

# **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
- Simulation/Animation
- Image/Video
- Rendering
- Visualization
- Interaction/VR
- Fabrication
- Sound Graphics
- ...

Let's have a Look!



Technical Papers Preview Trailer

[SIGGRAPH 2020](#)

[SIGGRAPH 2021](#)

[SIGGRAPH 2022](#)

# What drives CG?

- Movie Industry



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



# What drives CG?

- Game Industry

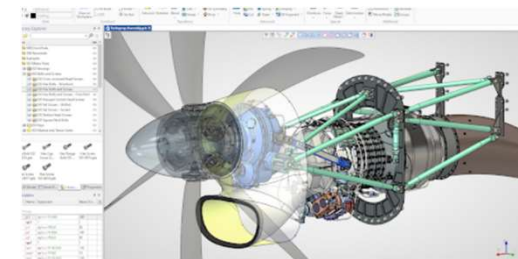
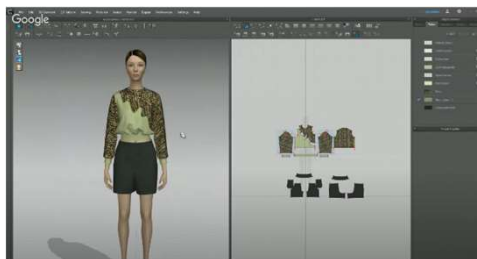


How was 《戴森球计划》 born?



# What drives CG?

- **Computer Aided Design**
  - 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?

- Metaverse



# What drives CG?

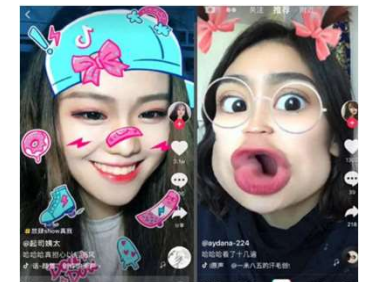
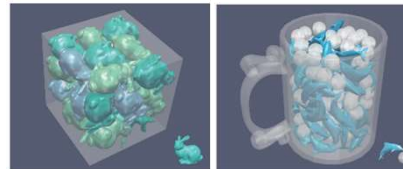
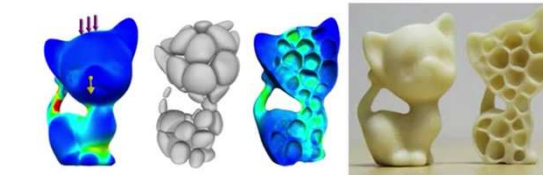
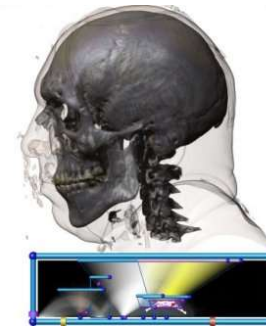
- Digital Twin





# What drives CG?

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



# Course Chapters

**Chapter 1. Introduction of Computer Graphics**

**Chapter 2. Computational Geometry**

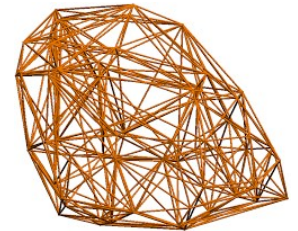
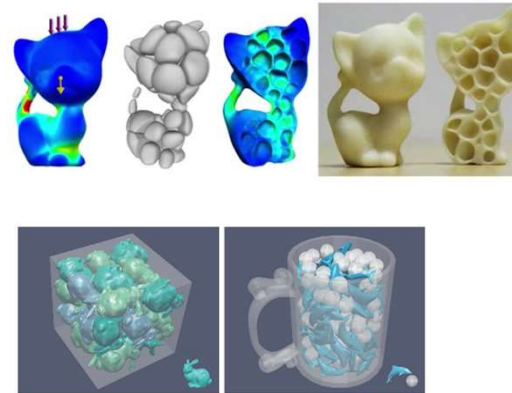
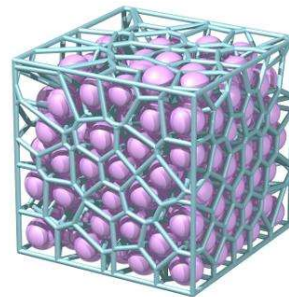
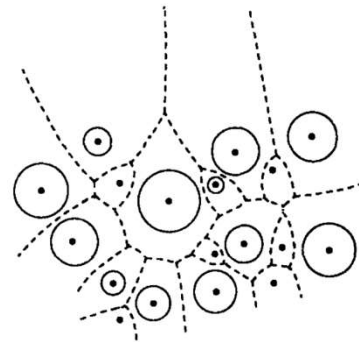
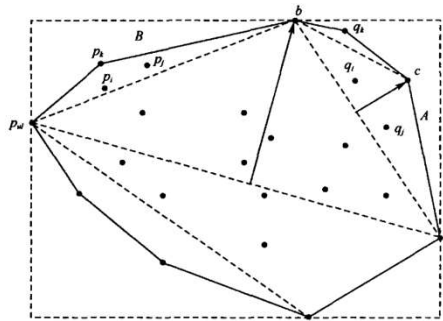
**Chapter 3. Mesh**

**Chapter 4. Point Cloud**

**Chapter 5. Image Processing**

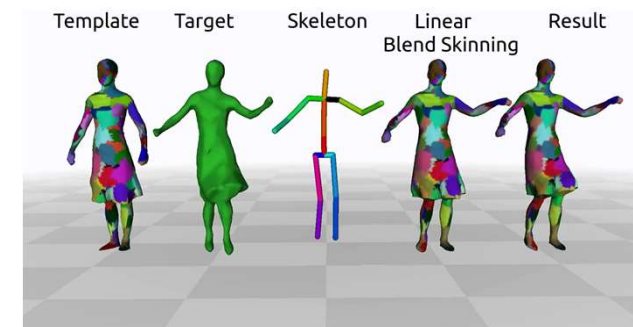
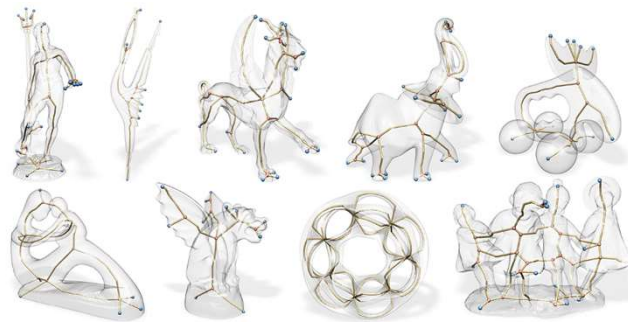
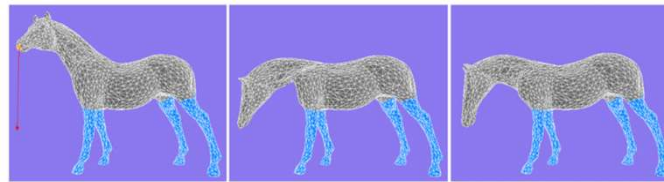
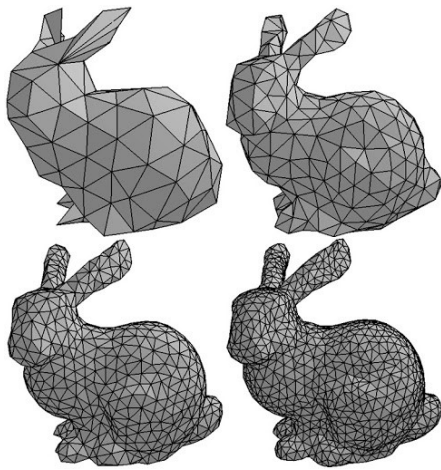
# Computational Geometry

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



# Mesh

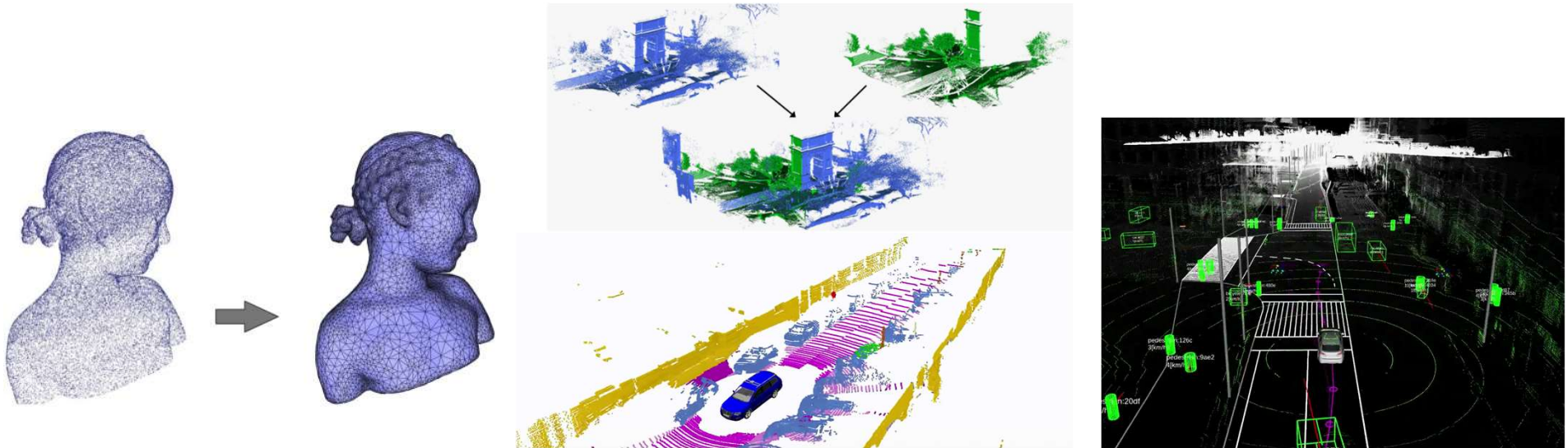
- mesh data structure, mesh smoothing, mesh simplification, skeleton extraction, human motion capture and modeling...



[MeshLab download](#)

# Point Cloud

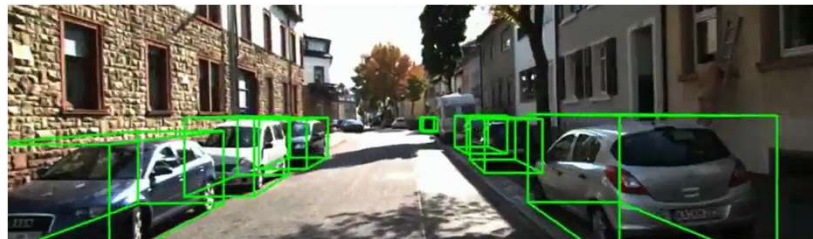
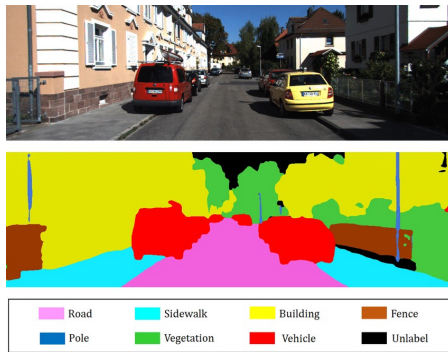
- calculating surface normal, outlier removal, point cloud alignment (ICP, RANSAC), point cloud completion, point cloud perception, point cloud reconstruction, point cloud registration...





# Image Processing

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



# Rendering ➡ CGI

- Programable Rendering Pipeline, Surface lighting, shading, and texturing, Shadow algorithms, Global illumination, and applications, e.g., scientific visualizations...

