Vision & Graphics

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Interaction is already strong

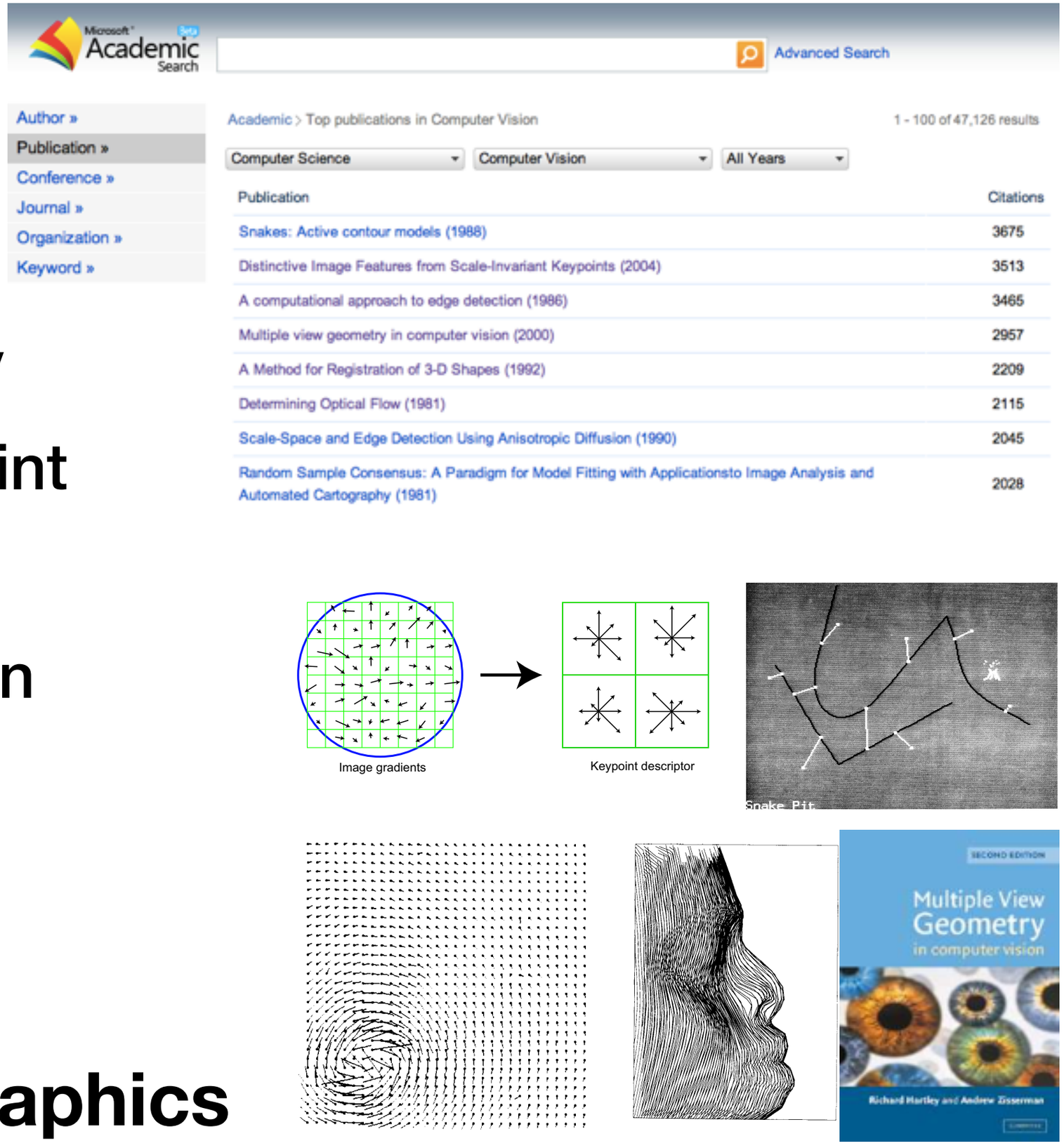
- Rick Szeliski received the Siggraph Achievement Award 2011

- Anat Levin received the Eurographics Young Researcher Award 2010

- Vision is used in special effects
- Computational photography

Bibliometrics: top vision papers

- Snakes
- SIFT
- Edge detection
- Multiview geometry
- Iterated Closest Point
- Optical flow
- Anisotropic diffusion
- Ransac
- Stereo
- Harris corners
- **... are used in graphics**

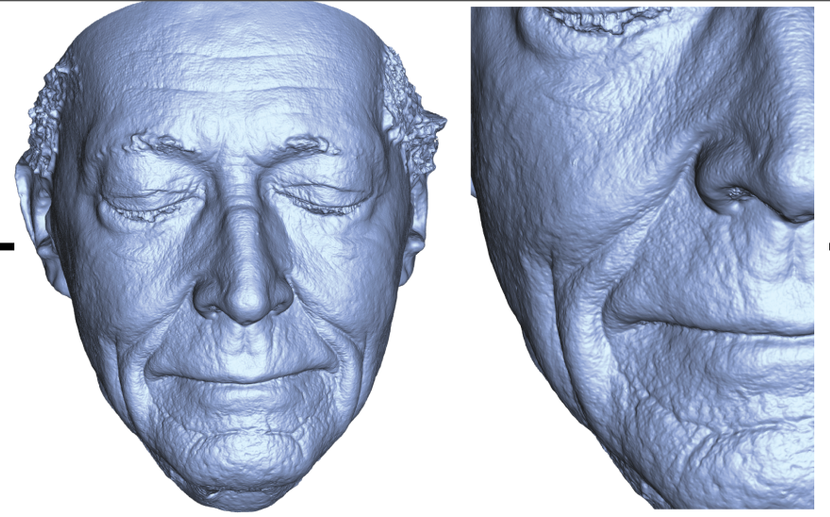


Computer vision

- Add value to visual inputs

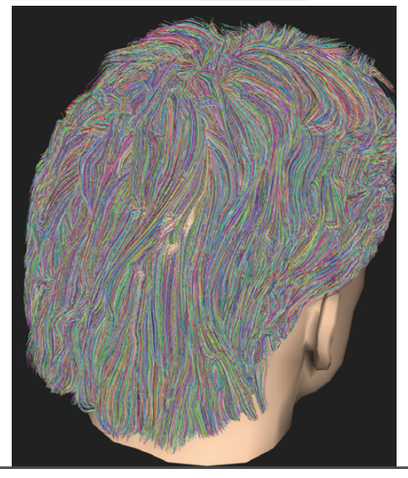
- Be open minded about
  - input
    - active, passive, 2D, 3D, 4D, etc.
  - added value
    - depth, recognition, flow, etc.
  - way to add
    - math, hack, stat, engineering, etc.

Acquisition



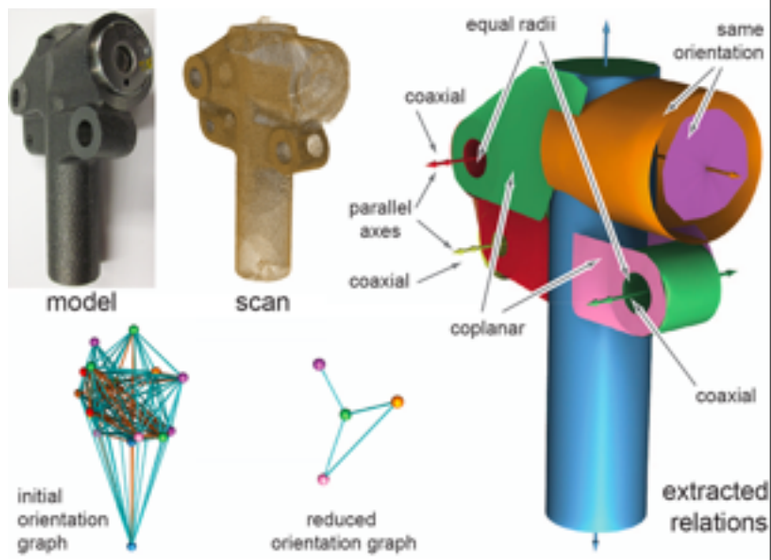
- Geometry
  - Also non-Lambertian materials
  - Also messy materials (hair, etc.)

- Complex deforming geometry



Acquisition: Geometry++

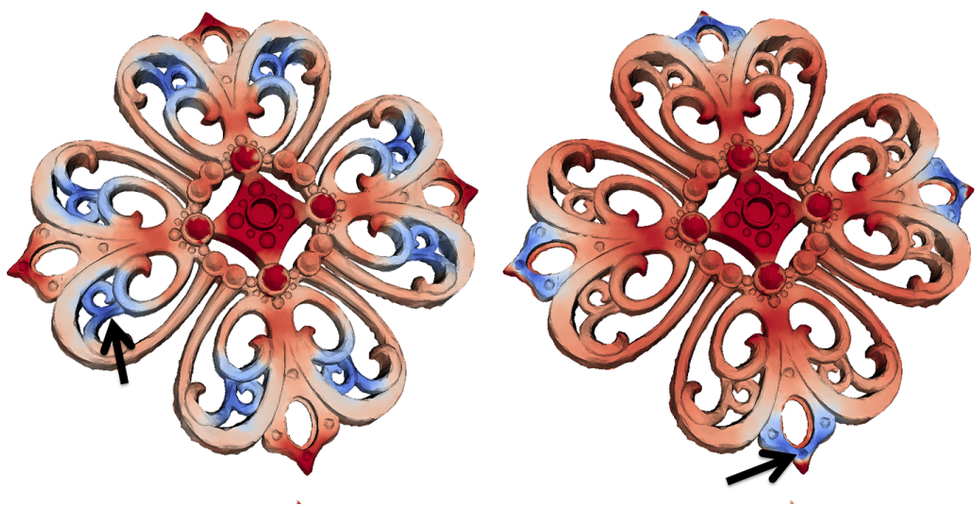
- A depth map is often not the final answer
  - not even always necessary

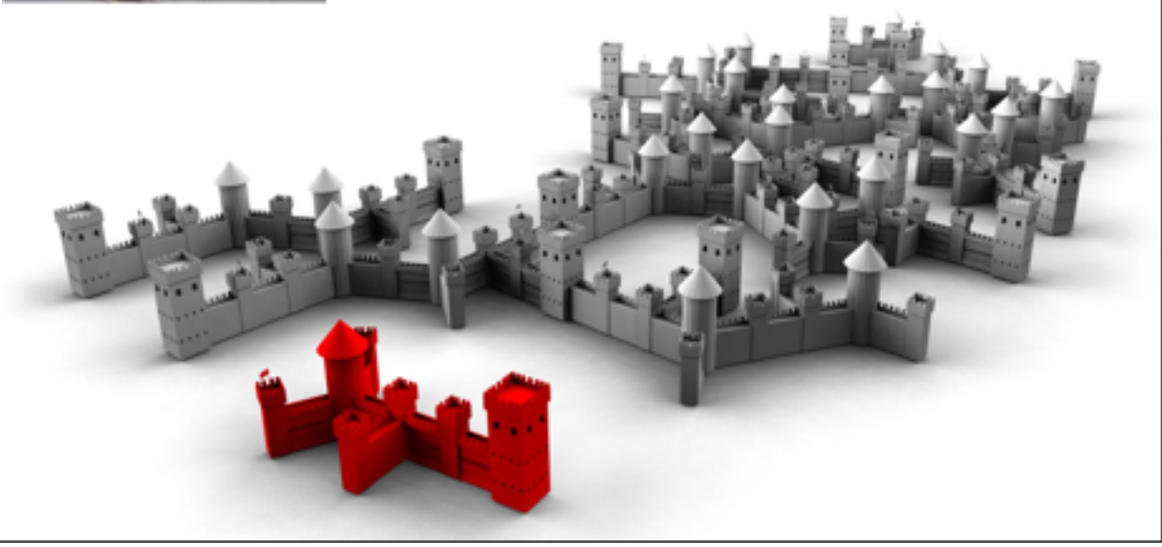


- Segments, parametric patches
- Full volumetric model
- Procedural models
  - buildings, trees



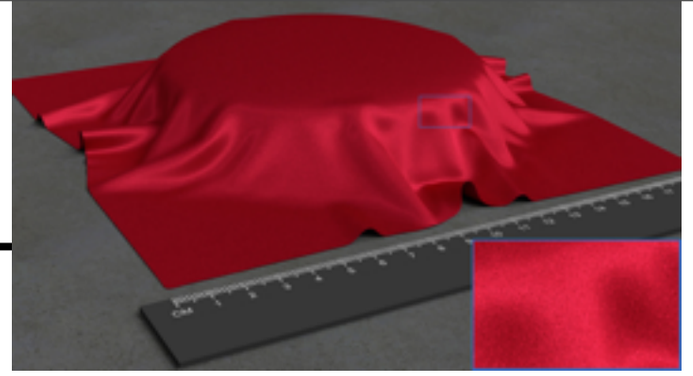

- Finding symmetries

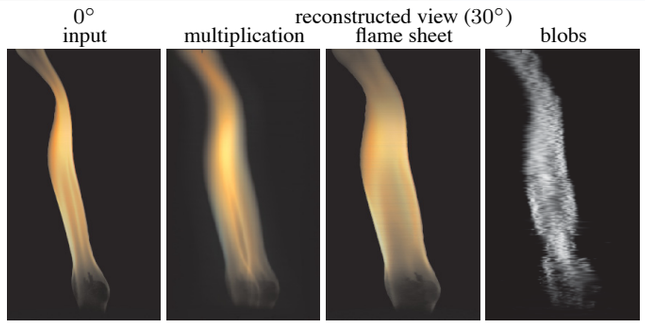


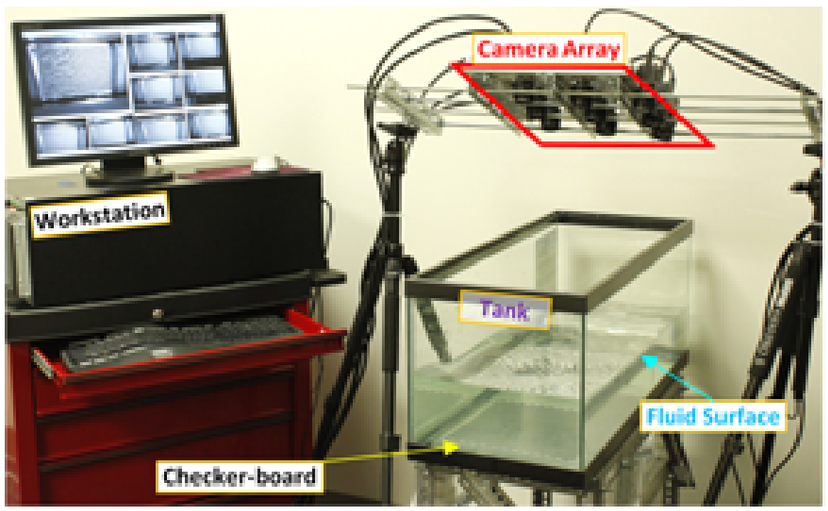


Acquisition

- Material Appearance
- Volumetric media
  - clouds, smoke, fire
- Articulated characters
  - active or markerless mocap
- Complex deforming geometry
  - physical parameters for simulation

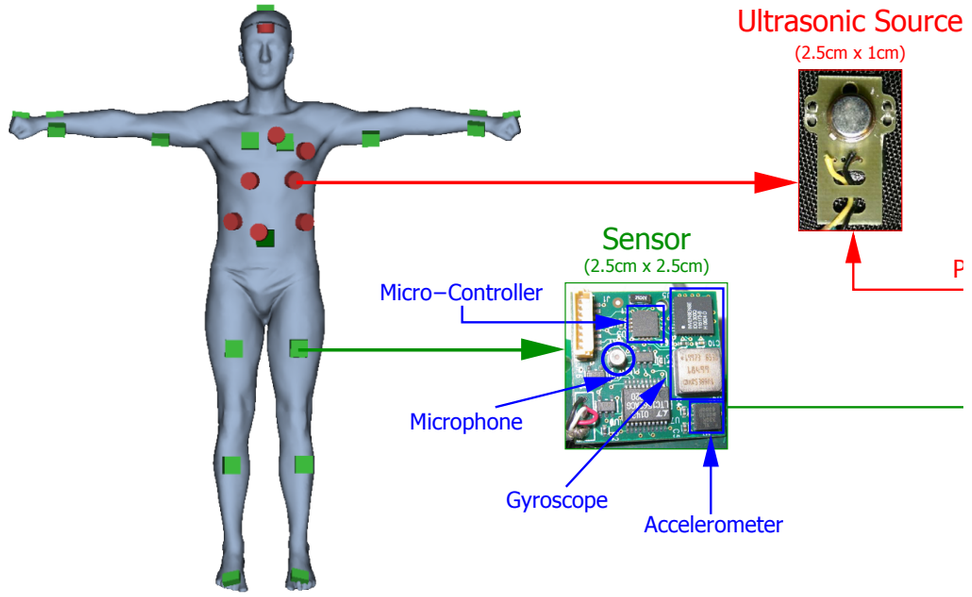


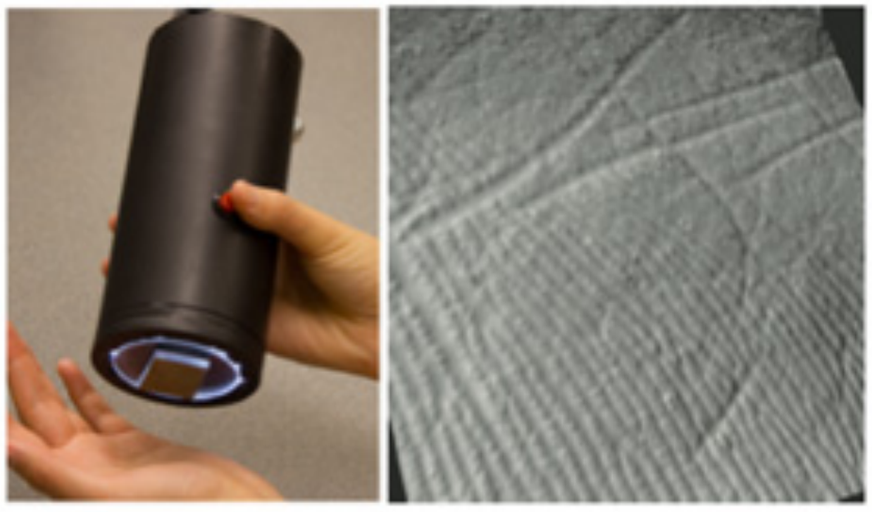




Active techniques

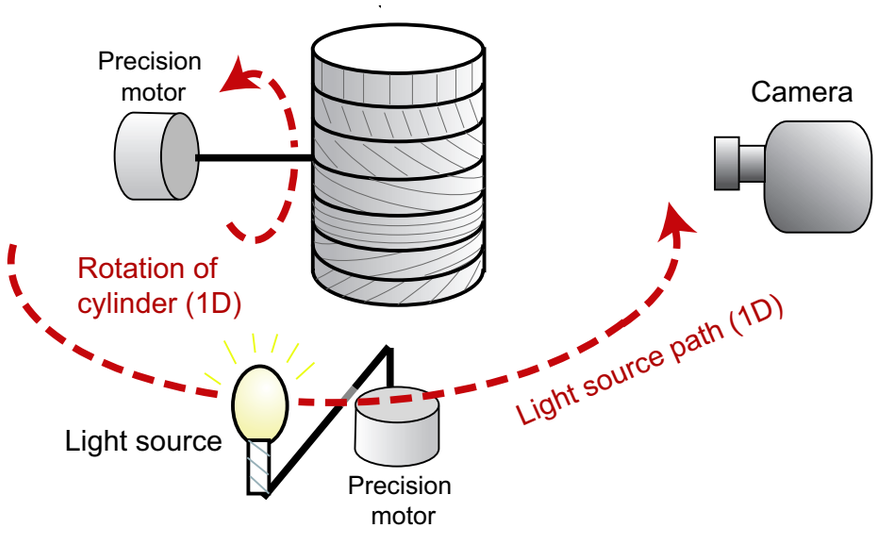
- They're great, don't overlook them
- Still require a lot of computation





portable configuration

reconstruction

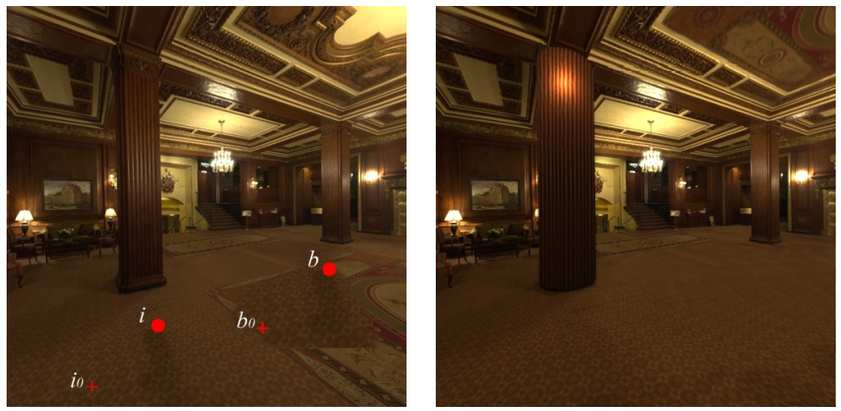


Content creation

- Biggest challenge in graphics
- Can vision help?
- related to capture, 3D acquisition, etc.
- Sketch-based modeling
- Priors for modeling/editing

Analysis-resynthesis for editing

- Recipe:
  - Analyze input/ decompose
  - Edit layers/channels/components recombine / rerender

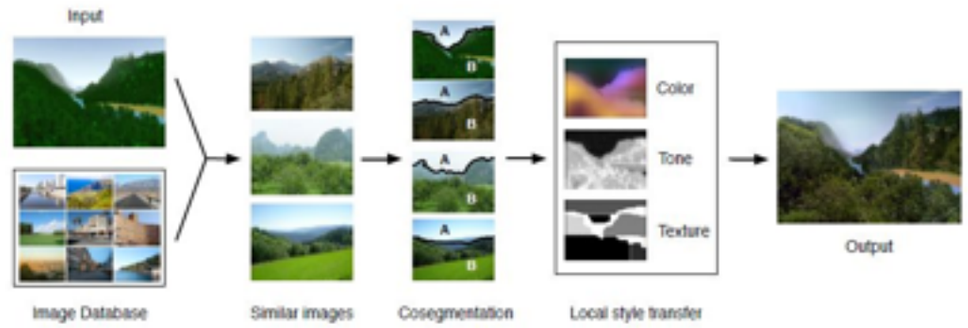


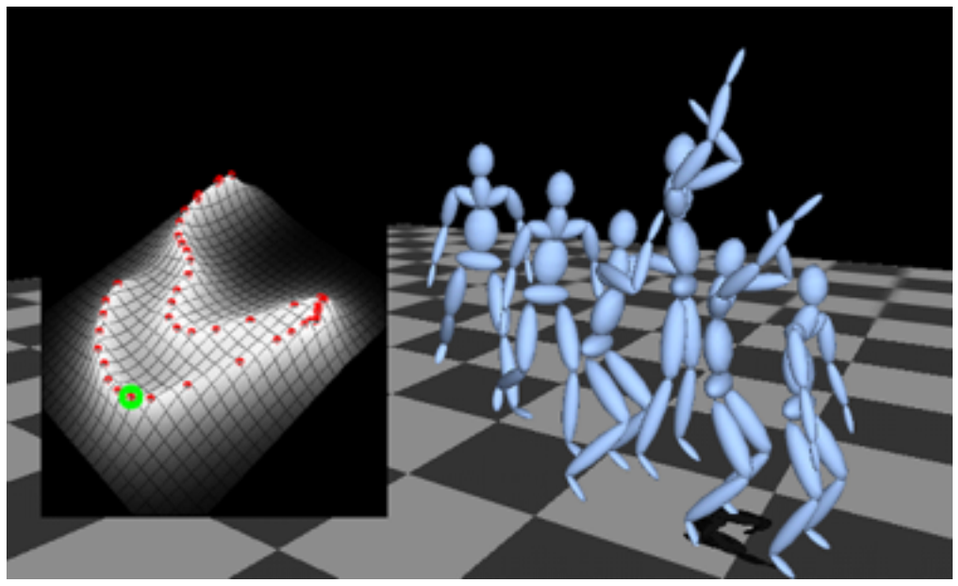
- Images
  - HDR
  - relighting

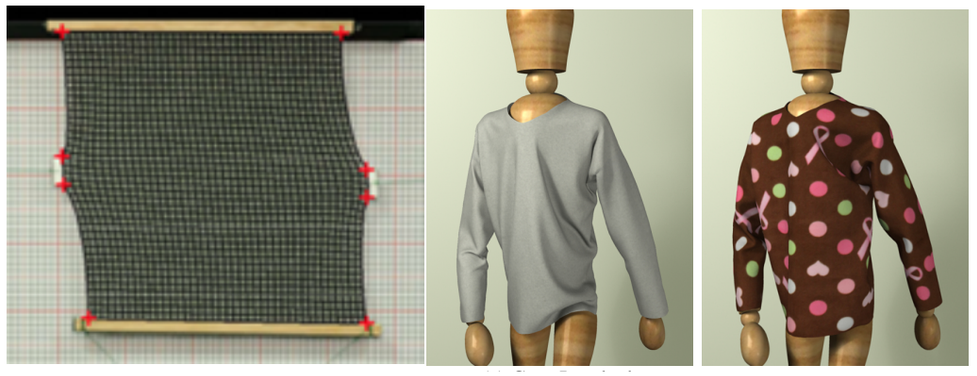
- 3D data
- Motion
- => low to mid-level analysis is important

Priors for synthesis

- Can we use natural priors to synthesize motion, images?
- Texture synthesis
  - inpainting
  - making CG more real
- Motion
  - Used a lot for humans (see Aaron)
  - Cloth, hair, fluids?
  - Directly from video?
- Priors used directly in 3D renderer?

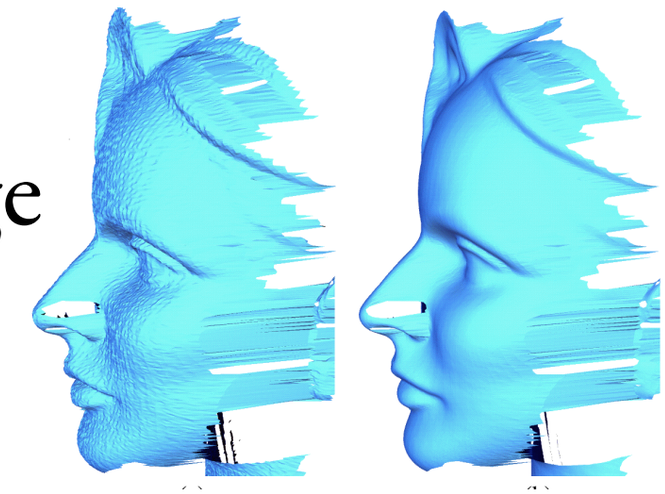




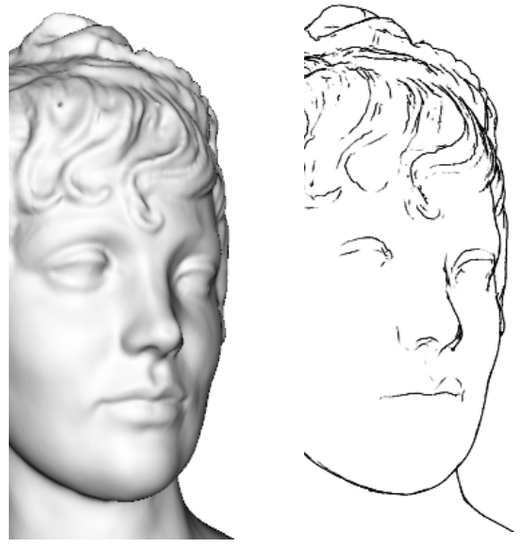


Applying vision to other signals

- Geometry
  - challenge: domain is conflated with range



- Motion capture data
- PDEs, signal processing, edge detection



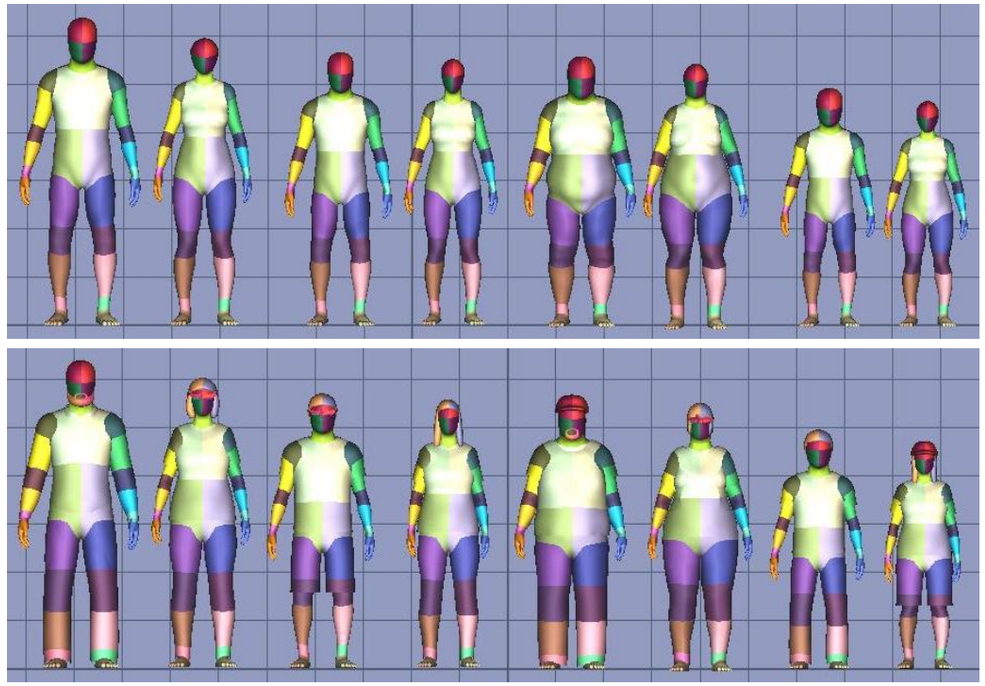
- Features, retrieval, recognition
- Priors

(Feature detection) Feature description Vector quantization Bag of words Bag of expressions

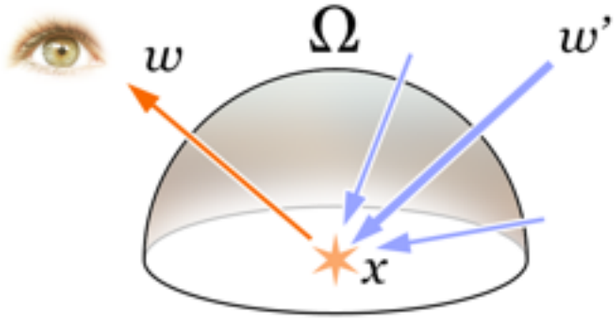
Fig. 2. Flow of the ShapeGoogle algorithm.

Using graphics for Vision

- Ground truth, training data



- **The image formation equations are the same**
  - Example: motion blur, depth of field
  - Graphics knows more about light transport, material appearance



- **Human motion modeling**

Where graphics culture is better

- Connection to the real world
- Speed, scalability
- Systems issues, languages, API
- Most important publications easy to identify
  - Fewer siggraph papers than ICCV+CVPR+ECCV
- ... Siggraph parties are better but vision conference locations are better

Recap: connections

- Acquisition
  - Geometry, material appearance, motion
- Active techniques
- Content creation
- Analysis-resynthesis for editing
- Priors for synthesis
  - images, motion
- Applying vision to other signals
  - motion, geometry
- Using graphics for vision