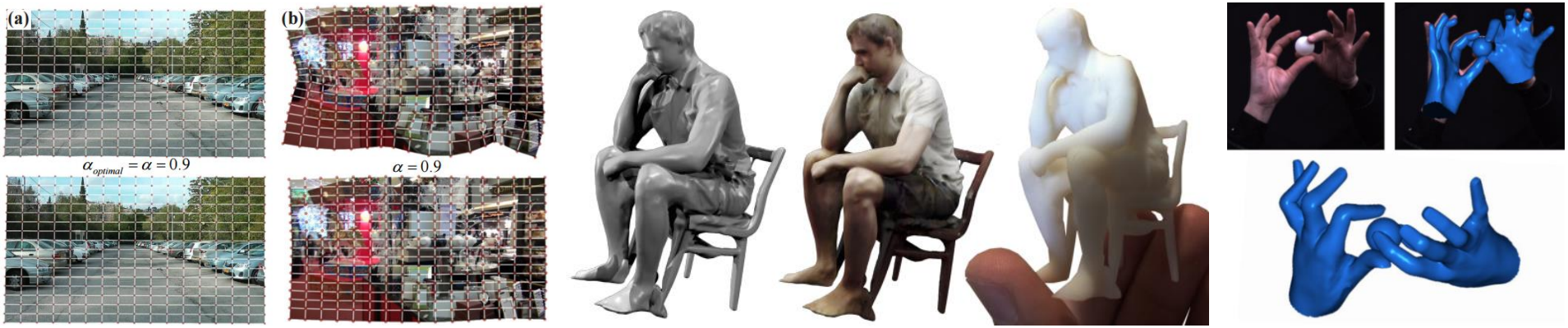


Graphics, Vision and Video Group

Computer Vision for Computer Graphics

Prof. Dr. Christian Theobalt
Dr. Christian Richardt

Summer Semester 2015

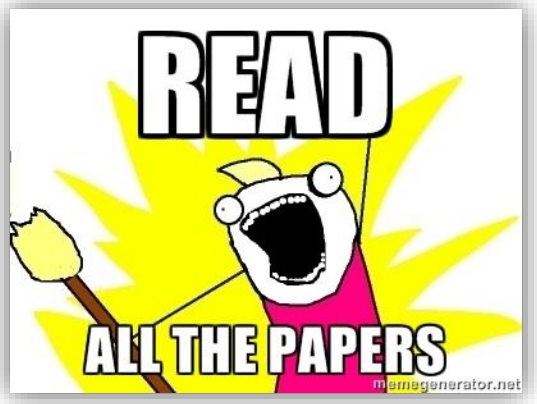
Basic Coordinates

- MPI-INF – E1 4, room 021
- Thursdays, 14:15 – 16:00
- Mailing list:
  - itvc@lists.mpi-inf.mpg.de
  - https://lists.mpi-inf.mpg.de/listinfo
- Website:
  - http://gvv.mpi-inf.mpg.de/teaching/gvv_seminar_2015/

Organisers

- Christian Theobalt
  - MPI-INF, room 228
  - theobalt@mpi-inf.mpg.de
- Christian Richardt (organisational contact)
  - MPI-INF, room 215
  - richardt@mpi-inf.mpg.de

Formal requirements in a nutshell



- You read all the papers
- Your presence is required!
  - We will monitor attendance.
- Then submit questions for and participate in discussion
- One topic is “Your Topic” (2 papers):
  - Deliver a 30 minute presentation
  - Write a 5–7 page report
- Grade: talk 30%, discussion 30%, report 40%

Prior knowledge

- Not for beginners in visual computing
- You need experience in:
  - computer vision
  - computer graphics
  - geometric modeling
  - basic numerical methods
- Examples: you should know how …
  - … a camera is modeled mathematically
  - … 3D transformations are described
  - … a system of equations is solved, etc.

Registration

- Register by email – richardt@mpi-inf.mpg.de
  - Matriculation number, degree program, semester, previous courses or experience (if you haven't done this yet)
- Fill in sign-up sheet
- Topic assignment:
  - Send a list of 3 topics (in order of preference) until **Tomorrow, Friday, 24 April 2015**
  - Slots are filled in first-come, first-served fashion
  - We will try to accommodate wishes as much as possible
  - Topics will be assigned on **Monday, 27 April 2015**
- Lastly register in HiS POS in 2–4 weeks (email to come)

Organisation

- 19 topics to choose from
  - Listed on seminar website
  - Introduced in detail later today
- 10(+1) presentation slots in total:
  - First presentation: **Thursday, 7 or 21 May 2015**
  - Each week until **Thursday, 30 July 2015** (including)
- Each topic has a supervisor:
  - You can ask questions by e-mail at any time
    - about your topic, the papers, your presentation and report
  - Up to one office hour per week

Presentations

- Same order as on seminar website
  - Slots can be swapped if necessary: talk to other participants first
- About 30 minutes long:
  - About 5 minutes:
    - summary of previous week
    - finding themes that join the two weeks
  - About 25 minutes:
    - presentation of the two papers
    - again finding the common links between the papers
- Direct public feedback from seminar organisers after talk

Suggested presentation preparation

- Schedule two meetings with your supervisor:
  - First meeting: 2–3 weeks before presentation:
    - Read the papers for this meeting
    - Ask questions if you have difficulties
    - Discuss your plans for presentation
  - Second meeting: 1 week before presentation:
    - Prepare a preliminary presentation
    - We can provide feedback
- It is your responsibility to arrange the meetings
- Do not rely on them proving last-minute feedback

Discussion

- 45–60 minutes long
- Day before the seminar:
  - Submit 2+ questions for discussion to richardt@mpi-inf.mpg.de
  - Important: your contribution will be marked
- At the seminar:
  - One person chosen at random leads the discussion
  - Will get digest of questions submitted before the seminar
  - Gives summary of the strengths and weaknesses
  - Moderates and guides discussion
  - Raises open questions that remain
  - This will also be marked

Report

- 5–7 page summary of the major ideas in your topic:
  - 3–4 pages on the two papers
  - 3–4 additional paper references
  - 2–3 pages with your own ideas, for example:
    - Limitations not mentioned in the paper + sketch of potential solution
    - Try to suggest improvements
    - Novel ideas based on content described in the papers
    - Can be the result of the discussion after your presentation
- The idea is that you get a feeling for your specific topic surpassing the level of simply understanding a paper.

Report

- Due date: **Thursday, 27 August 2015**
  (4 weeks after the last seminar)
- Send PDF by e-mail
- We will provide a LaTeX template on seminar website
  - If you use other software, make it look like the LaTeX template
    - this is your responsibility
  - Strongly recommended to learn LaTeX

Grading

- **Presentation** (overall: 30%)
  - Form (30%): time, speed, structure of slides
  - Content (50%): structure, story line and connections, main points, clarity
  - Questions (20%): answers to questions
- **Discussion** (overall: 30%)
  - Submitted questions (33%): insight, depth, inquisition
  - Participation (33%): willingness, debate, ideas
  - Moderation (33%): strengths and weaknesses, integration of questions
- **Report** (overall: 40%)
  - Form (10%): diligence, structure, appropriate length
  - Context (20%): the big picture, topic in context
  - Technical correctness (30%)
  - Discussion (40%): novelty, transfer, own ideas / in own words

Benefits to you

- Practise important skills in research
  - Read and understand technical papers
  - Present scientific results and convince other people
  - Analyse and develop new ideas through discussions
- Discussion is essential:
  - If you don’t participate, you miss a big chance
  - Most ideas are developed in discussions about other papers
- Therefore:
  - Prepare for the seminar classes
  - Participate actively in the discussions
  - Benefit from the interaction in the group

What this seminar is not …

- A course to just sit and listen
  - Come prepared
  - Read all papers before class, think about problems, submit questions and discuss them in class
  - Your participation benefits everyone
    - the group makes the seminar
- "Cheap" 8 credit points
  - Don't underestimate the time it takes to understand a paper, prepare a talk, and write a report
  - So take it seriously!

Schedule

- **23 April** – Introduction ◄ You are here
- **30 April** – Lectures:
  - “How to read an academic paper”
  - “How to give a good talk”
- (**7 May** – Example conference presentation)
- **7 or 21 May** – First presentation by a student
- … 8 more weekly presentations
- **30 July** – Last presentation by a student
- **27 August** – Report deadline

Introduction to the topics

Vision or graphics?

Vision or graphics?

Vision or graphics?

Vision or graphics?

Vision or graphics?

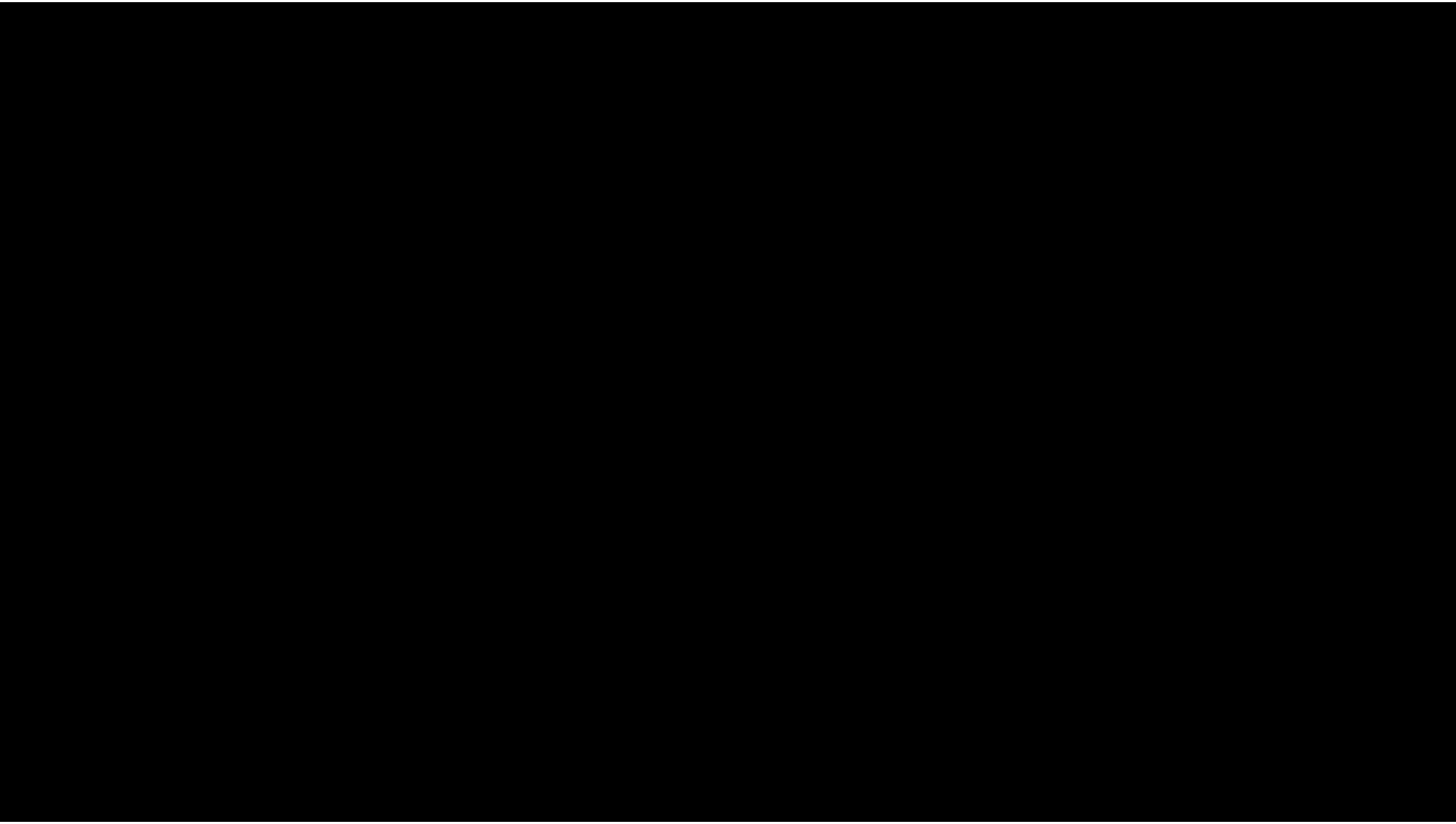
Vision or graphics?

Vision or graphics?

Song Hye Kyo

Vision or graphics?

Applications: The Foundry Showreel



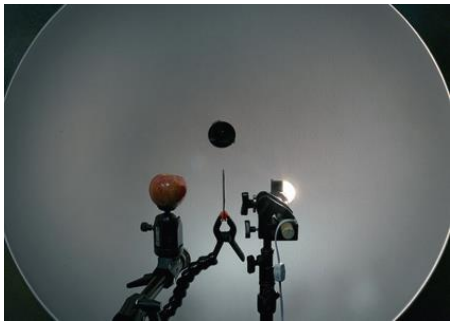
Geometry

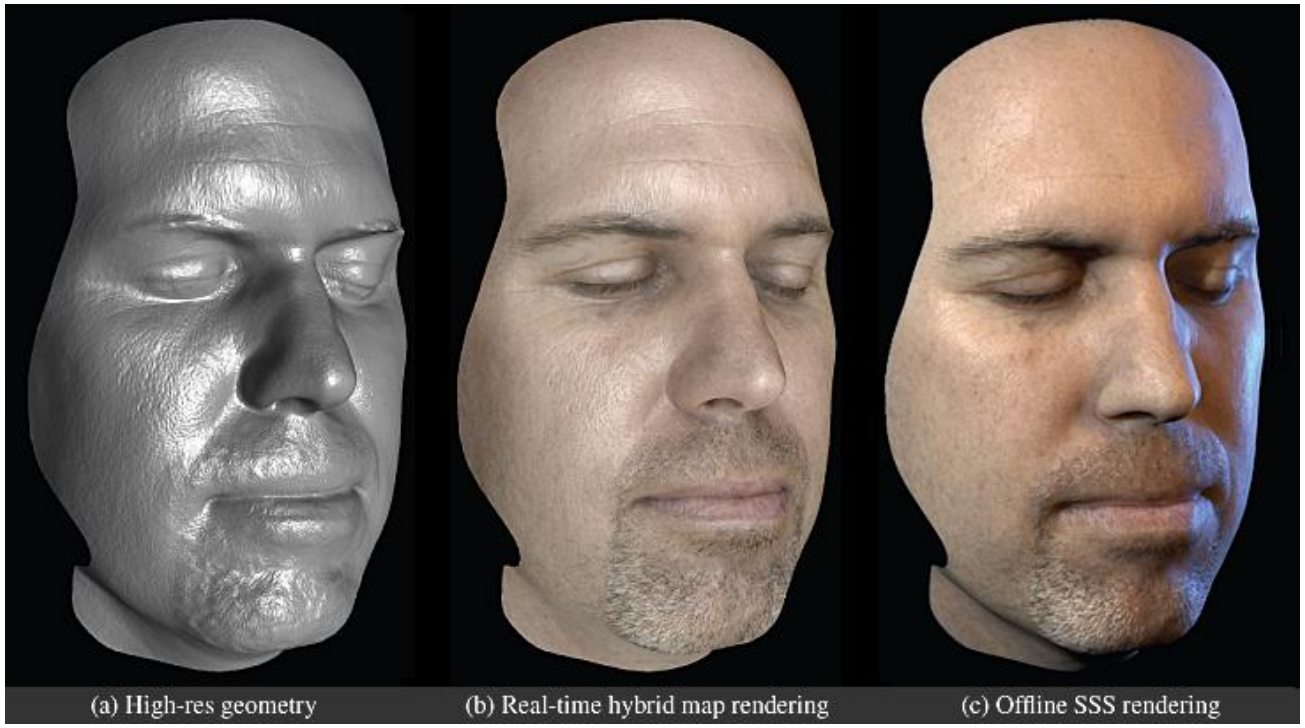
- e.g. environment models

[*Bokeloh et al.*, Eurographics 2009]

Appearance

- e.g. human appearance models:

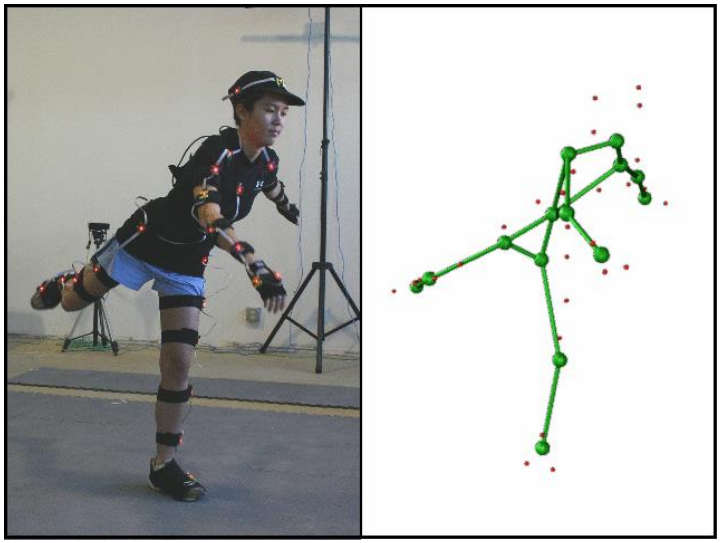




[*Ma et al.*, EGSR 2007]

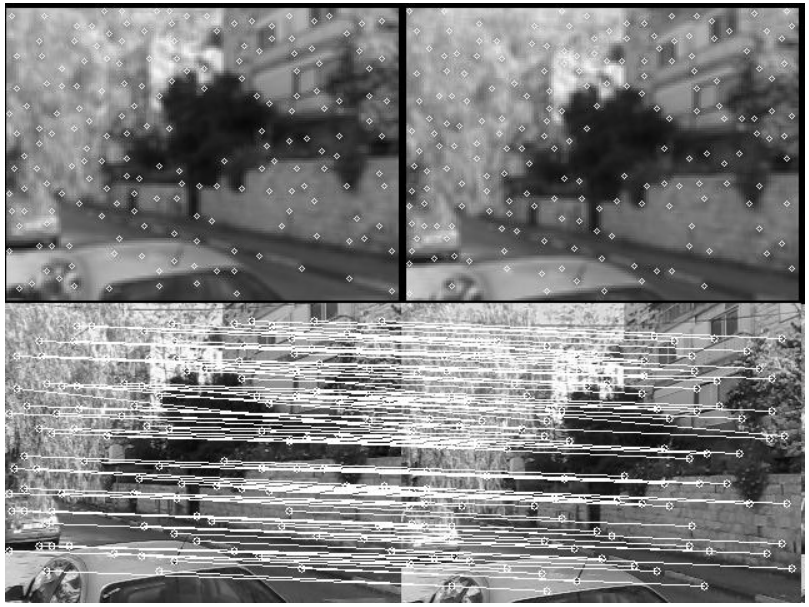
Motion

- e.g. marker-based performance capture:



Computer vision

- Low-level vision:



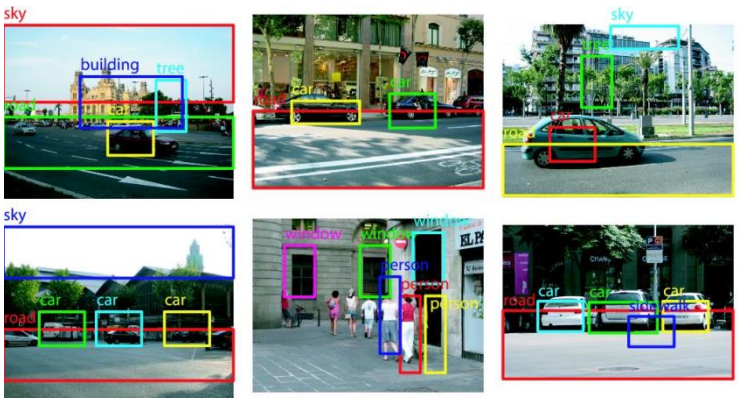
Feature detection
& correspondence

Optical flow

Computer vision

- High-level vision:
  - Scene understanding / recognition / reconstruction

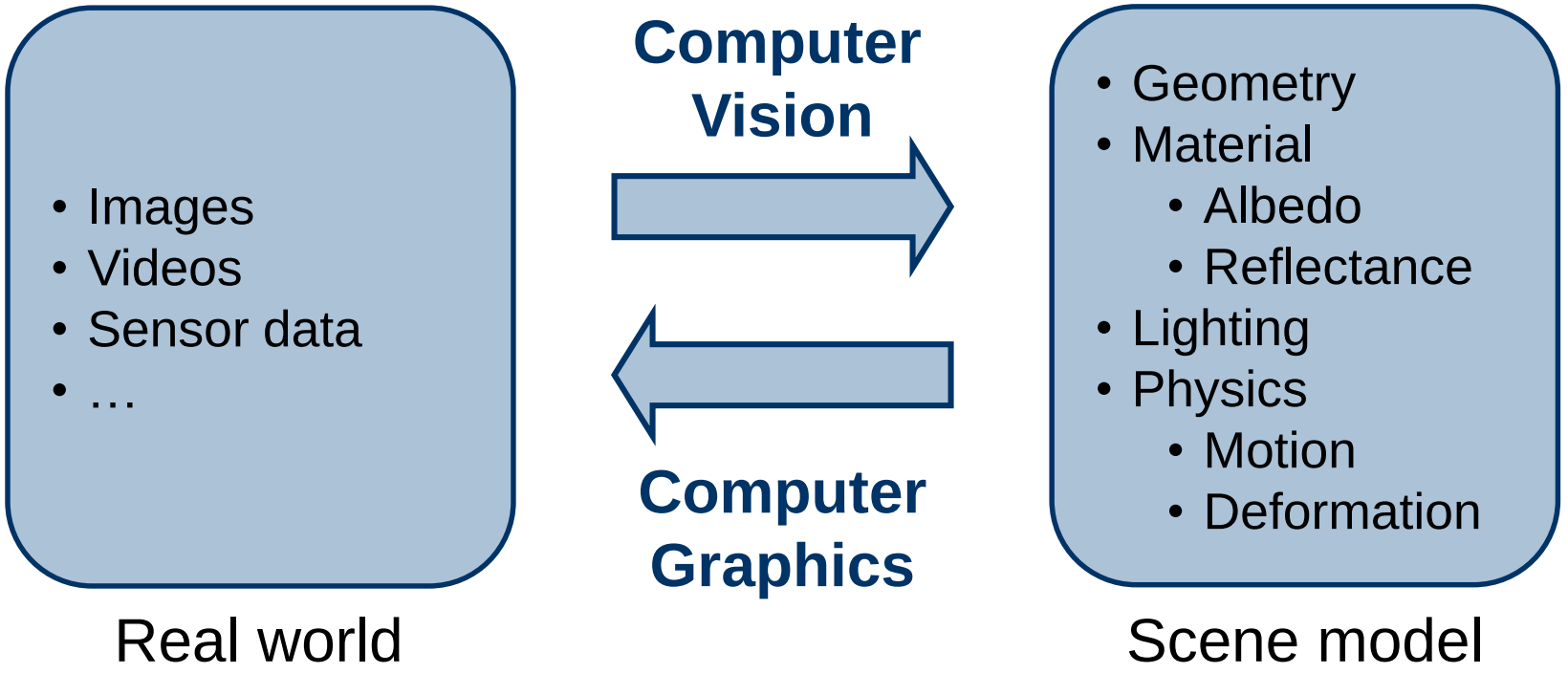
Human motion estimation



Object recognition

Multi-view stereo reconstruction

Computer Graphics / Computer Vision



Topics

- Covering state-of-the-art research papers
- Strong focus on top conferences and journals in computer vision and computer graphics:
  - SIGGRAPH & SIGGRAPH Asia (Transactions on Graphics)
  - Eurographics (Computer Graphics Forum)
  - IEEE Computer Vision and Pattern Recognition (CVPR)
  - International Conference on Computer Vision (ICCV)
  - European Conference on Computer Vision (ECCV)
  - International Journal of Computer Vision (IJCV)
  - Transactions on Pattern Analysis and Machine Intelligence (PAMI)

Estimating reflectance

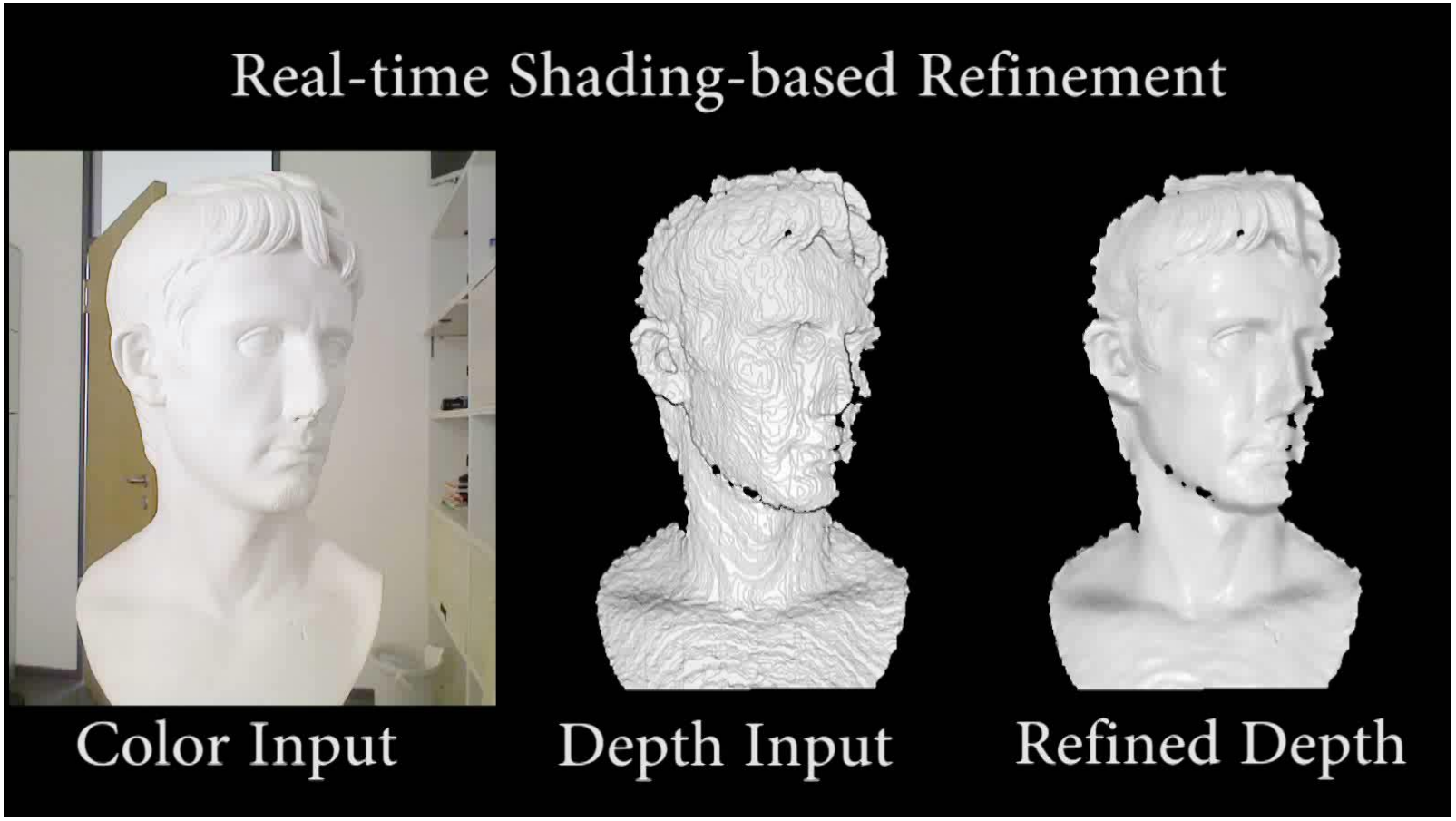
- Blind Reflectometry
  (*Romeiro and Zickler*, ECCV 2010)

- Appearance-from-Motion: Recovering Spatially Varying Surface Reflectance under Unknown Lighting
  (Dong et al., SIGGRAPH Asia 2014)

Supervisor: Abhimitra

Shading-based refinement and intrinsic images

- Real-time Shading-based Refinement for Consumer Depth Cameras (*Wu et al.,* SIGGRAPH ASIA 2014)



Supervisor: Michael, Abhimetra

Shading-based refinement and intrinsic images

- A Simple Model for Intrinsic Image Decomposition with Depth Cues (*Chen and Koltun*, ICCV 2013)

Shading-based refinement and intrinsic images

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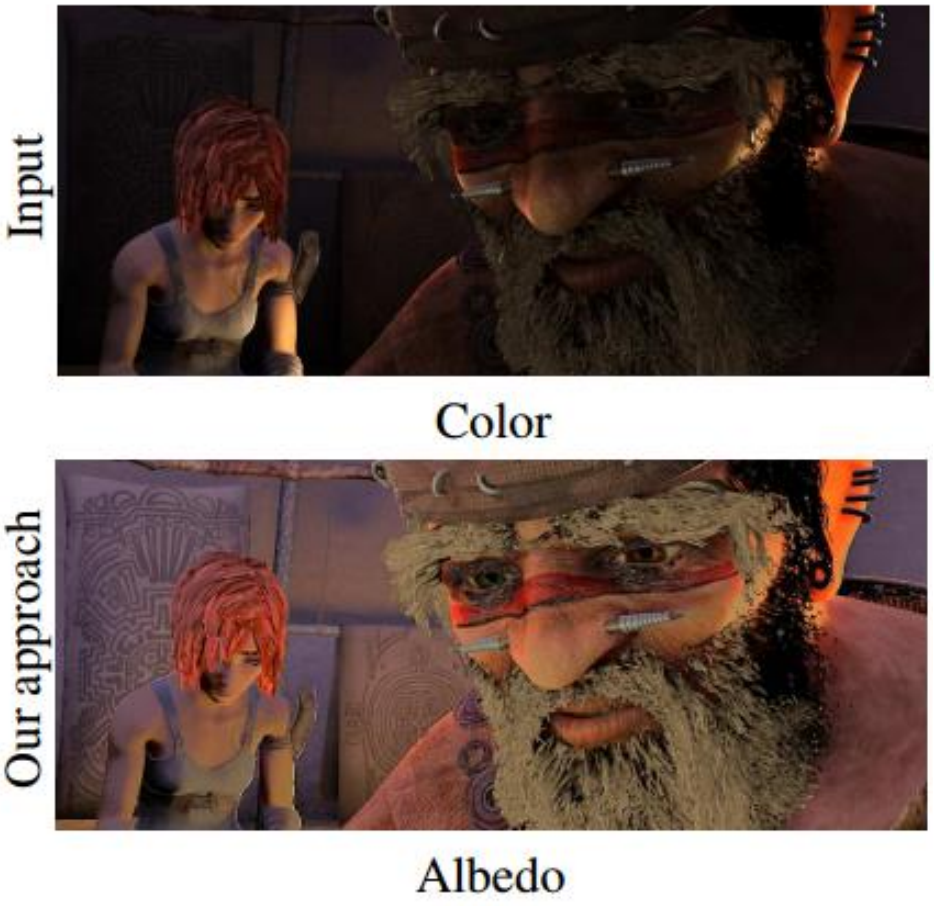


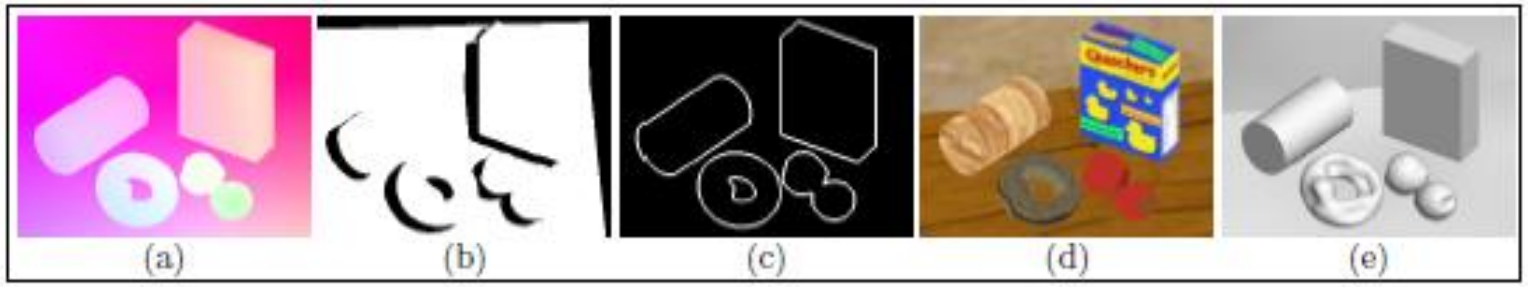
Supervisor: Michael, Abhimetra

Shading-based refinement and intrinsic images

- A Simple Model for Intrinsic Image Decomposition with Depth Cues (*Chen and Koltun*, ICCV 2013)

Intrinsic Video

- Intrinsic Video
  (*Kong et al.*, ECCV 2014)

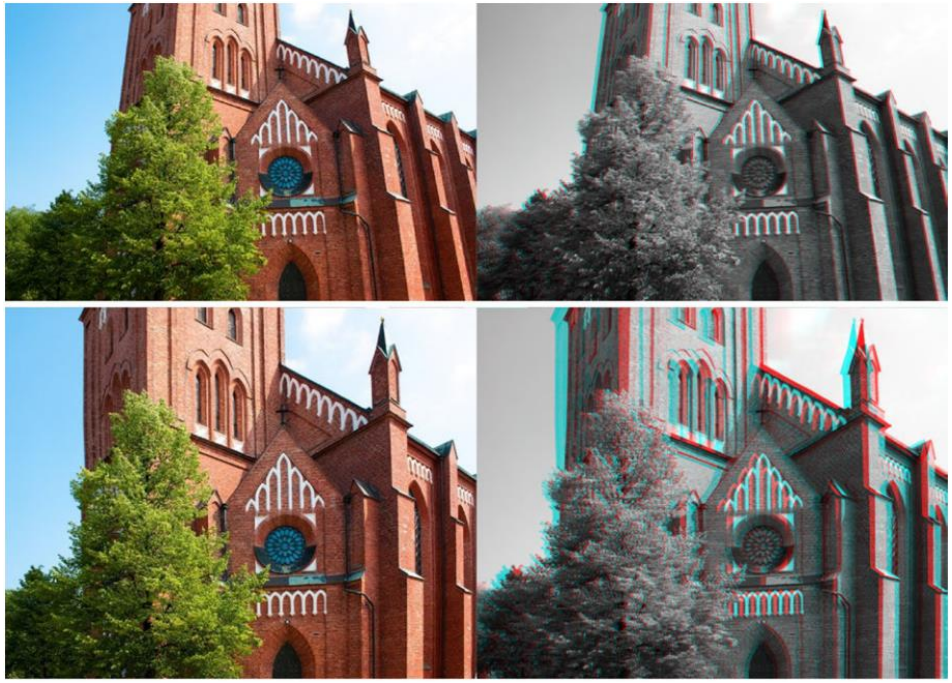


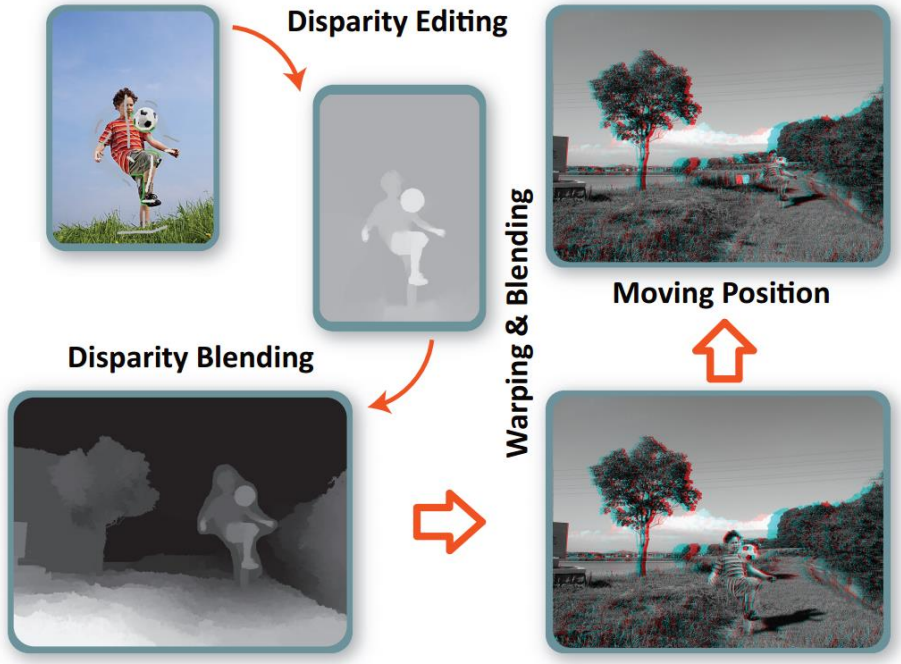
- Interactive Intrinsic Video Editing
  (Bonneel et al., SIGGRAPH Asia 2014)

Supervisor: Abhimitra, Christian R.

Stereoscopic image editing

- Changing Perspective in Stereoscopic Images
  (*Du et al.*, TVCG 2013)
- StereoPasting: Interactive Composition in Stereoscopic Images
  (*Tong et al.*, TVCG 2013)

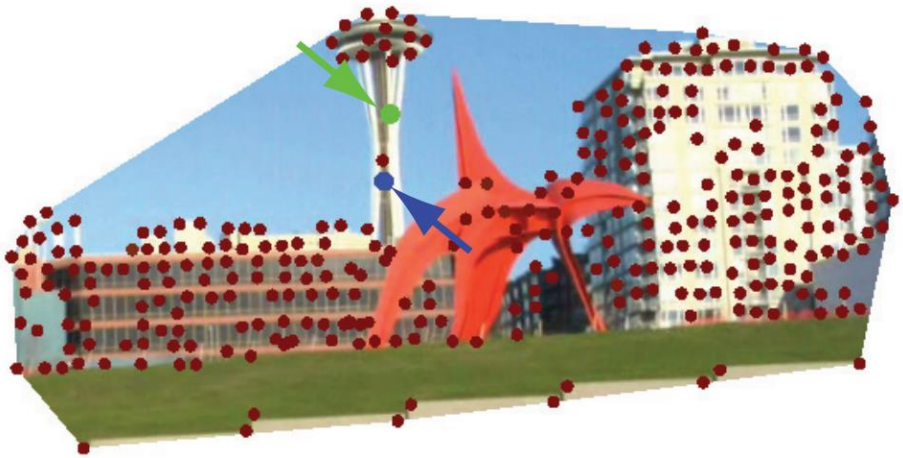


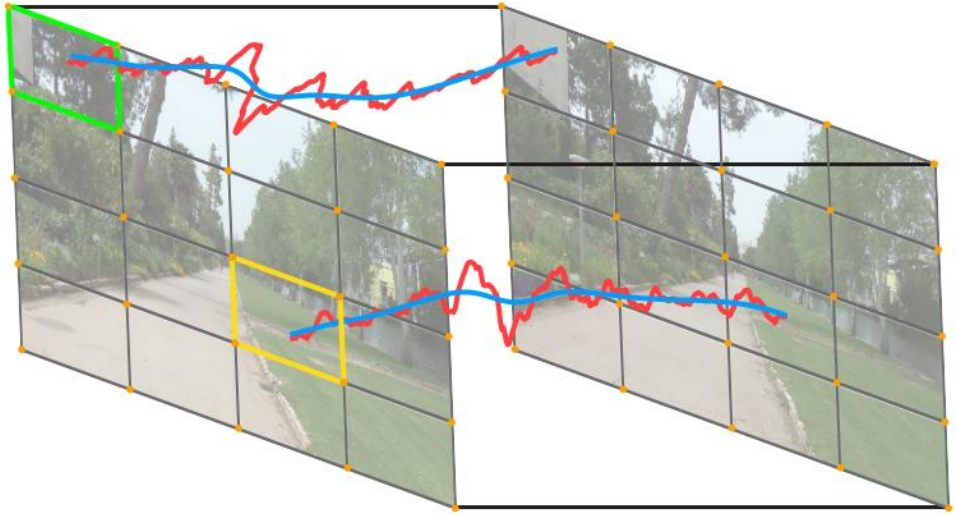


Supervisor: Christian R.

Video stabilisation

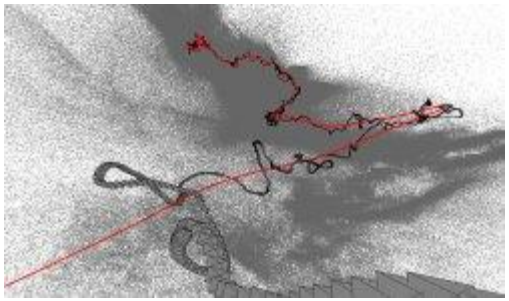
- Subspace Video Stabilization
  (*Liu et al.*, TOG 2011)
- Bundled camera paths for video stabilization
  (*Liu et al.*, SIGGRAPH 2013)

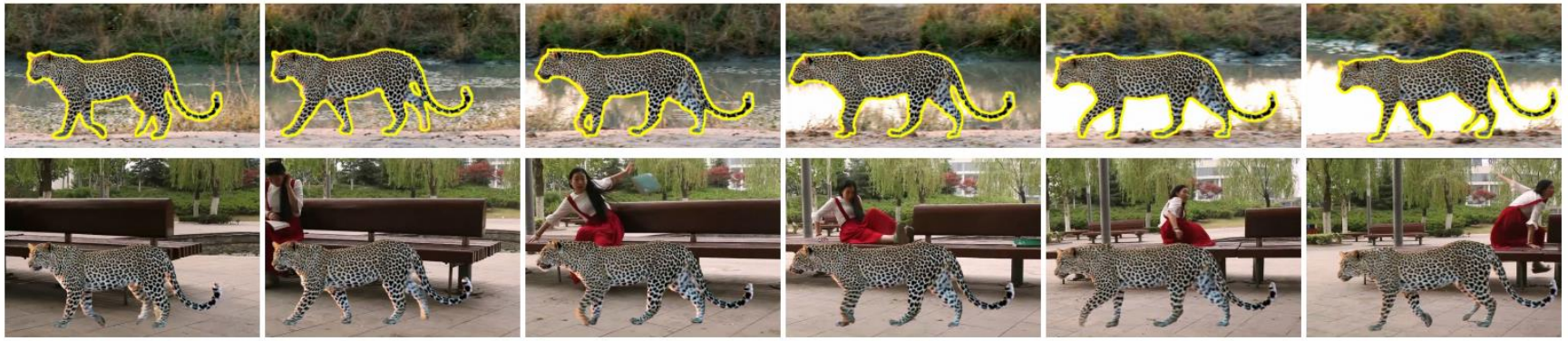




Video motion editing

- First-person Hyperlapse Videos
  (*Kopf et al.*, SIGGRAPH 2014)
- Slippage-free Background Replacement for Hand-held Video
  (*Zhong et al.*, SIGGRAPH Asia 2014)





Supervisor: Hyeongwoo

Light-field panoramas

- Megastereo: Constructing High-Resolution Stereo Panoramas
  (*Richardt et al.*, CVPR 2013)
- Panorama Light-Field Imaging
  (*Birklbauer & Bimber*, Eurographics 2014)

Supervisor: Christian R.

Multi-view image segmentation

- Wide Baseline Multi-View Video Matting using a Hybrid Markov Random Field (*Wang et al*., ICPR 2014*)*
- Sparse Multi-View Consistency for Object Segmentation (*Djelouah et al.,* PAMI 2015*)*

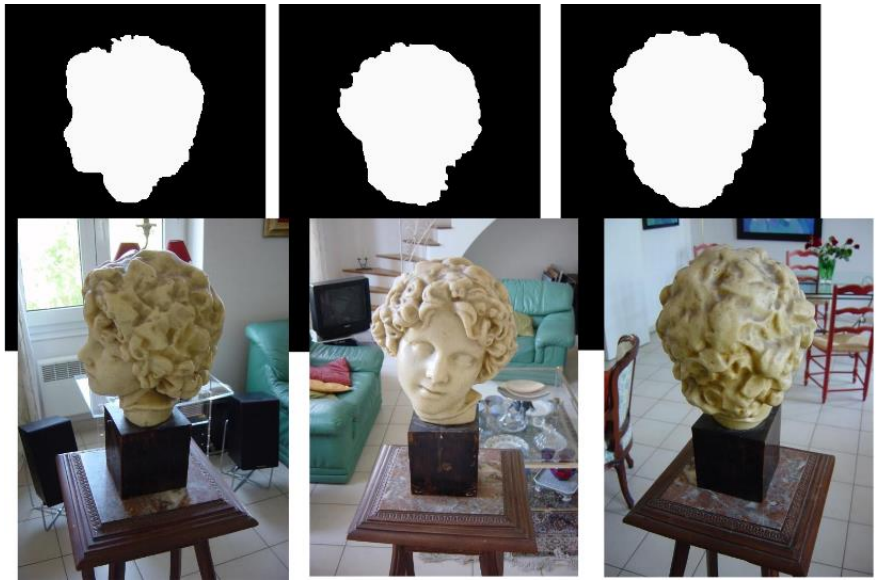
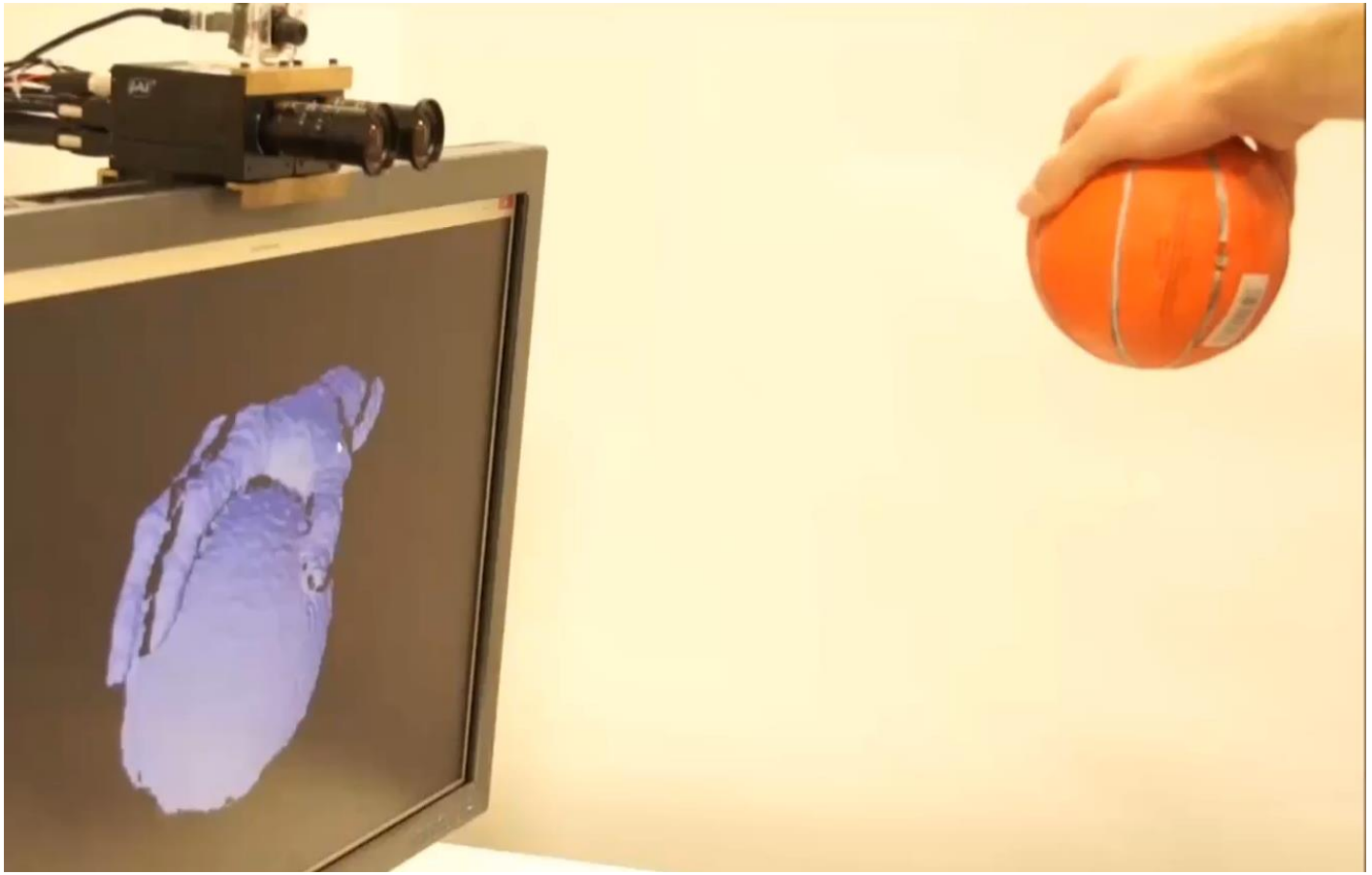


Fig. 2. Multi-view segmentation results for SALSA (upper) and KARATE (lower). Red: under-detected vs. groundtruth. Blue: over-detected vs. groundtruth.

Supervisor: Nadia

Scanning and deformation

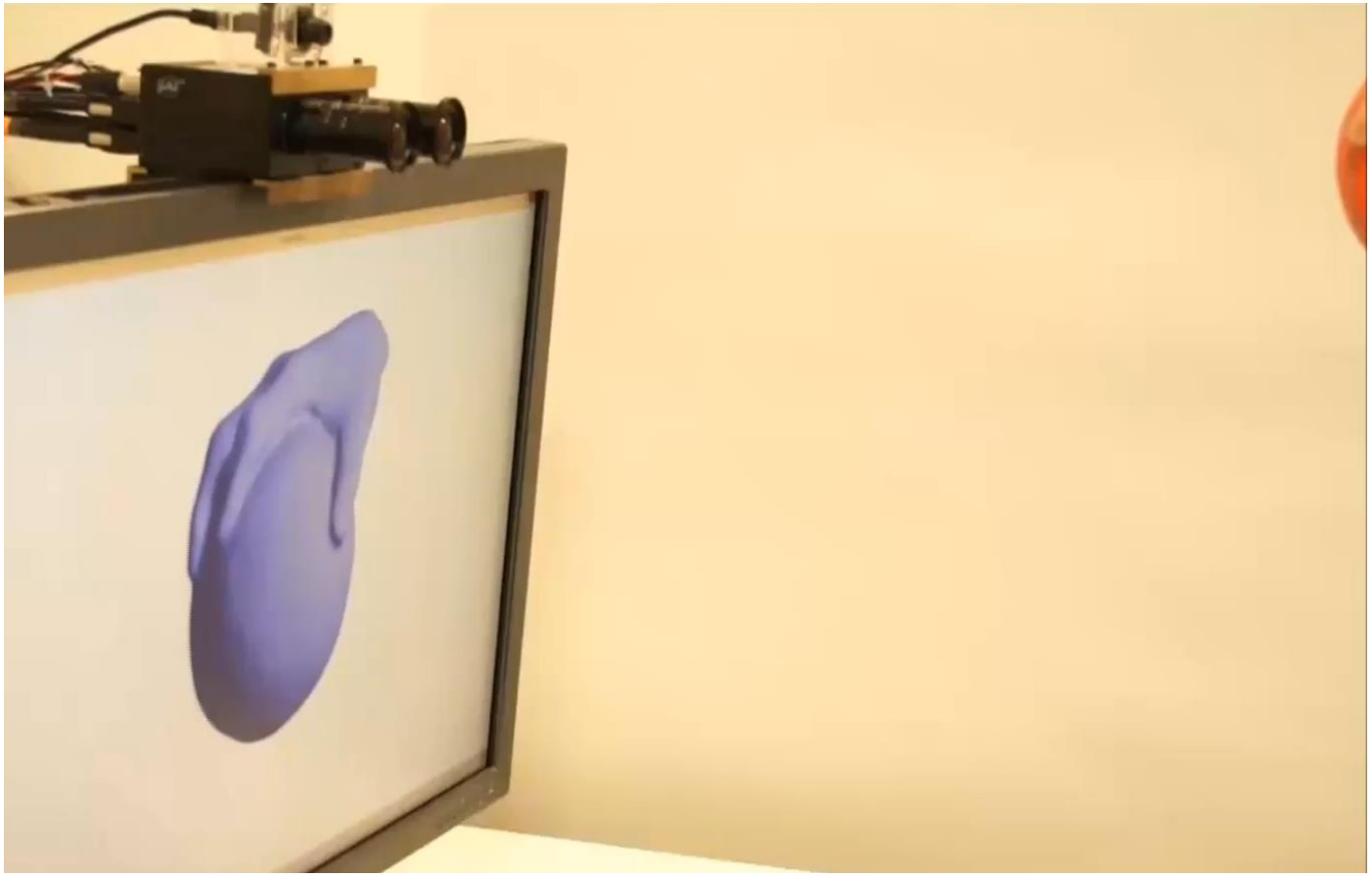
- Real-time Non-rigid Reconstruction using an RGB-D Camera (*Zollhöfer et al.*, SIGGRAPH 2014)



Supervisor: Michael

Scanning and deformation

- Real-time Non-rigid Reconstruction using an RGB-D Camera (*Zollhöfer et al.*, SIGGRAPH 2014)



Supervisor: Michael

Scanning and deformation

- 3D Self-Portraits (*Li et al.,* SIGGRAPH Asia 2013)

Texture Optimization

- Color Map Optimization for 3D Reconstruction with Consumer Depth Cameras (*Zhou and Koltun*, SIGGRAPH 2014)
- High Resolution 3D Shape Texture from Multiple Videos (*Tsiminaki et al.*, CVPR 2014)

Supervisor: Nadia

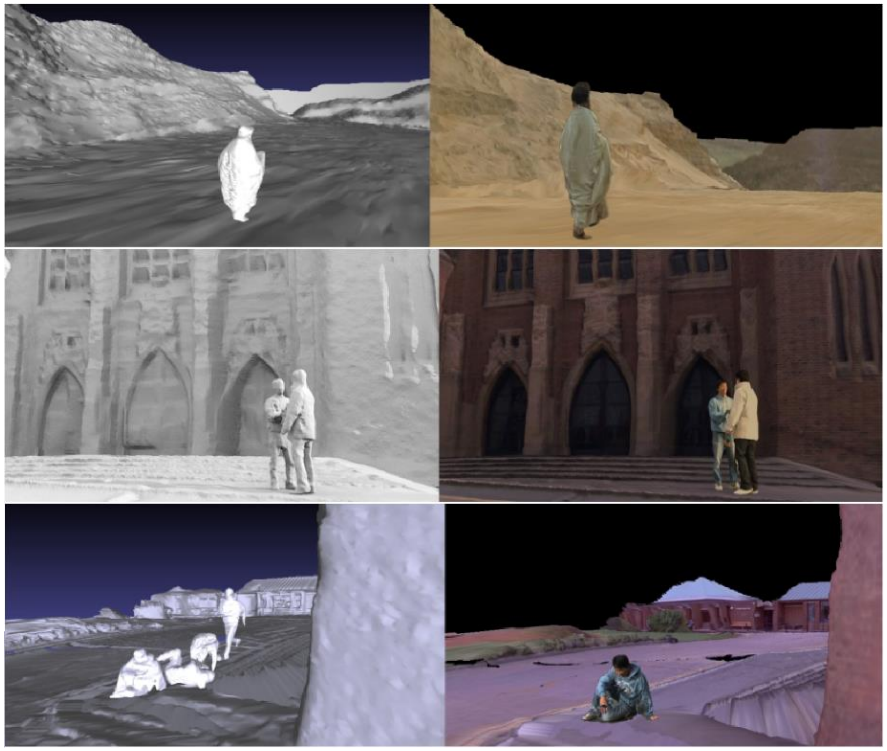
Modelling static geometry

- 3D Modelling of Static Environments Using Multiple Spherical Stereo (*Kim et al.*, ECCV 2010 Workshops)
- Floating Scale Surface Reconstruction (*Fuhrmann and Goesele*, SIGGRAPH 2014)

Supervisor: Nadia

Modelling dynamic geometry

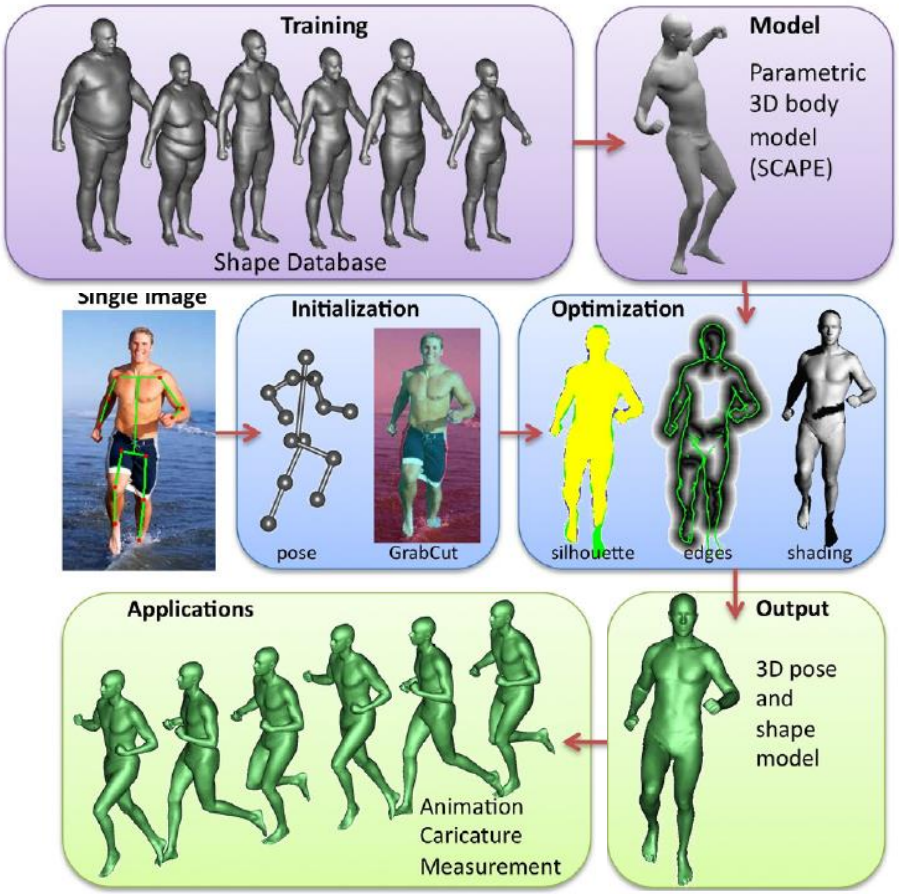
- Outdoor Dynamic 3-D Scene Reconstruction (*Kim et al.*, IEEE Transactions on Circuits and Systems for Video Technology 2012)
- Surface Capture for Performance-Based Animation (*Starck and Hilton*, Computer Graphics & Applications 2007)



Supervisor: Nadia, Dan

Human shape estimation

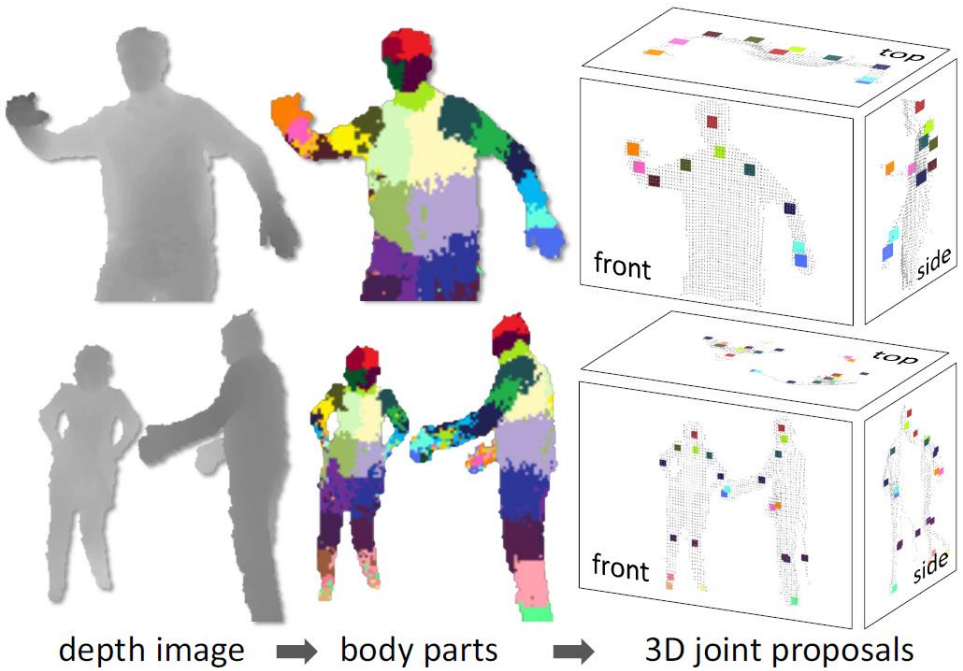
- Deformable model for estimating clothed and naked human shapes from a single image (*Chen et al.*, Visual Computer 2013)
- Estimating Human Shape and Pose from a Single Image (*Guan et al.*, ICCV 2009)

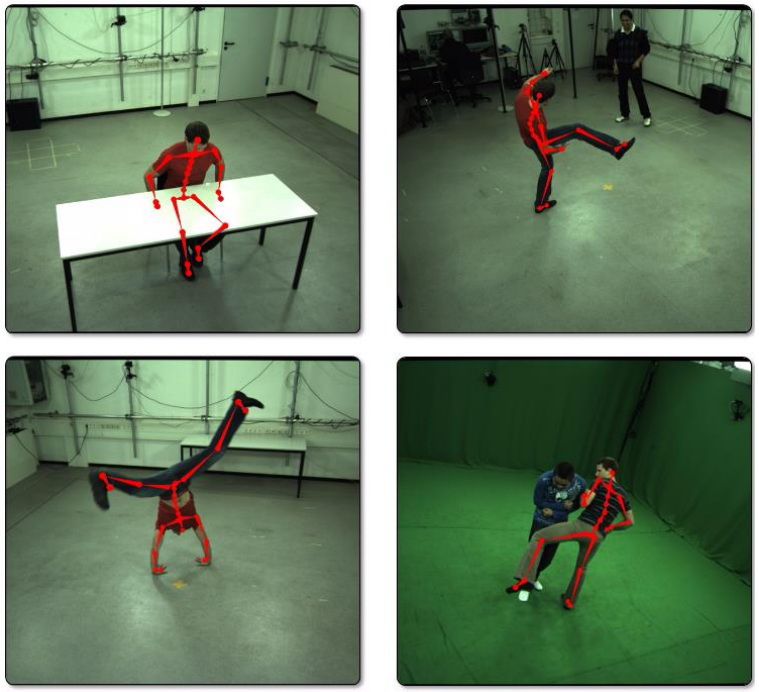


Supervisor: Helge

Human pose estimation

- Real-Time Human Pose Recognition in Parts from a Single Depth Image (*Shotton et al.,* CVPR 2011)
- Fast Articulated Motion Tracking using a Sums of Gaussians Body Model (*Stoll et al.,* ICCV 2011)

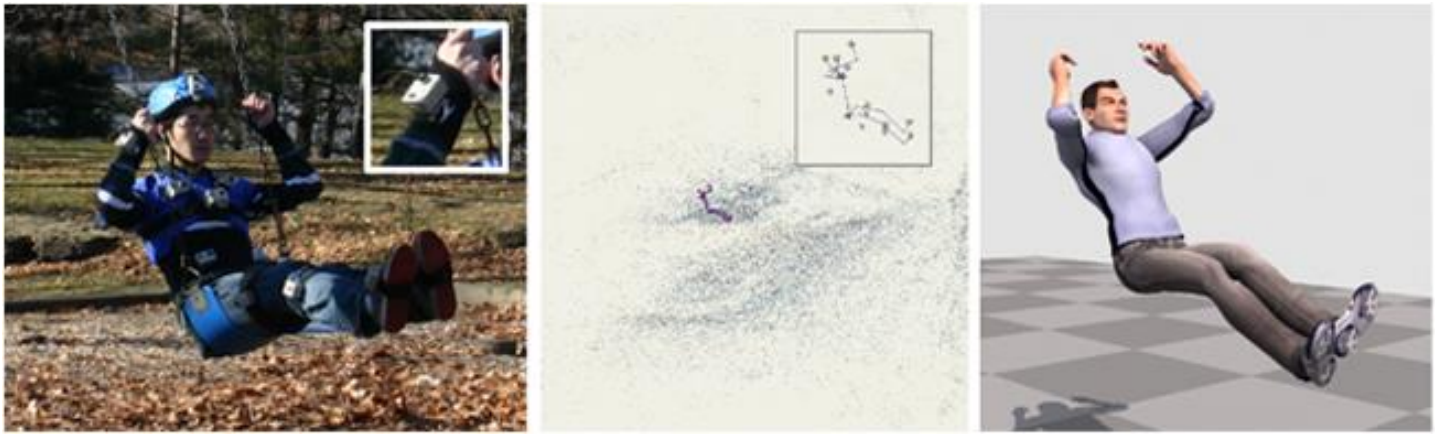




Supervisor: Srinath, Helge, Ahmed

Outdoor motion capture

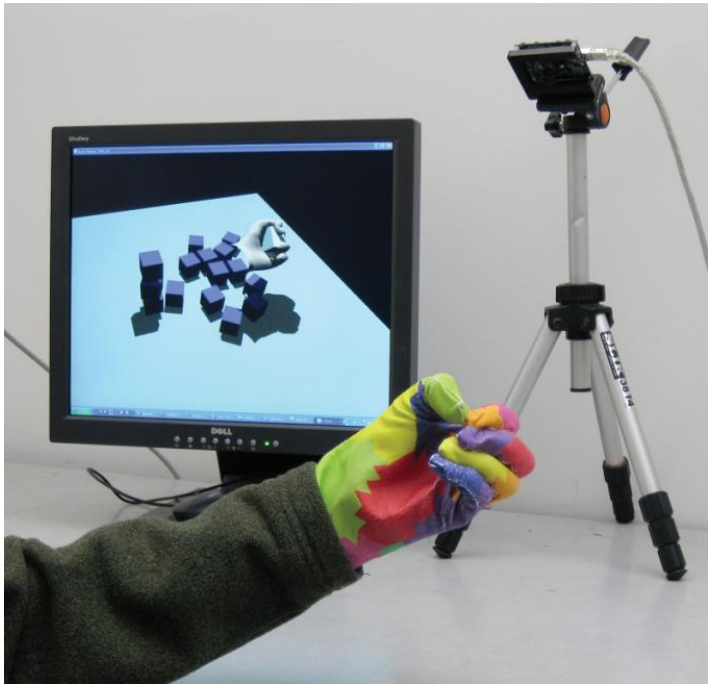
- Motion Capture from Body-Mounted Cameras
  (*Shiratori et al.*, SIGGRAPH 2011)
- Efficient ConvNet-based Marker-less Motion Capture in General Scenes with a Low Number of Cameras
  (*Elhayek et al.*, CVPR 2015)

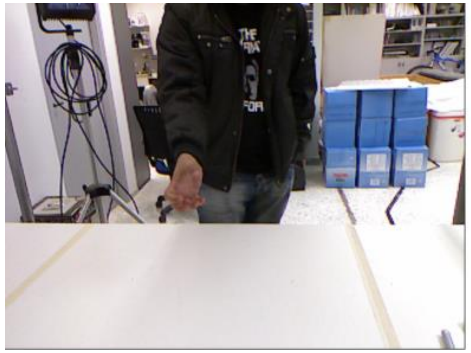


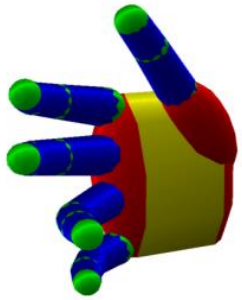
Supervisor: Helge, Ahmed

Hand tracking

- Real-Time Hand-Tracking with a Color Glove
  (*Wang & Popović*, SIGGRAPH 2009)
- Efficient model-based 3D tracking of hand articulations using Kinect
  (*Oikonomidis et al.,* BMVC 2011)



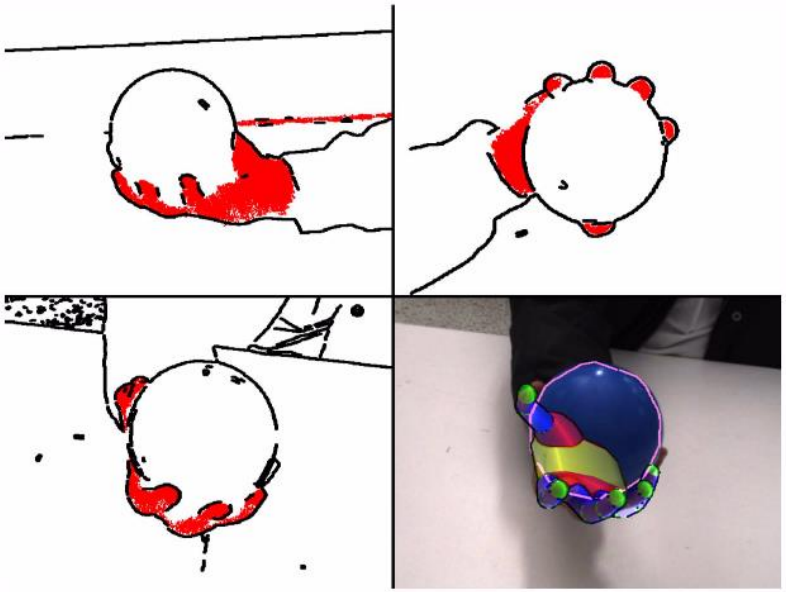


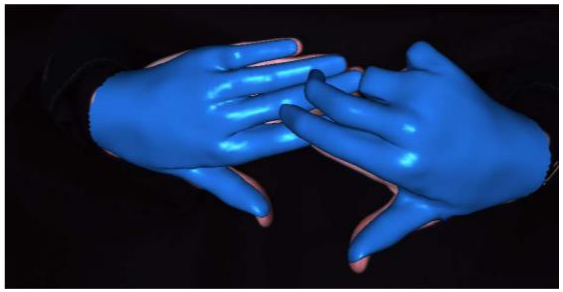


Supervisor: Srinath

Hands+object tracking

- Full DOF Tracking of a Hand Interacting with an Object by Modeling Occlusions and Physical Constraints
  (*Oikonomidis et al.*, ICCV 2011)
- Motion capture of hands in action using discriminative salient points,
  (*Ballan et al., ECCV 2012*)

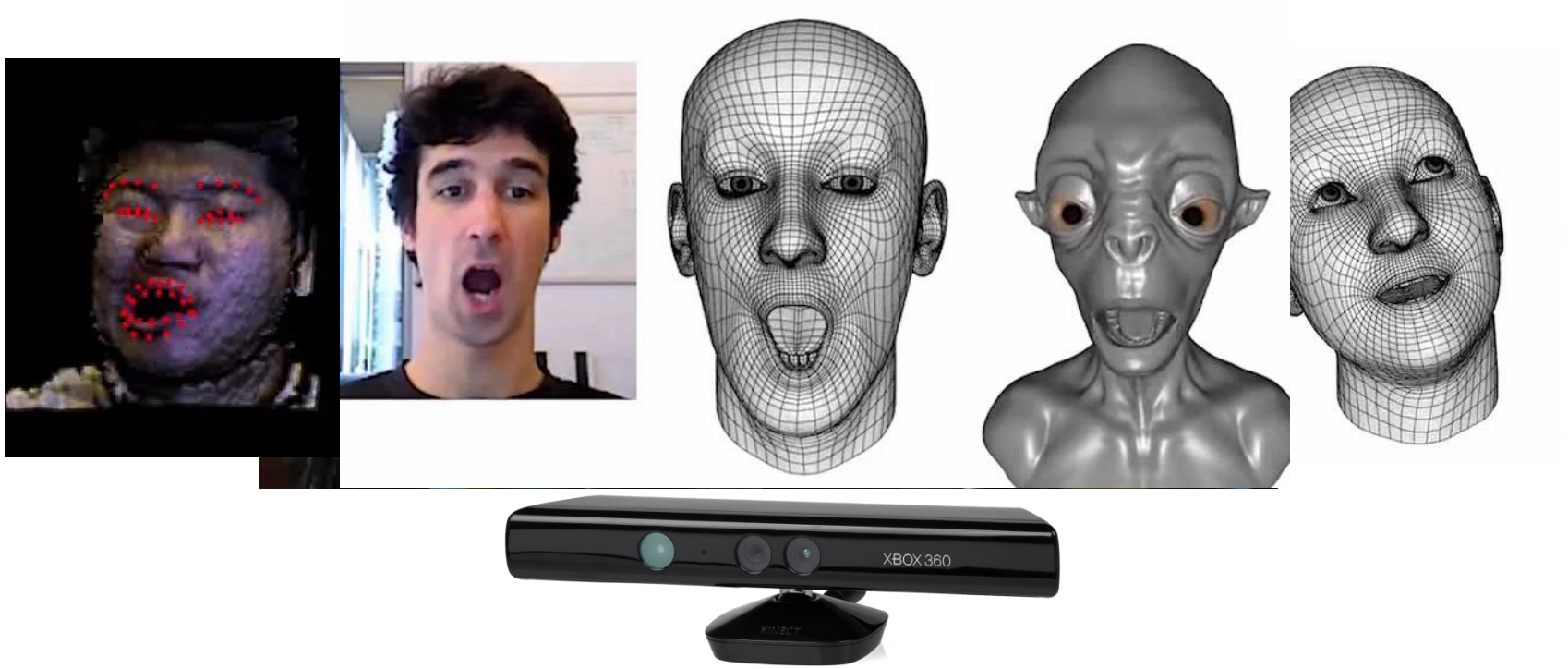




Supervisor: Srinath

Facial performance capture

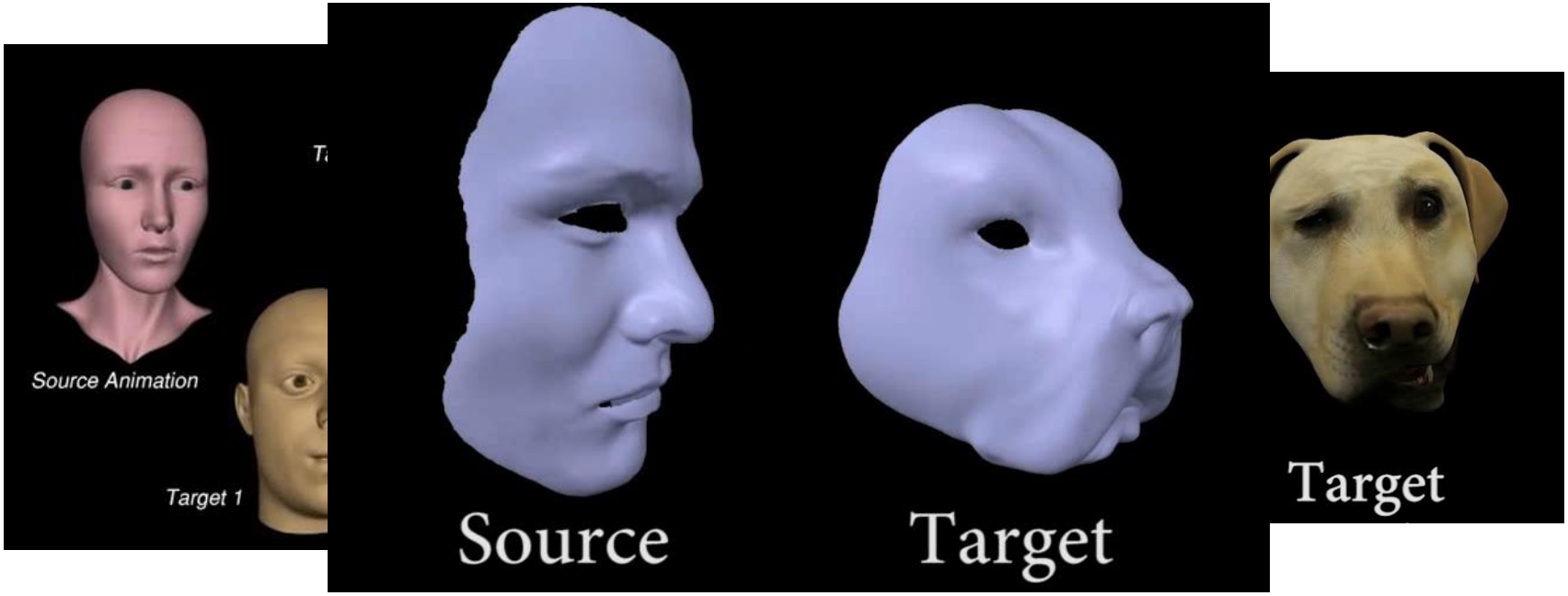
- Realtime Facial Animation with On-the-fly Correctives
  (*Li et al.*, SIGGRAPH 2013)
- Online Modeling For Realtime Facial Animation
  (*Bouaziz et al.*, SIGGRAPH 2013)



Supervisor: Pablo

Facial performance transfer

- Spacetime Expression Cloning for Blendshapes
  (*Seol et al.*, TOG 2012)
- Controllable High-fidelity Facial Performance Transfer
  (*Xu et al.*, SIGGRAPH 2014)



Supervisor: Pablo

Character animation from multi-camera capture

- 4D Video Textures for Interactive Character Appearance
  (*Casas et al.*, Eurographics 2014)
- Video-based Characters – Creating New Human Performances from a Multi-view Video Database
  (*Xu et al.*, SIGGRAPH 2011)

Supervisor: Dan

Summary

- Topic assignment:
  - Send a list of 3 topics (in order of preference) until **Tomorrow, Friday, 24 April 2015**
  - Slots are filled in first-come, first-served fashion
  - We will try to accommodate wishes as much as possible
  - Topics will be assigned on **Monday, 27 April 2015**
- First topic presentation: **Thursday, 7 or 21 May 2015**
- Next week:
  - “How to read an academic paper”
  - “How to give a good talk”
- Questions?