



Digital Geometry -Motivations

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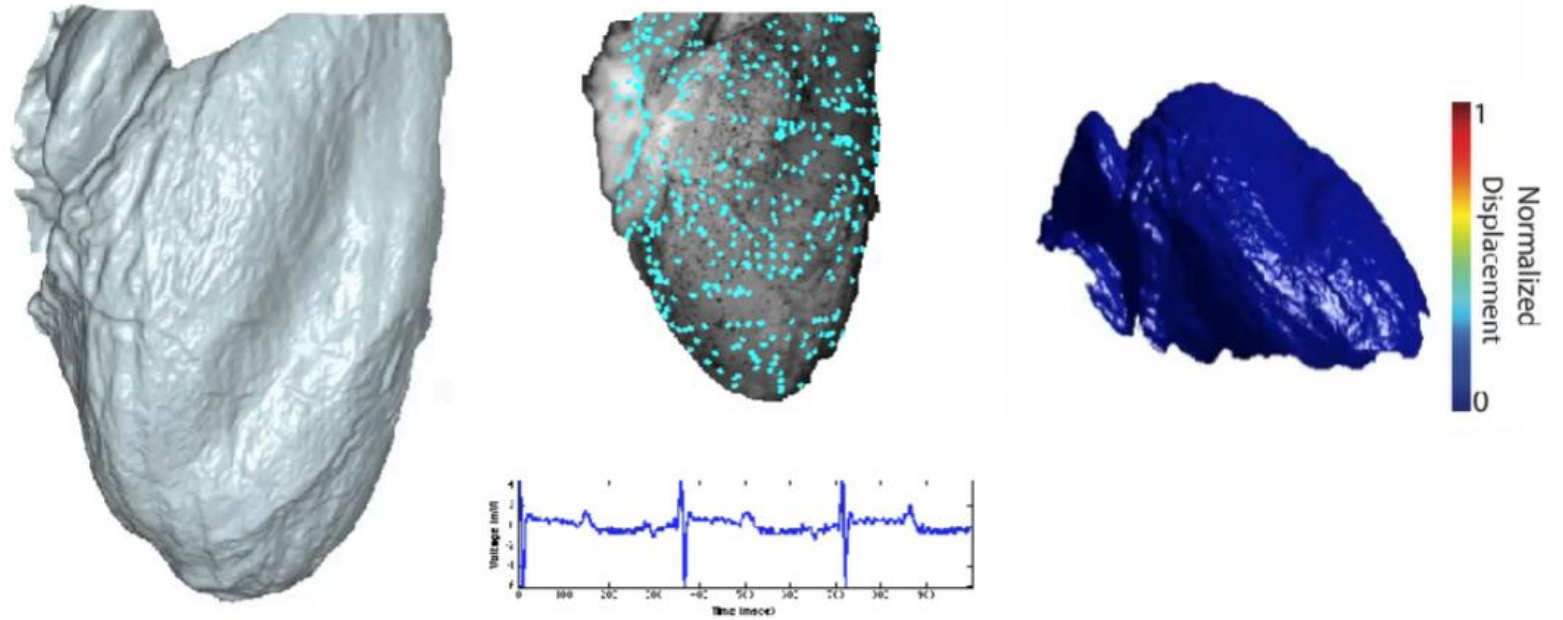
Spring 2017

<http://jjcao.github.io/DigitalGeometry/>

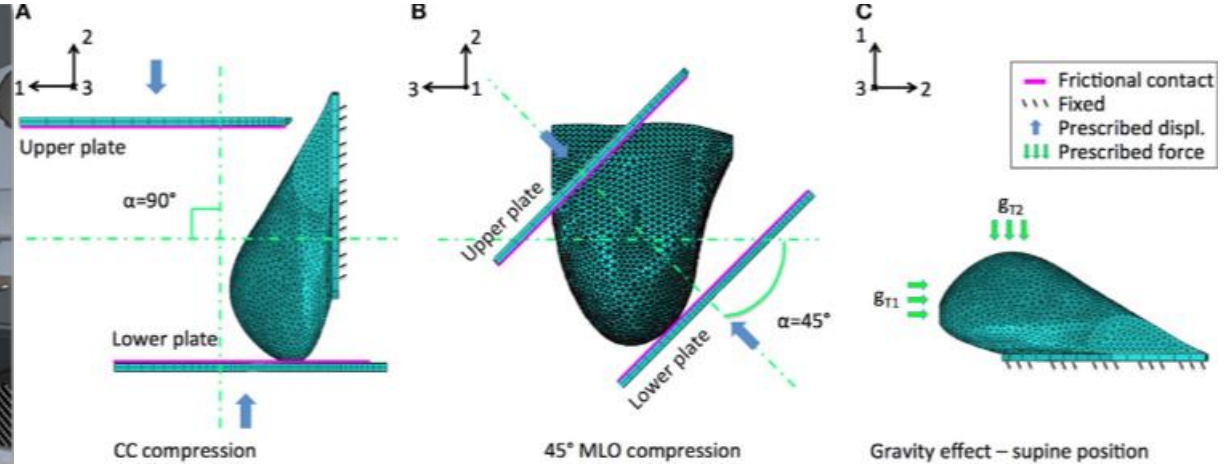
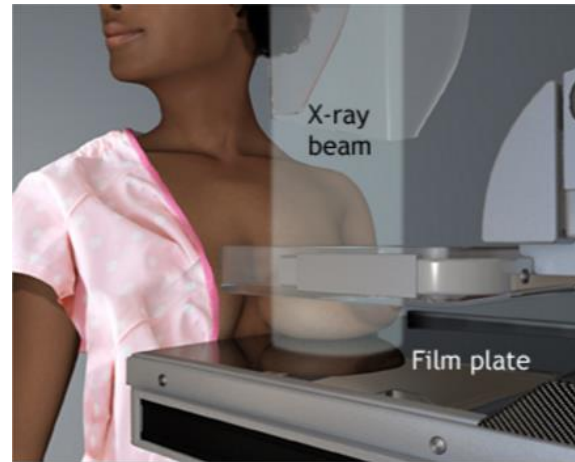
Pleasure may come from illusion, but happiness can come only of reality.

Impacting Science

Cardiology



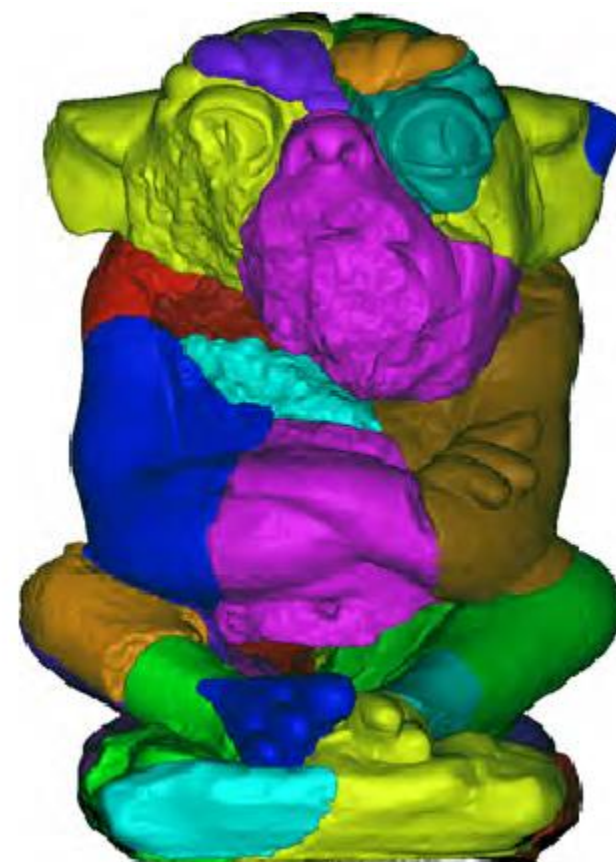
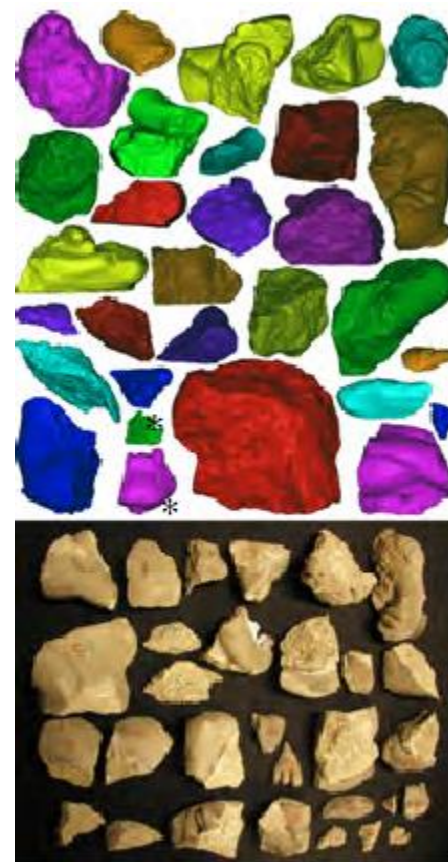
Mammographic



Computational archaeology



Eg14_Content-Aware Surface Parameterization for Interactive Restoration of Historical Documents



Reassembling a gargoyle statue: photo (bottom left) and 3D models (top left) of the fragments, final assembly (right).

Multi-View Stereo

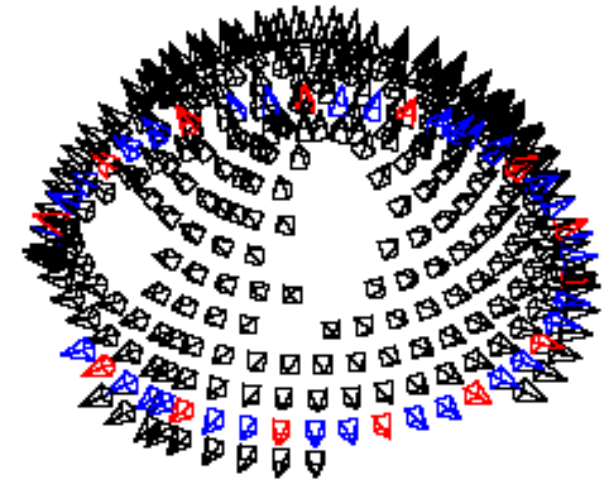
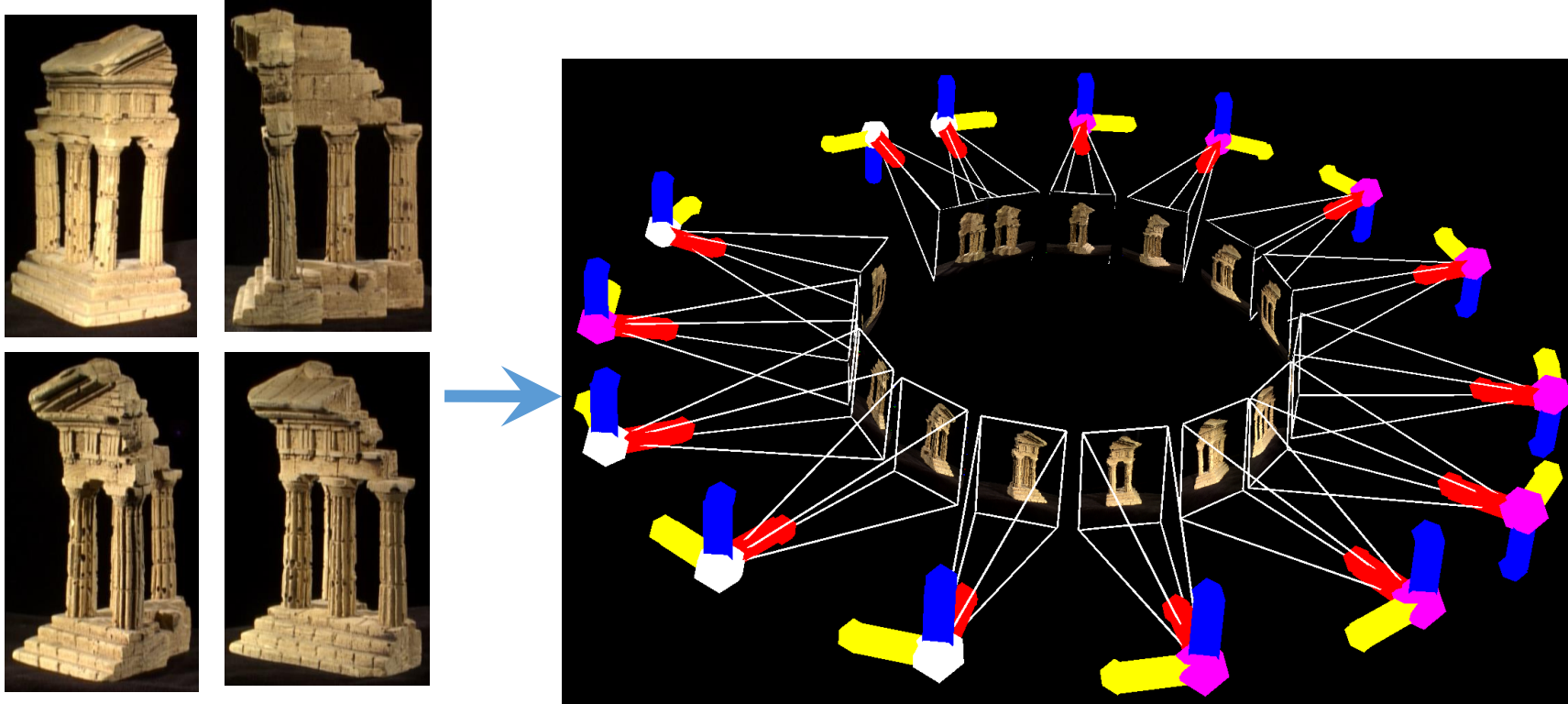
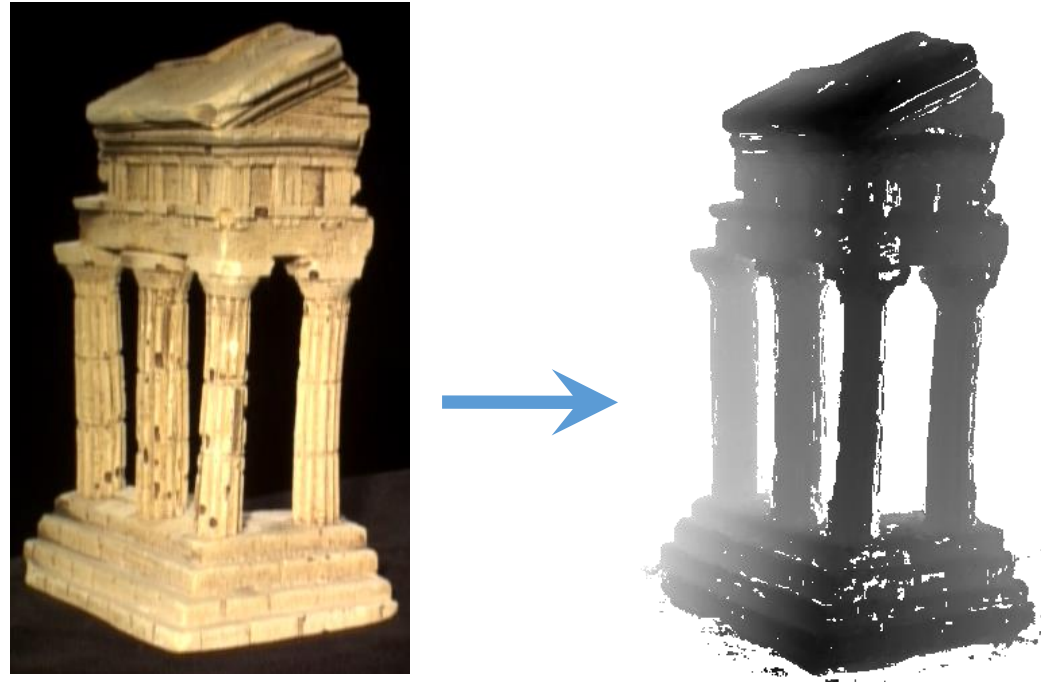


Image Calibration



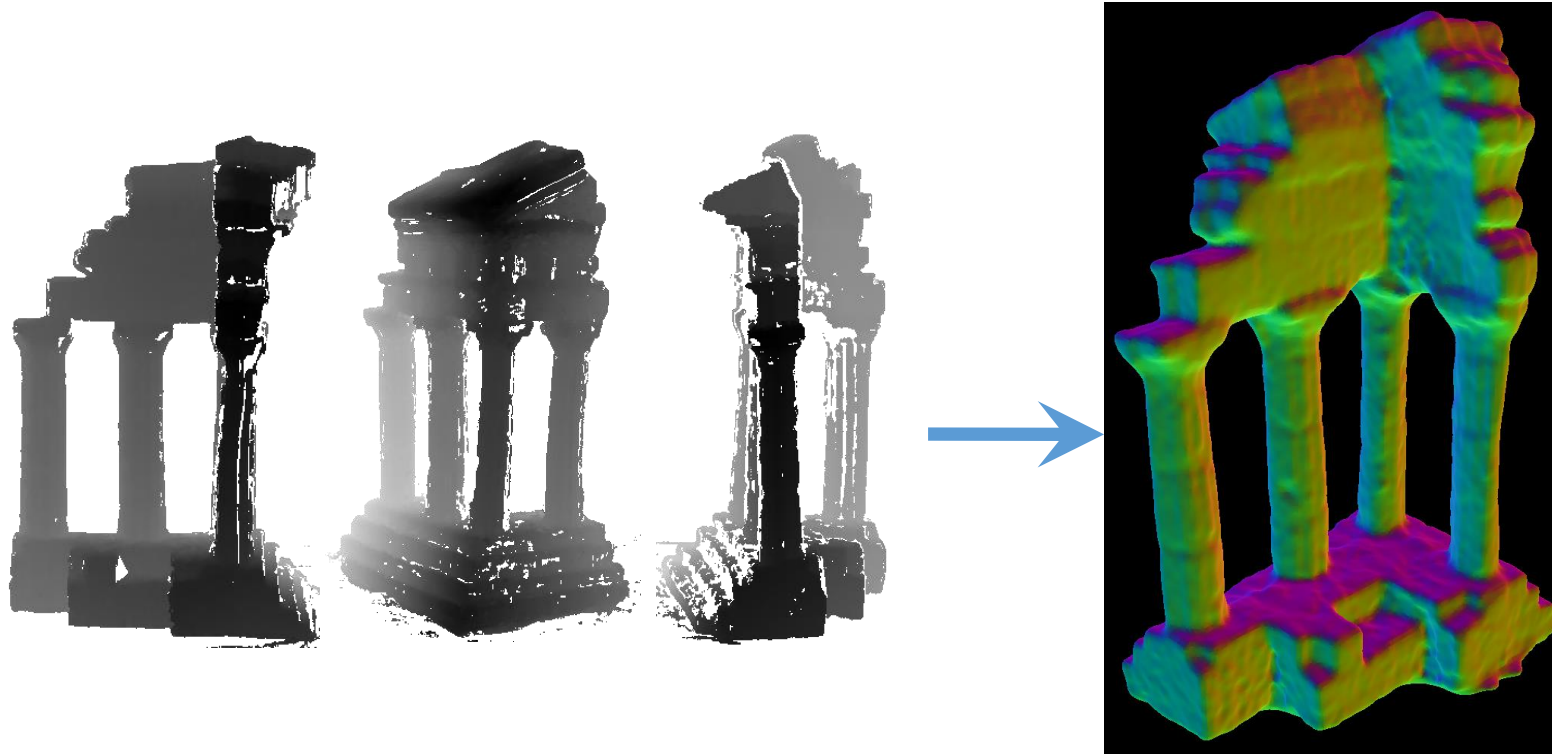
- Input: set of pictures
- Output: camera position, orientation, intrinsic parameters (focal length, optical center)

Depth Map Construction



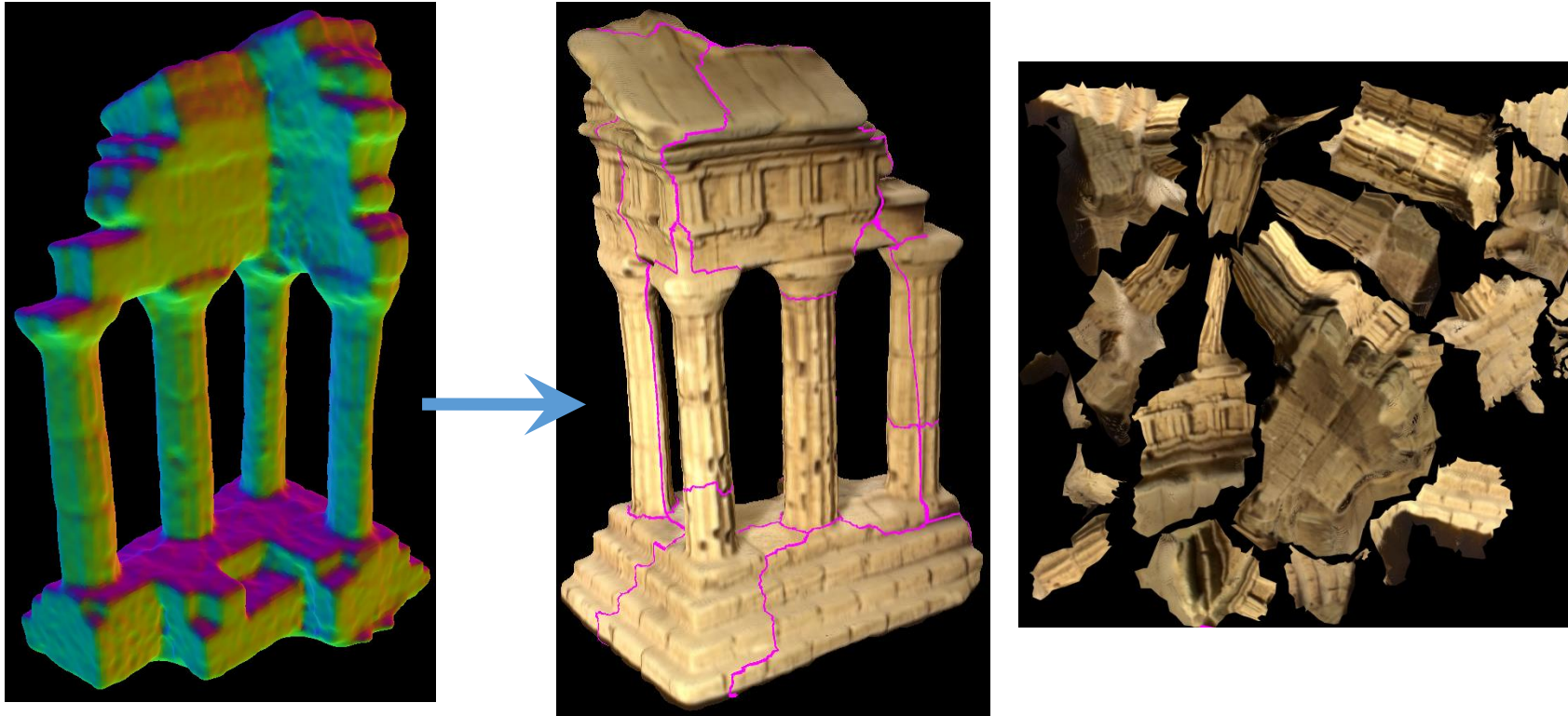
- Input: set of calibrated images
- Output: distance to object for each pixel in the image

Mesh Registration & Reconstruction



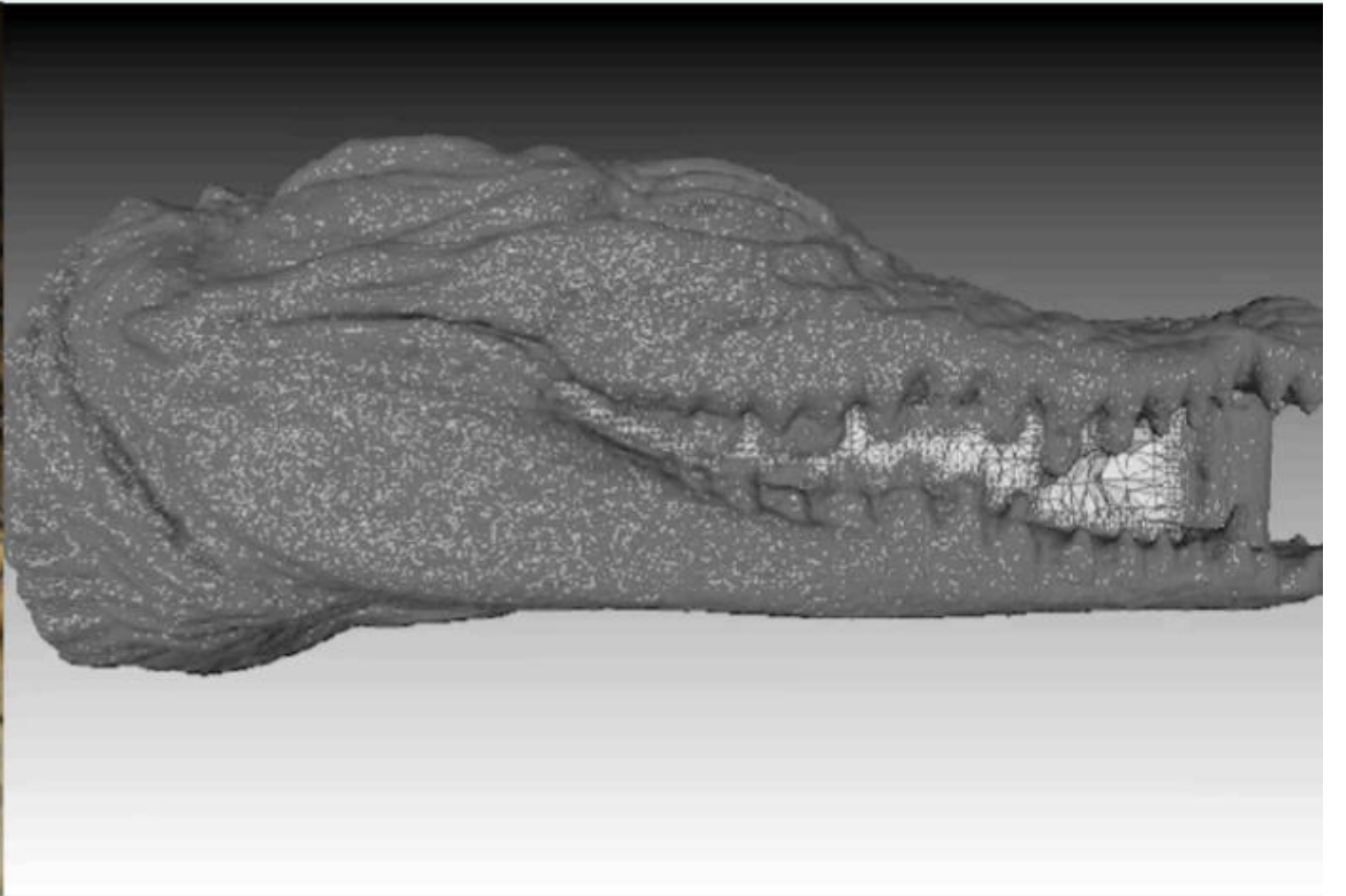
- Input: set of calibrated images & depth maps
- Output: mesh of object

Texture Generation

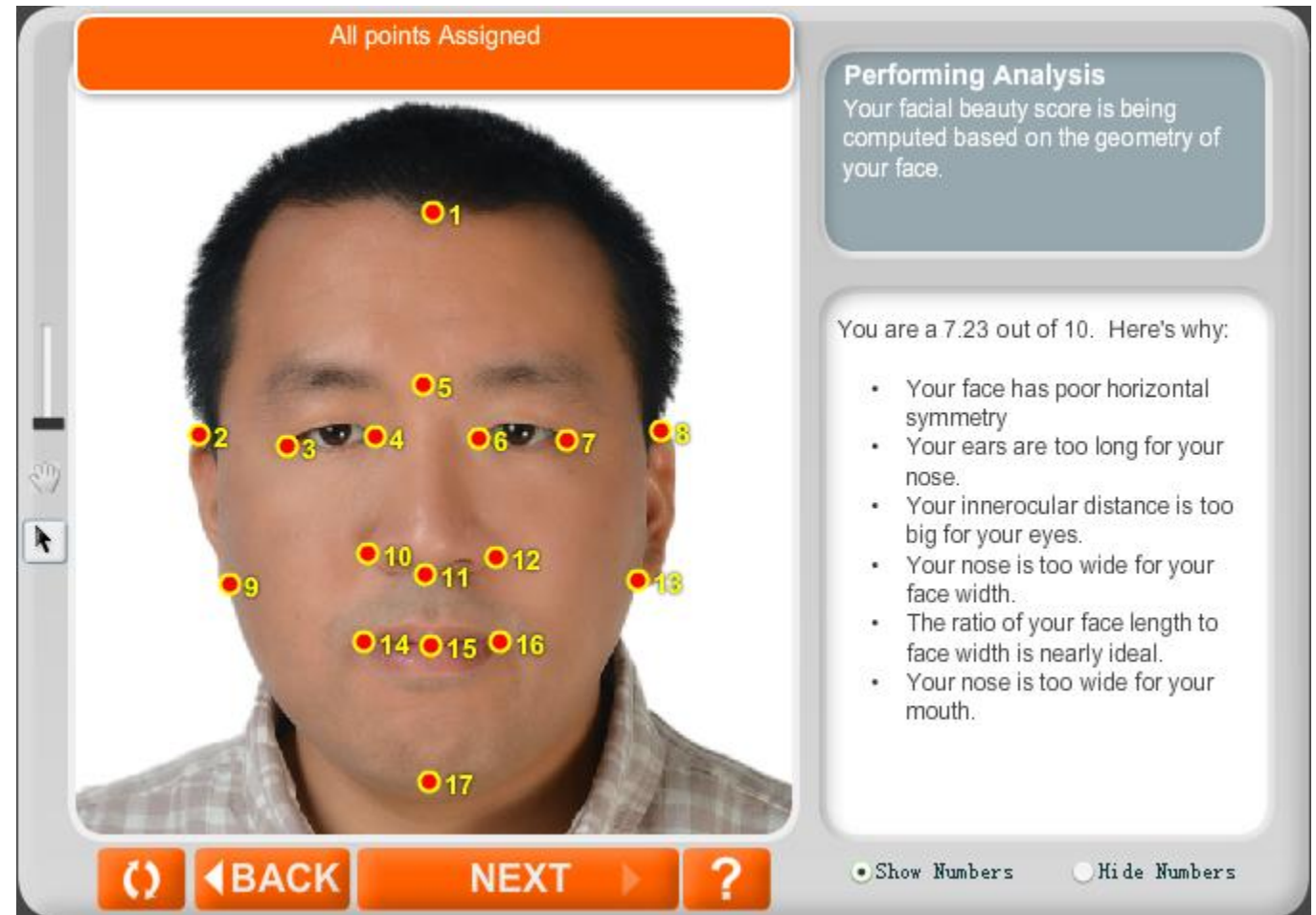


- Input: set of calibrated images and mesh of object
- Output: atlas and texture

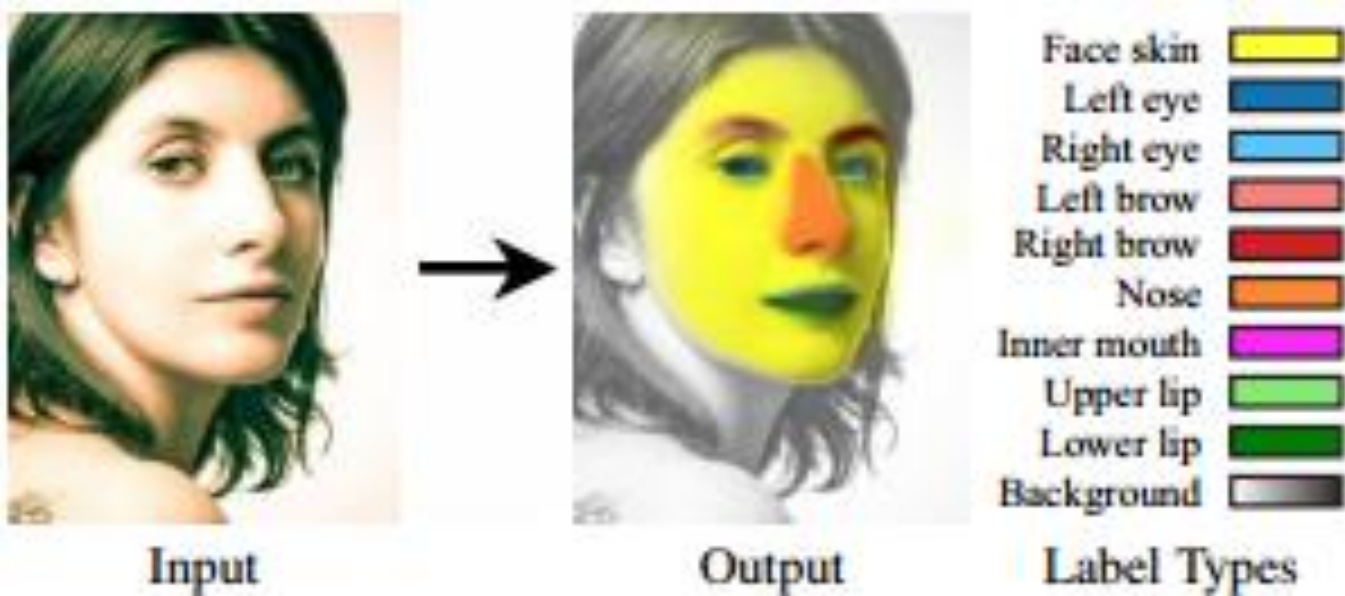
Evolutionary Biology



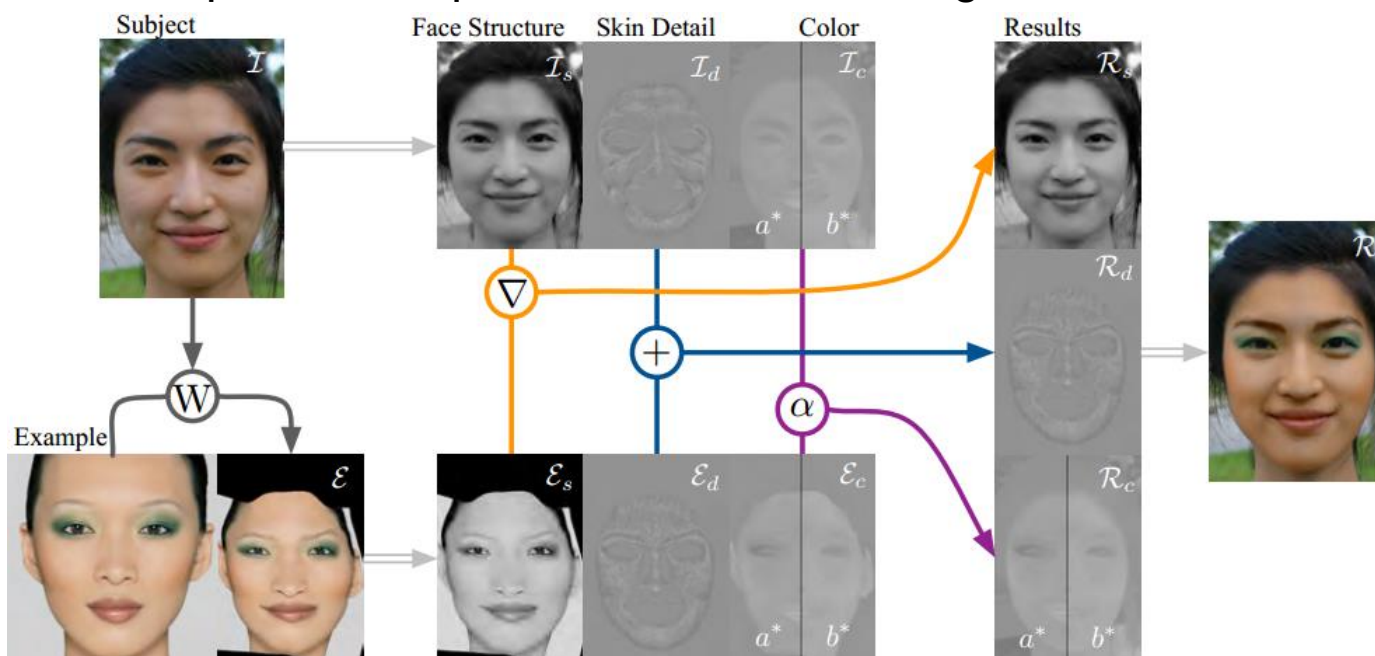
Computational aesthetics



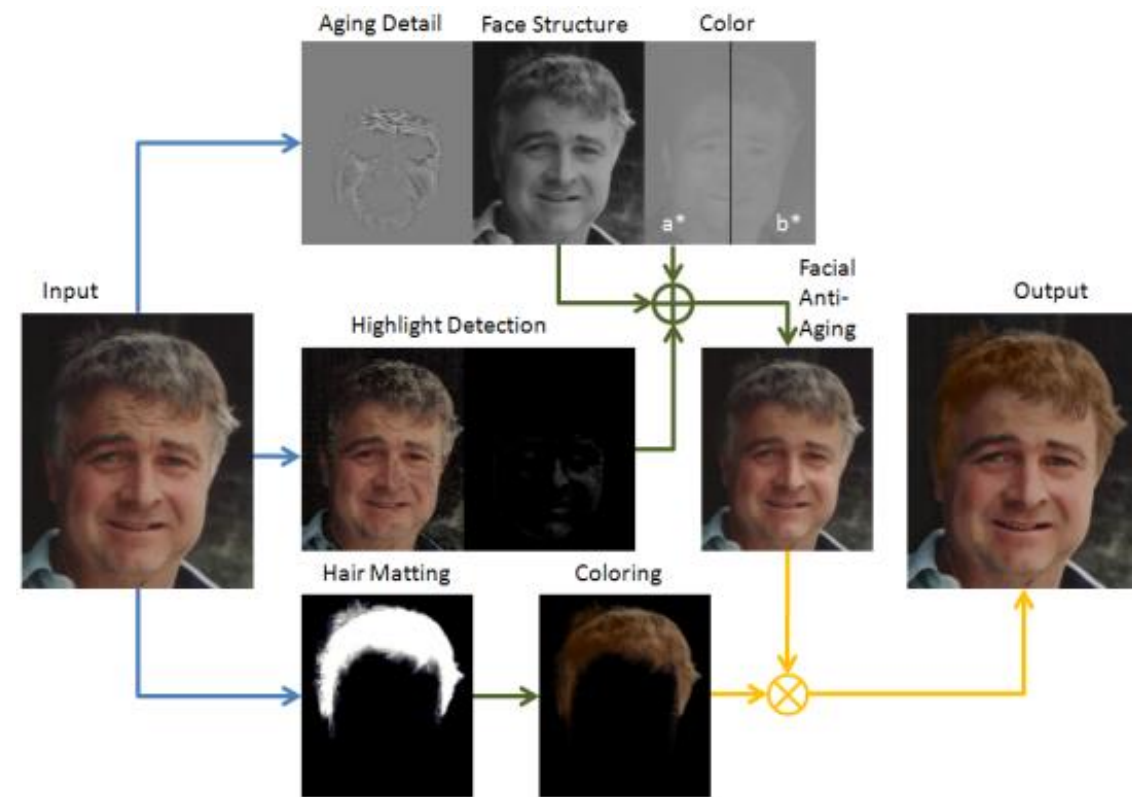
- [Facial Beauty Analysis - Score Your Face](#)



Cvpr13_Exemplar-Based Face Parsing

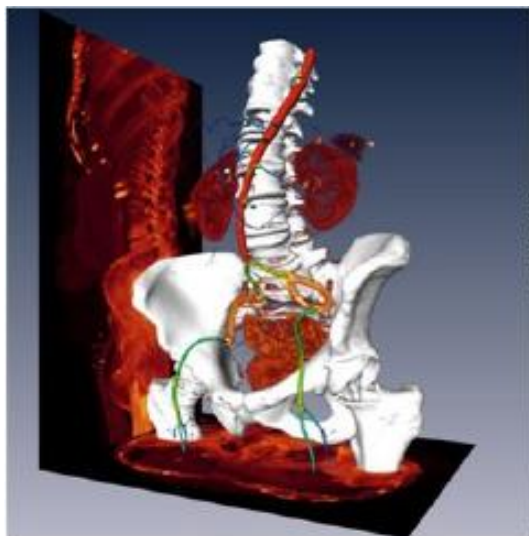


cvpr09_Digital Face Makeup by Example



lccv11_Digital anti-aging in face images

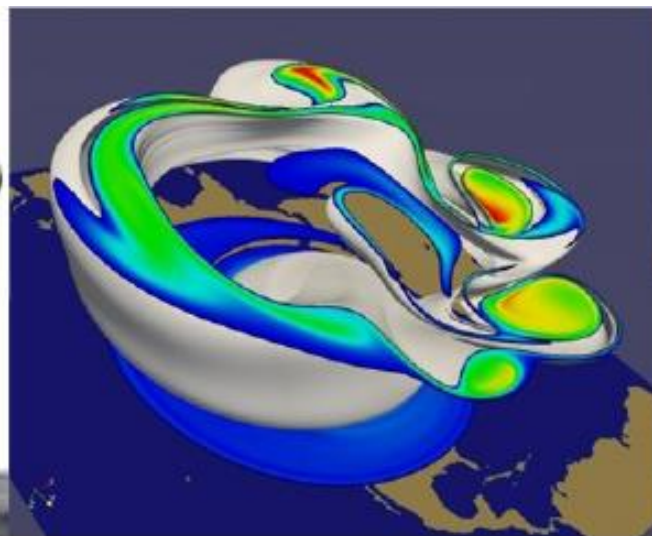
Applications



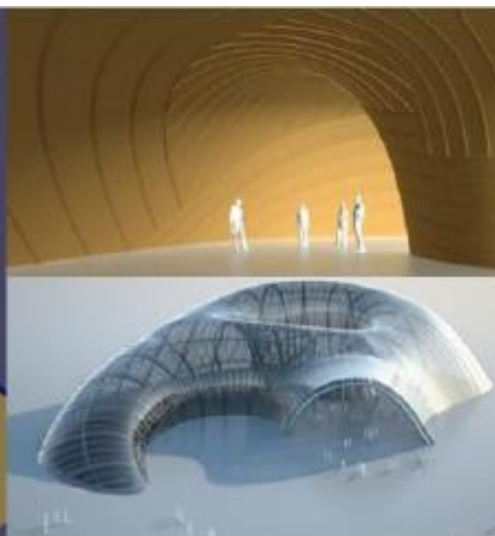
(a) 数字医疗



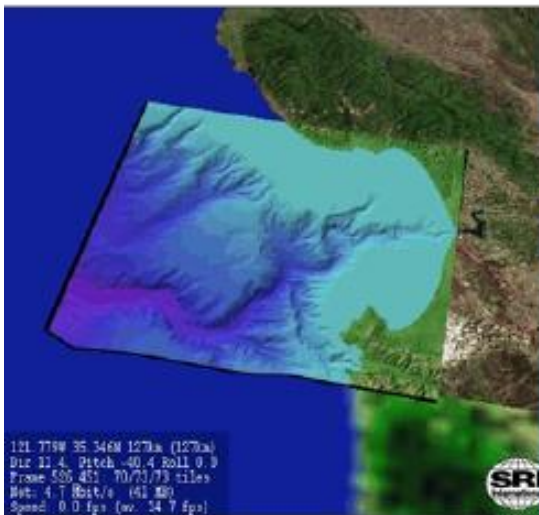
(b) 汽车设计



(c) 大气模拟



(d) 建筑设计



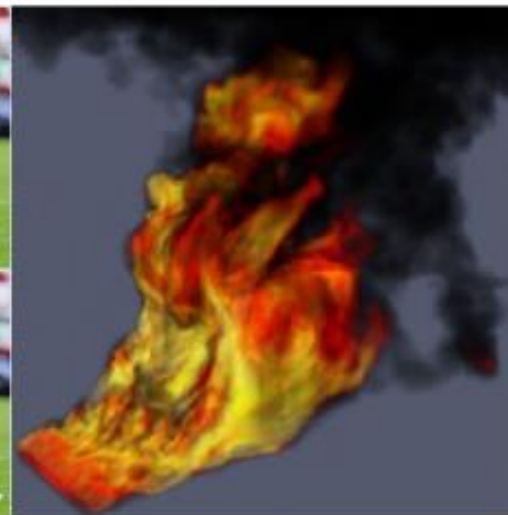
(e) 地形分析



(f) 虚拟现实



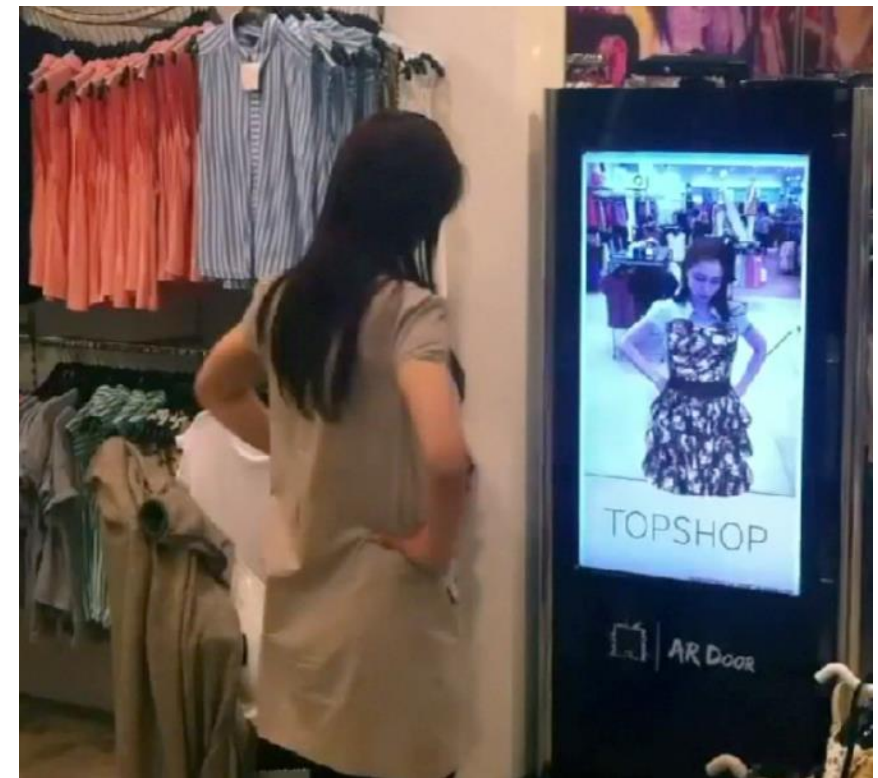
(g) 影视娱乐



(h) 虚拟科学实验

Digitized Future

Webcam Social Shopper: the virtual dressing room



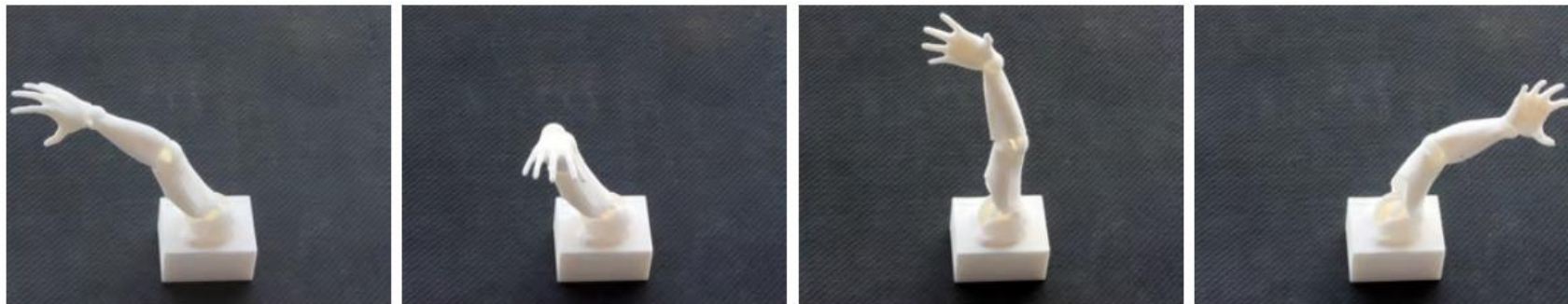
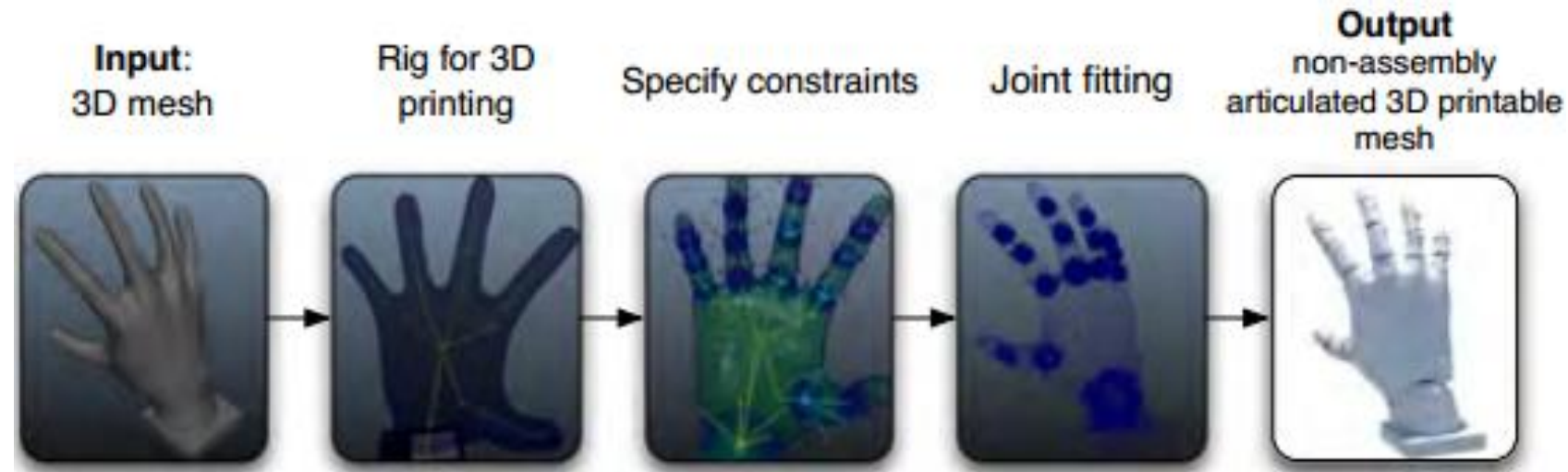
In laptops, tablets, smartphones



From Capture to Fabrication



Siga12_3D-Printing of Non-Assembly, Articulated Models



Realtime Future

Why Realtime?



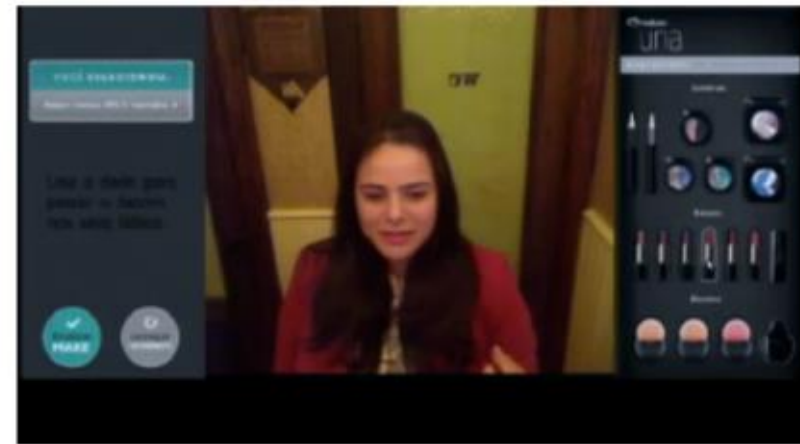
VFX/Game Production



Virtual Avatars



Robotics



AR/Virtual Mirror

Realtime Facial Performance capture



Siga10_A Practical Appearance Model for Dynamic Facial Color



Personalized Future

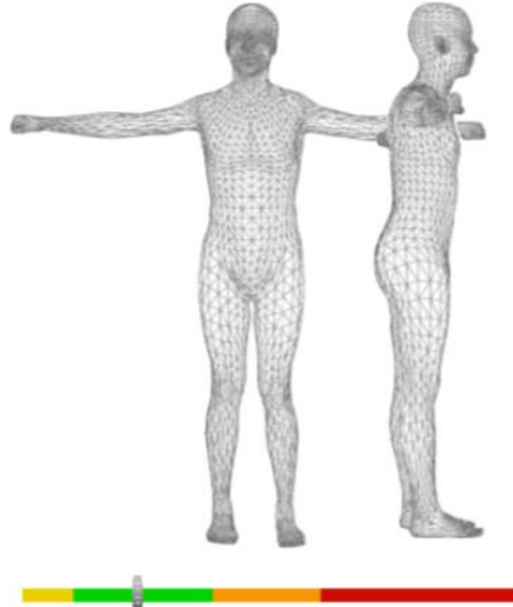
3D Self-Portraits



Personalized Applications



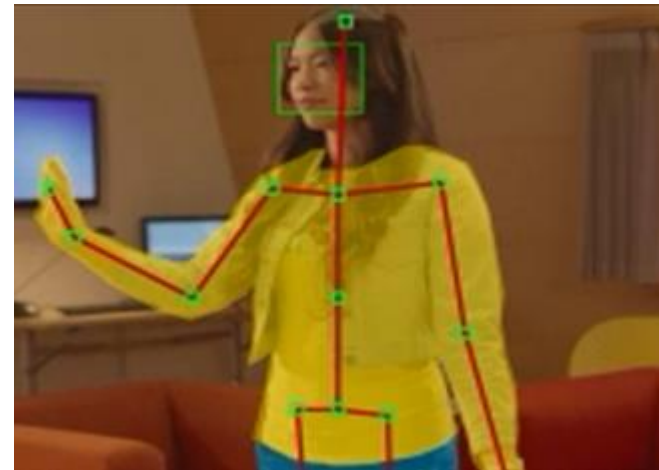
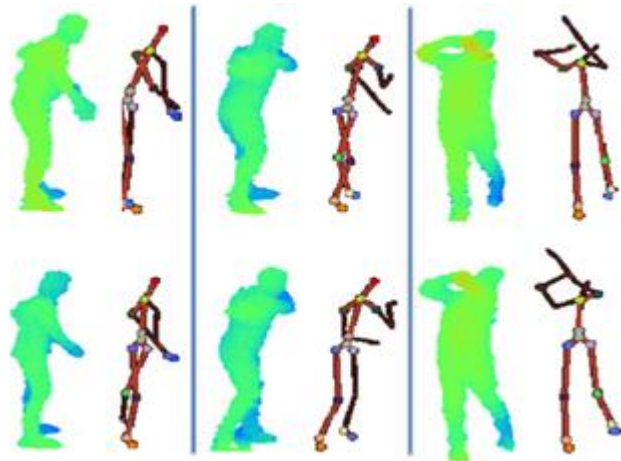
entertainment



fitness

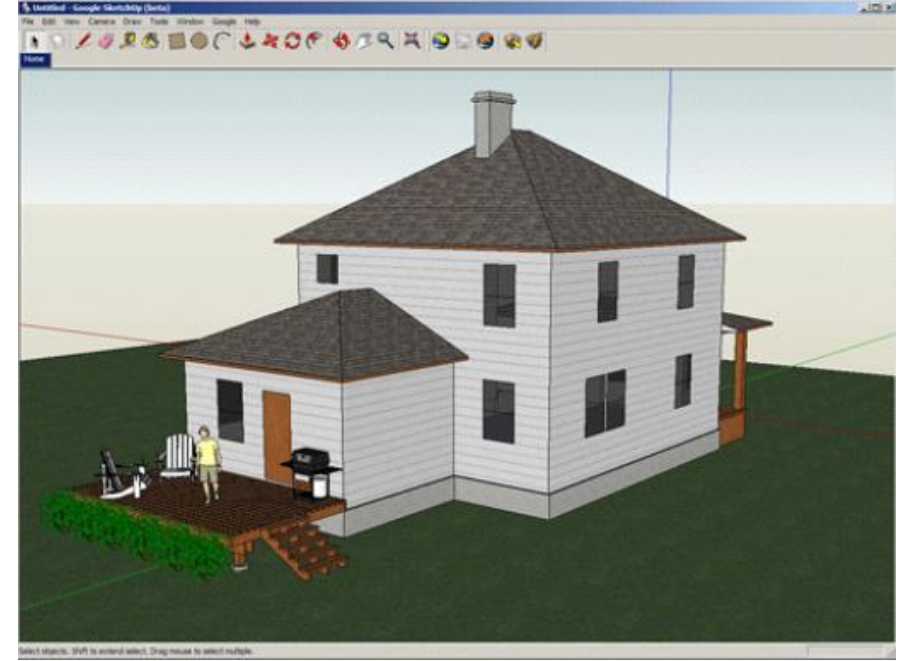
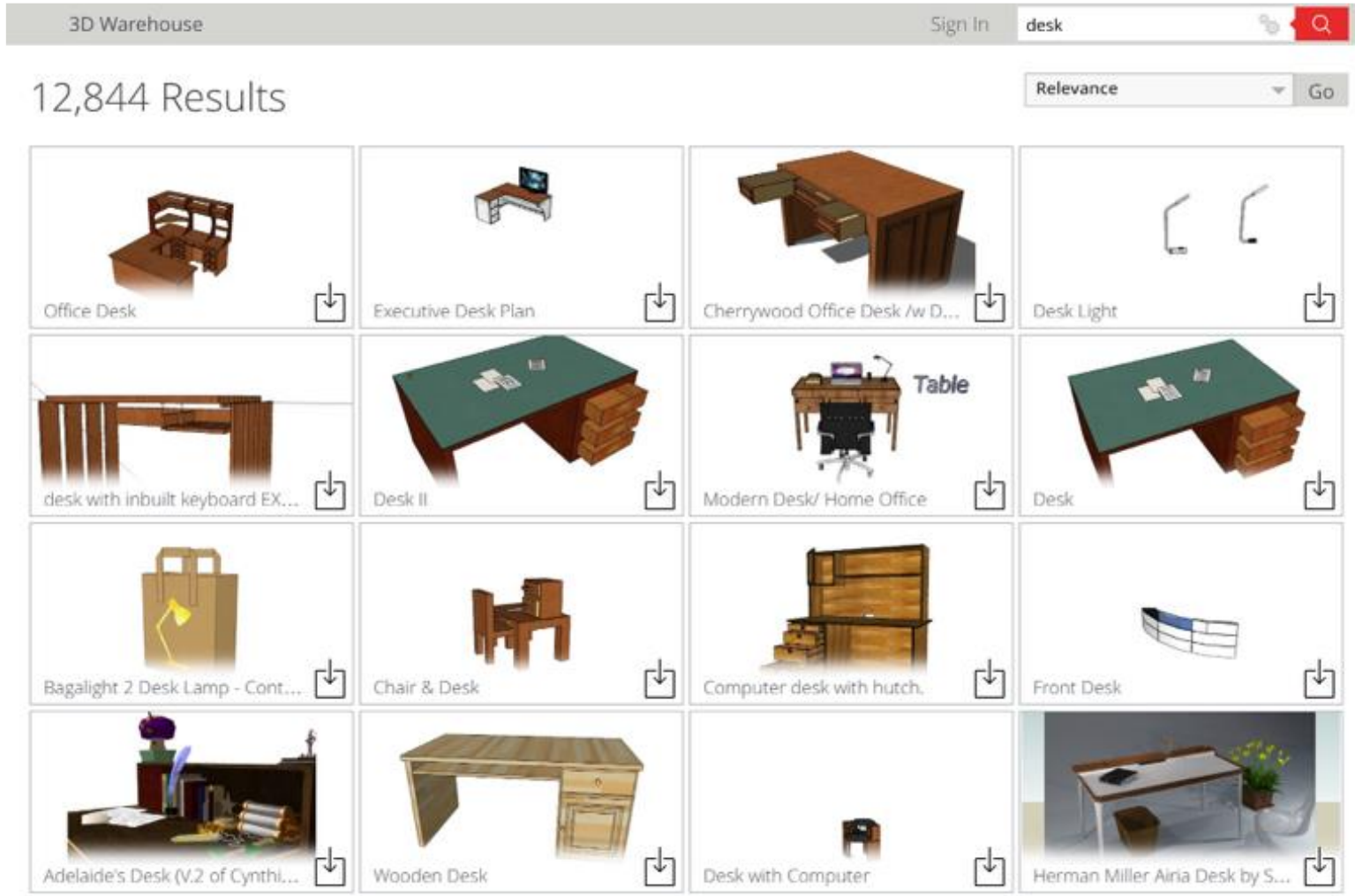


digital garment



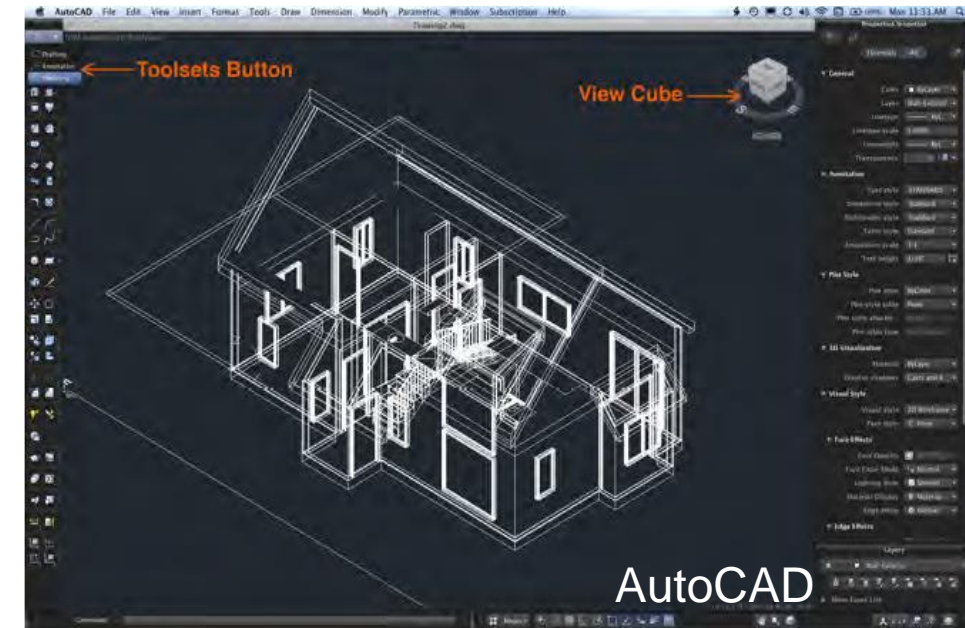
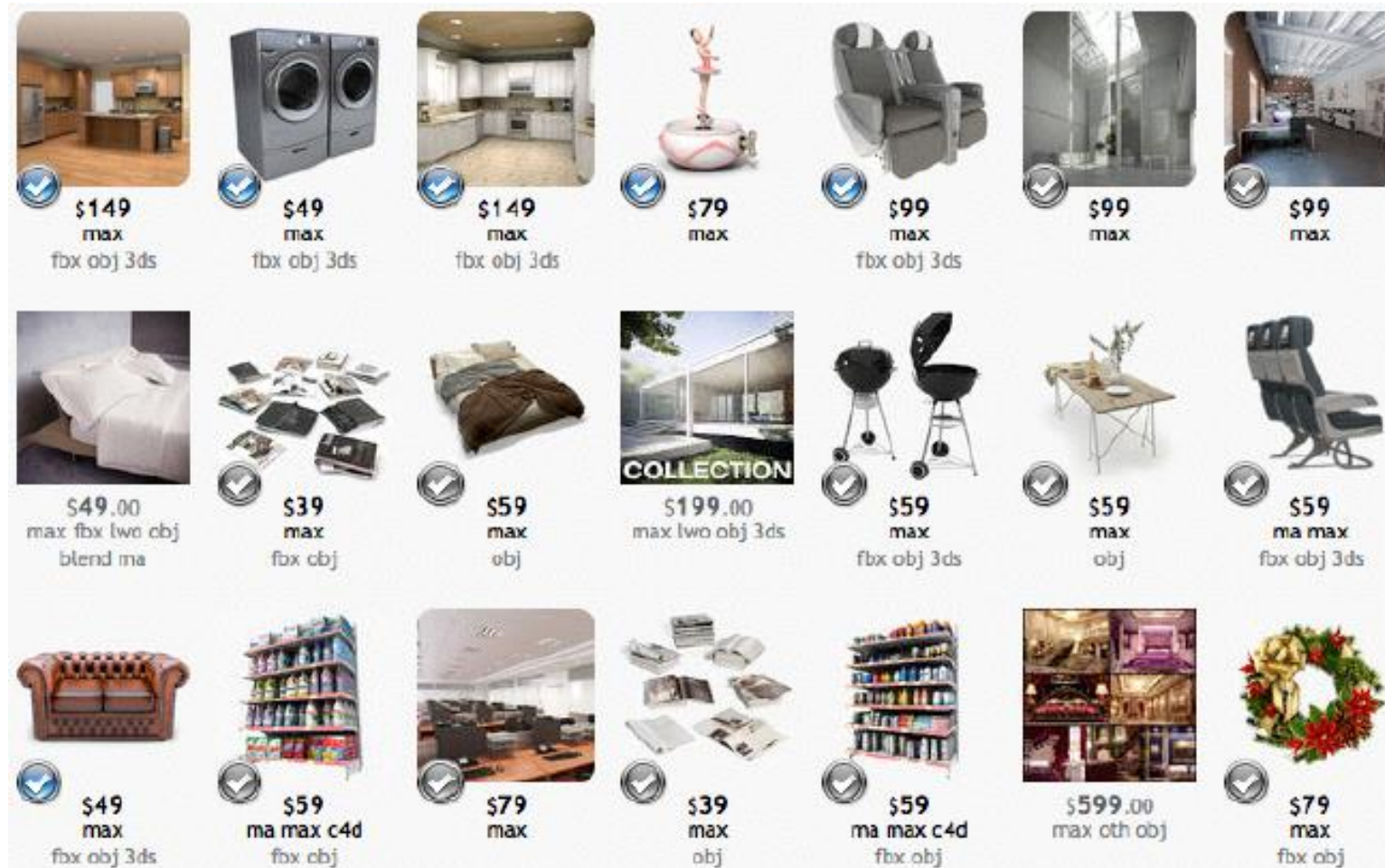
Big data

Large and growing repositories of 3D Models



Trimble 3D Warehouse
powered by Google

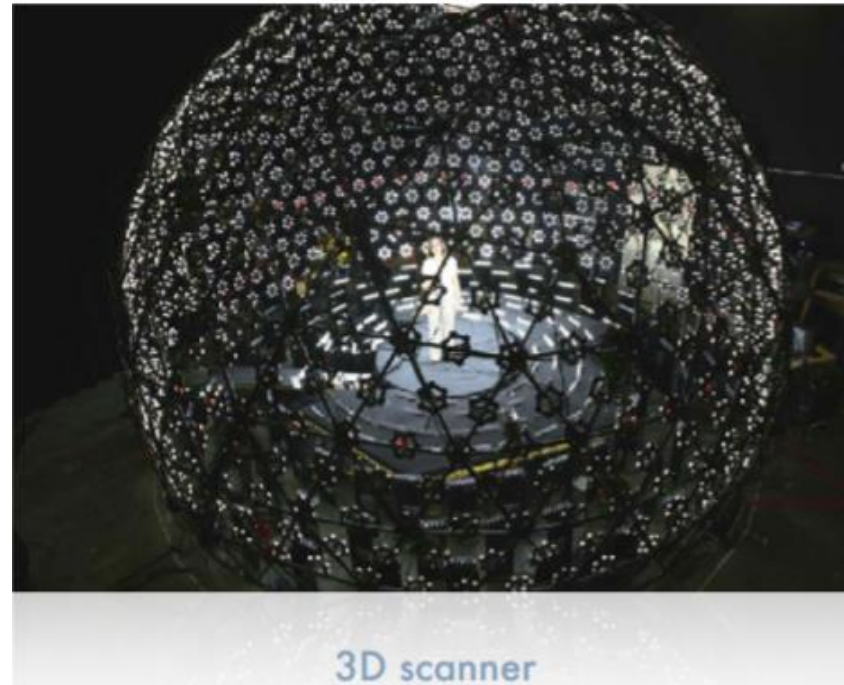
Large and growing repositories of 3D Models





ZBrush

Large and growing repositories of 3D Models



3D acquisition

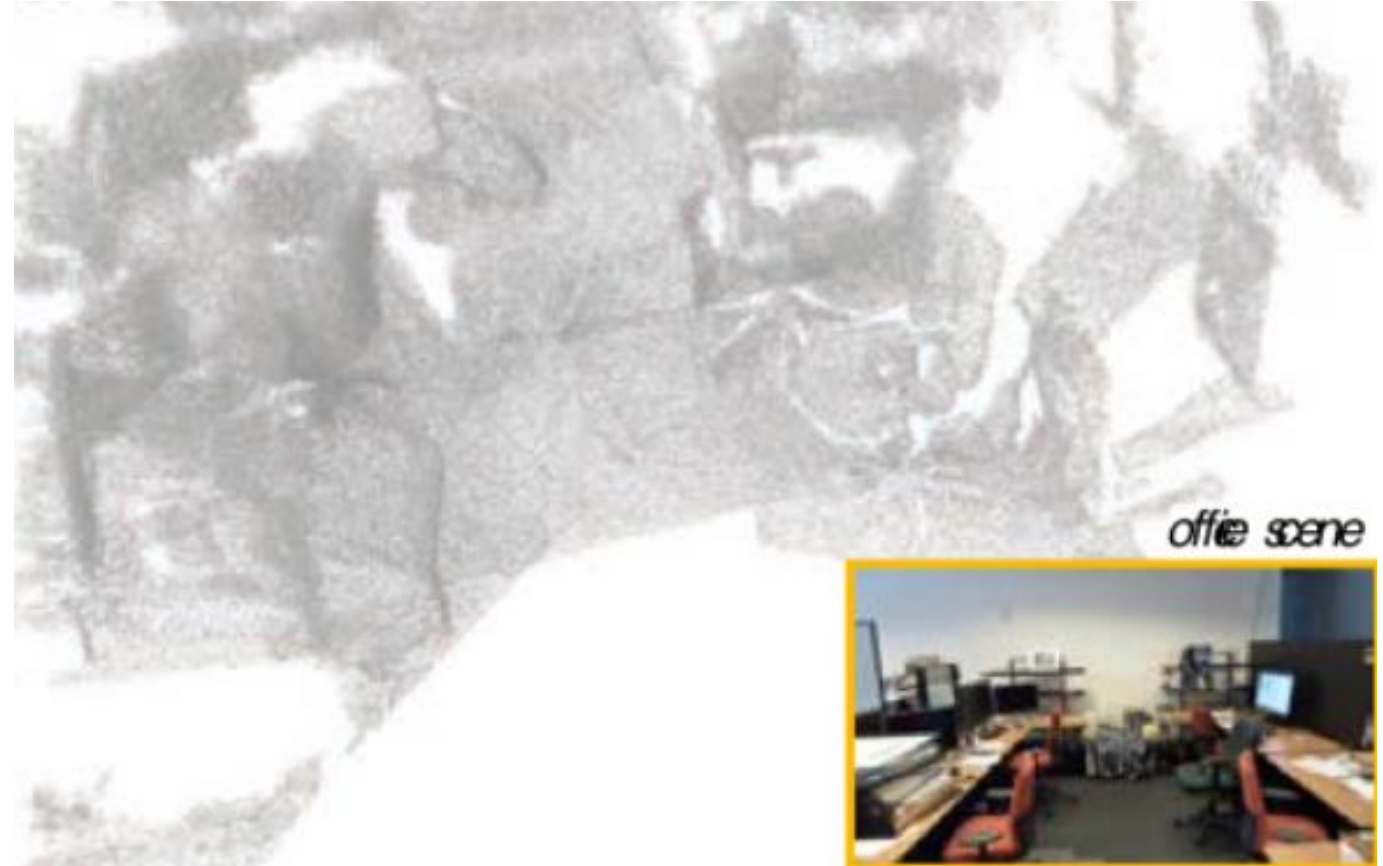
Large and growing repositories of 3D Models



Large and growing repositories of 3D Models



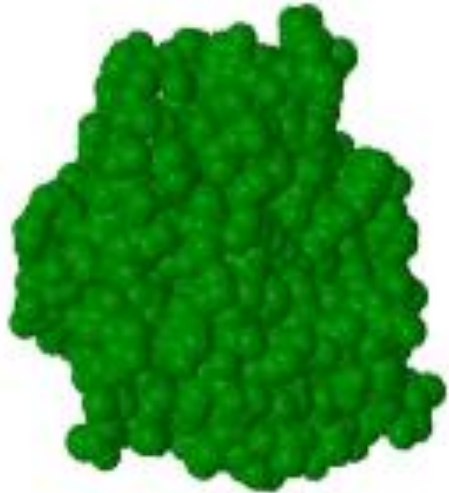
For Everyone



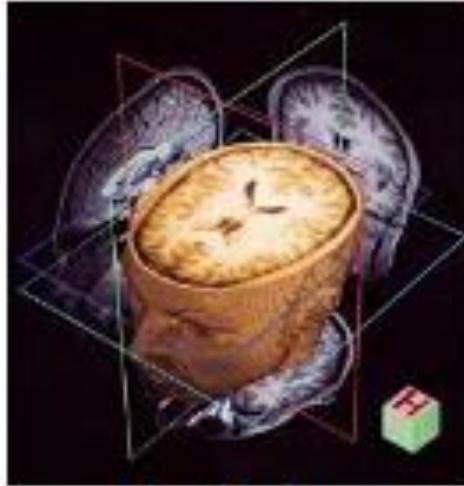
RGB-D data

Motivation

- **Lots** of geometric data in different domains!



Molecular Biology



Medicine



Engineering



Cultural Heritage



Paleontology



Computer Graphics



microscope



ultrasound



MRI scanner



x-ray diffractometer

Geometry

γεωμετρία



stereo camera



radio telescope



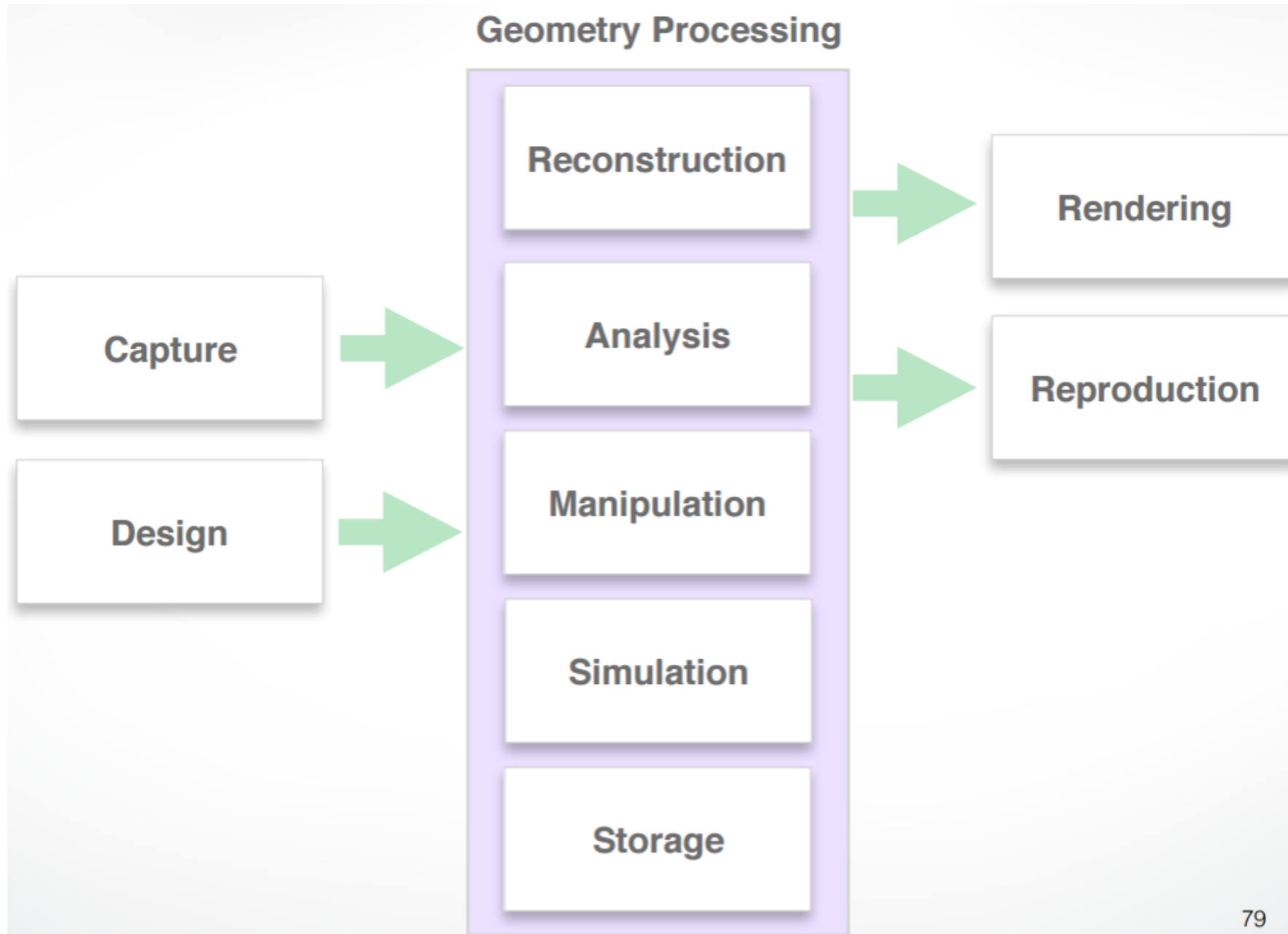
laser scanner



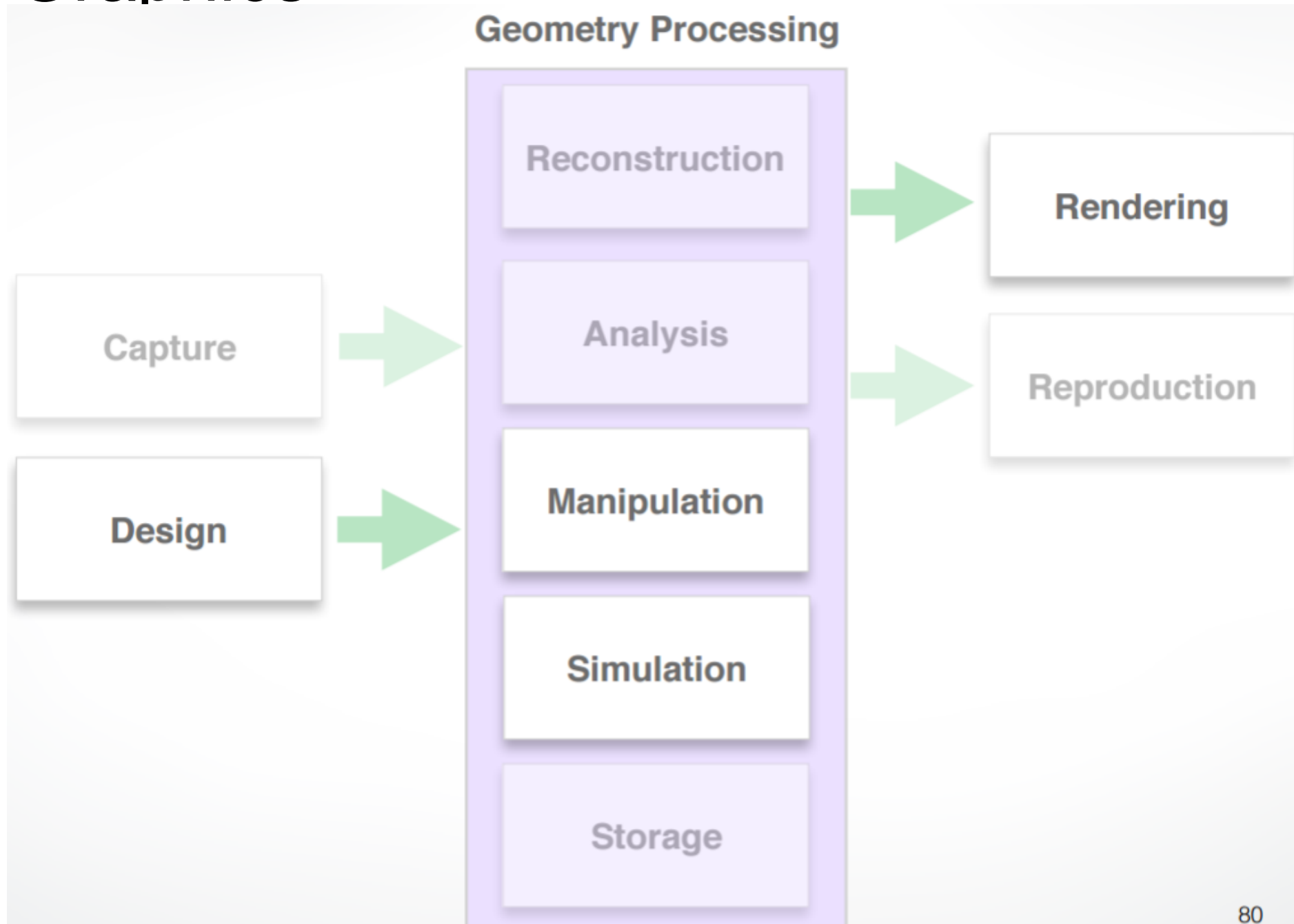
time-of-flight scanner

Summary

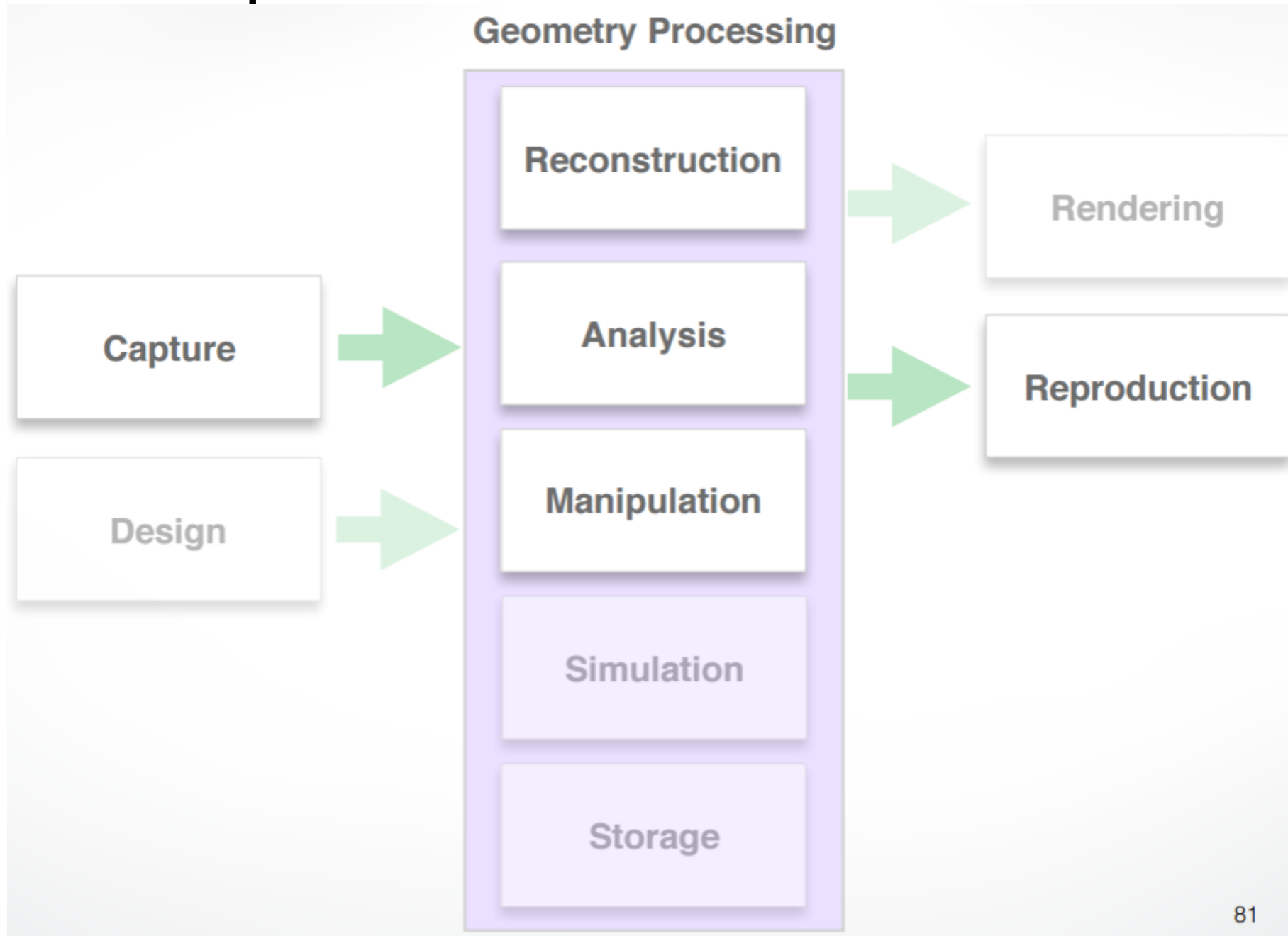
Summary



Classic Graphics



Modern Graphics/Vision



The Future: Big Data / Robotics

