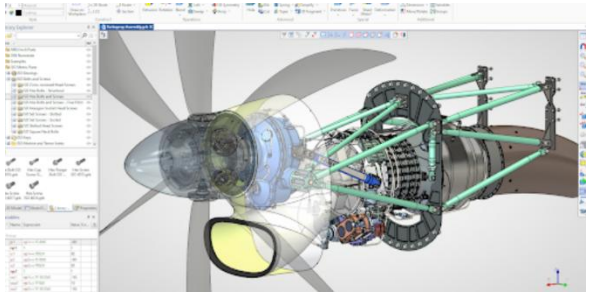
Let's have a Look! 

Technical Papers Preview Trailer
SIGGRAPH 2022
SIGGRAPH 2023
SIGGRAPH 2024

What drives CG?

- **C**omputer **A**ided **D**esign
  - Mechanical, Electronic, Architecture,…
  - Drives the high end of the hardware market
  - Integration of computing and display resources
  - Reduced design cycles == faster systems, sooner



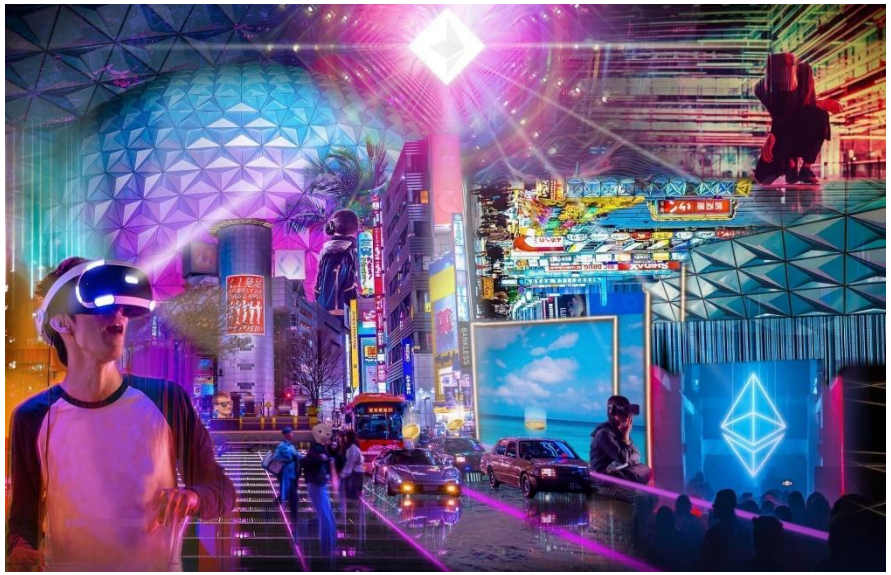


What drives CG?

- **Digital Twin**

What drives CG?

- **Metaverse**



What drives CG?

- Movie Industry

How much progress has the 《刺杀小说家》 made for special effects?

What drives CG?

- Game Industry

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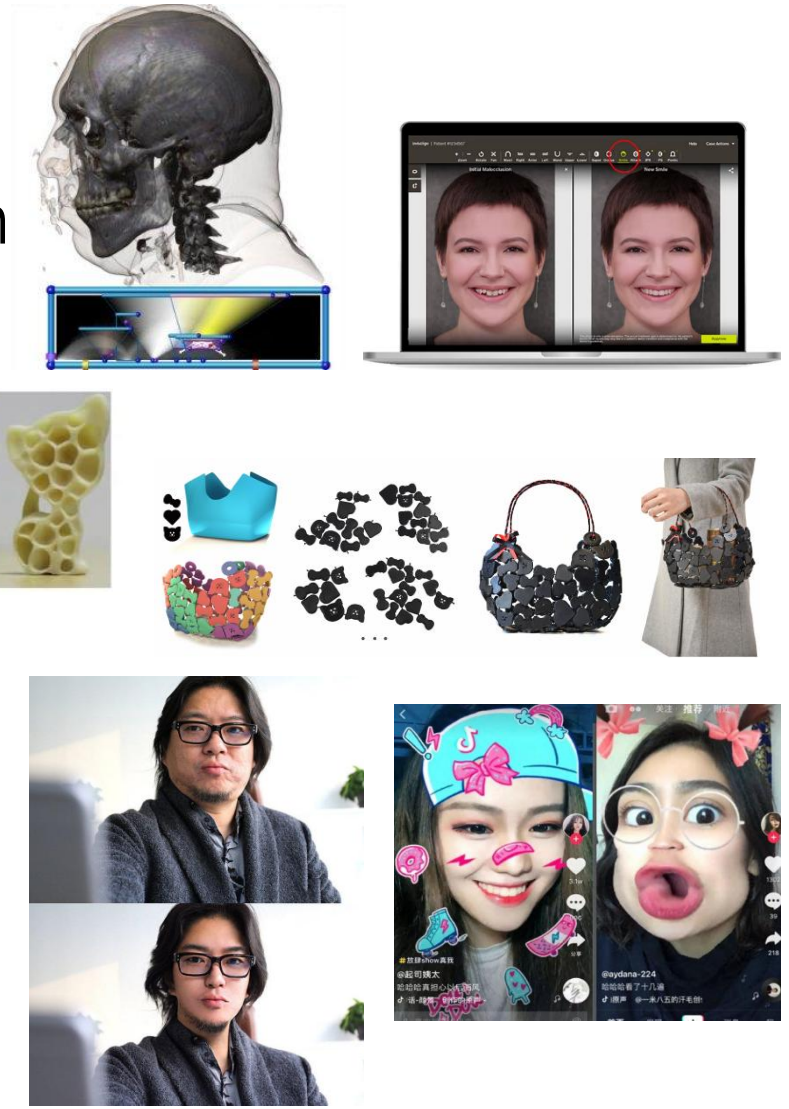
What drives CG?

- Medical Imaging and Scientific Visualization
- Fabrication (3D Printing)
- Industrial application
- Service industry
- Entertainment
- …



What drives CG?

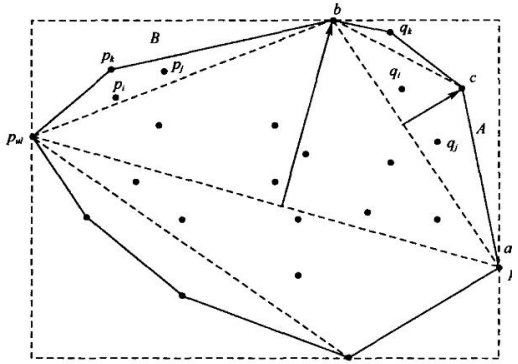
The meaning of science and technology is not only to explore more unknown for human beings, but also to let more people see this vast and beautiful world.

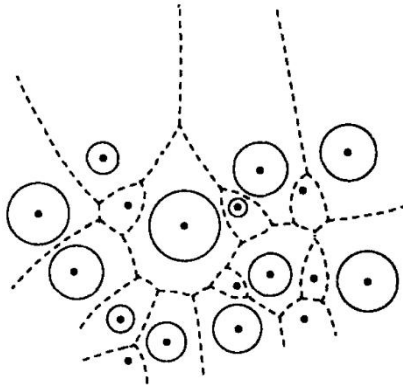
Course Chapters

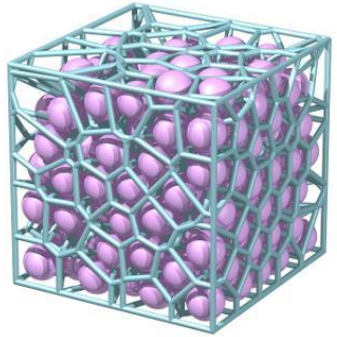
Chapter 1. Introduction of Computer Graphics
Chapter 2. Computational Geometry
Chapter 3. Mesh
Chapter 4. Point Cloud
Chapter 5. Image Processing

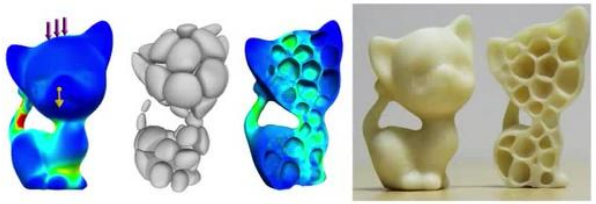
Computational Geometry

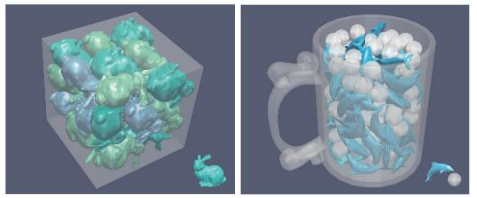
- convex hull, Voronoi graph, Delaunay triangulation, polygon triangulation, applications…

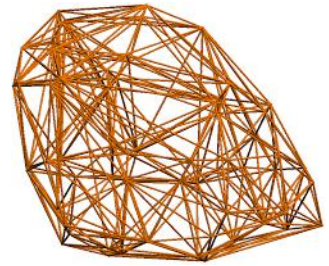






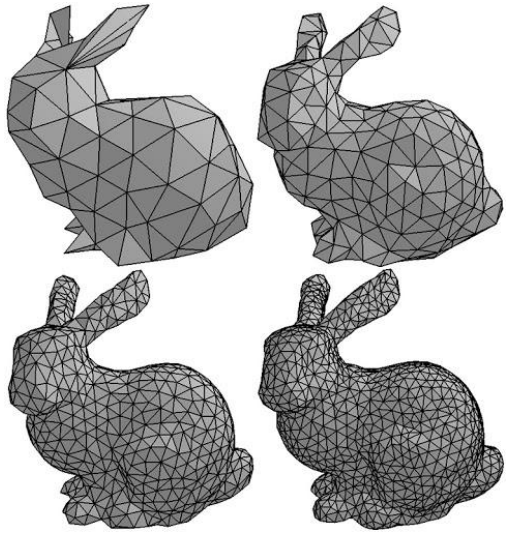


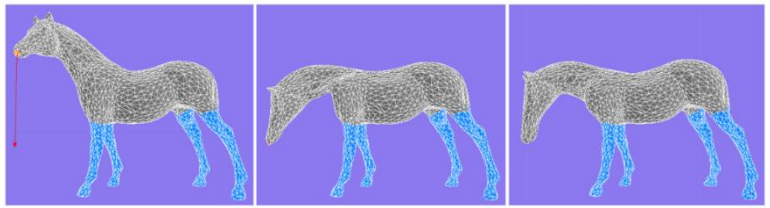


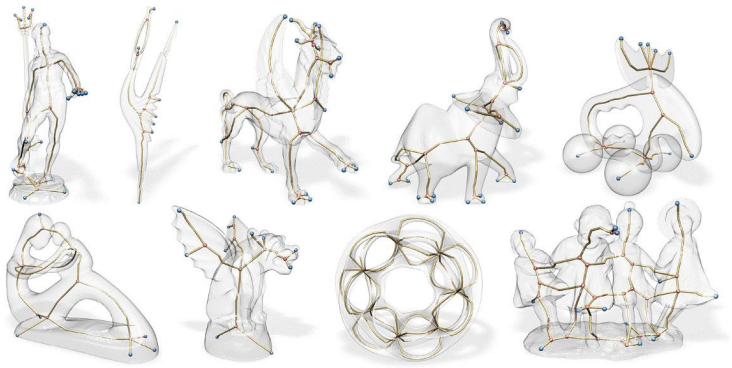


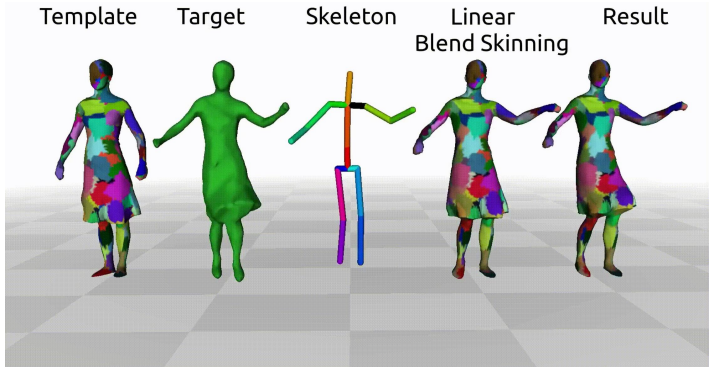
Mesh

- mesh data structure, mesh smoothing, mesh simplification, skeleton extraction, human motion caption and modeling…





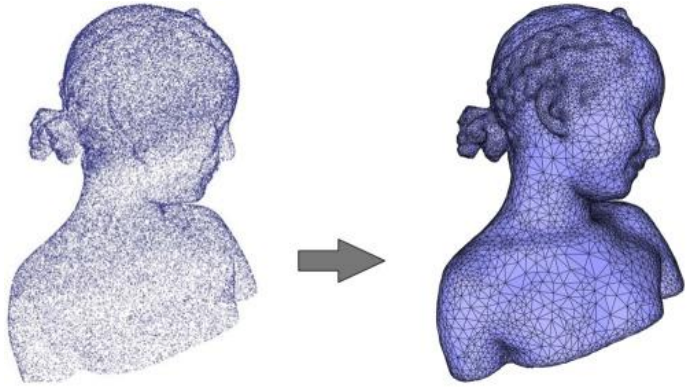


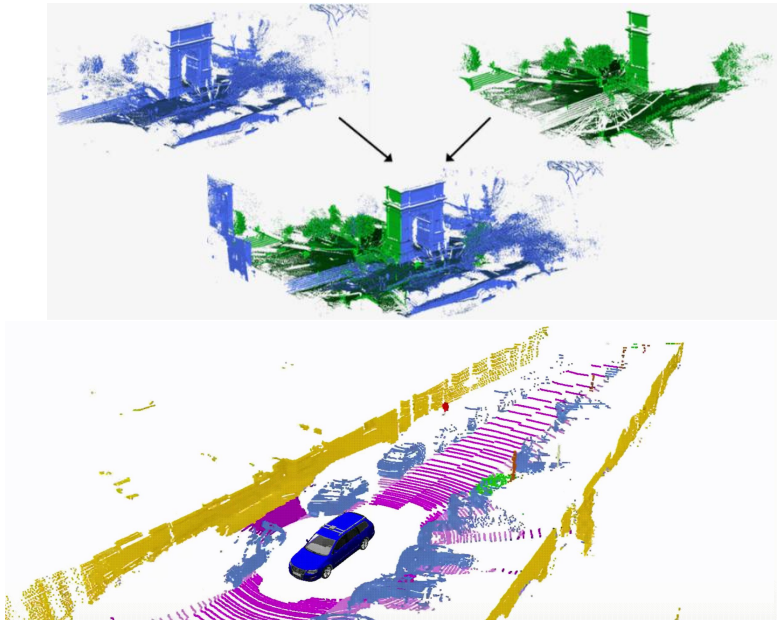


[MeshLab download]

Point Cloud

- calculating surface normal, outlier removal, point cloud alignment (ICP, RANSAC), point cloud completion, point cloud perception, point cloud reconstruction, point cloud registration…





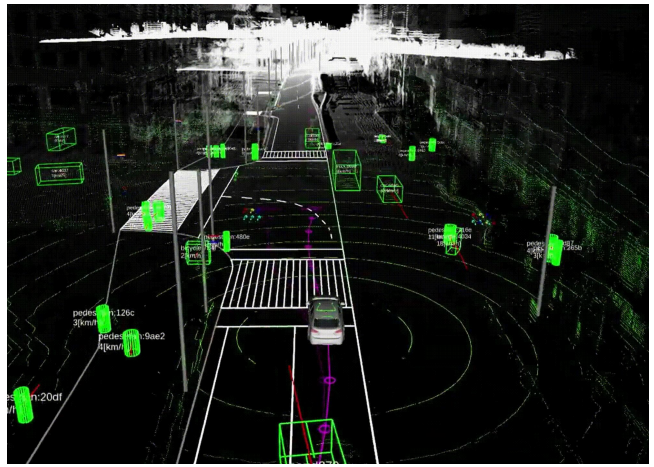


Image Processing

- image segmentation, image detection, 3D modeling from image…