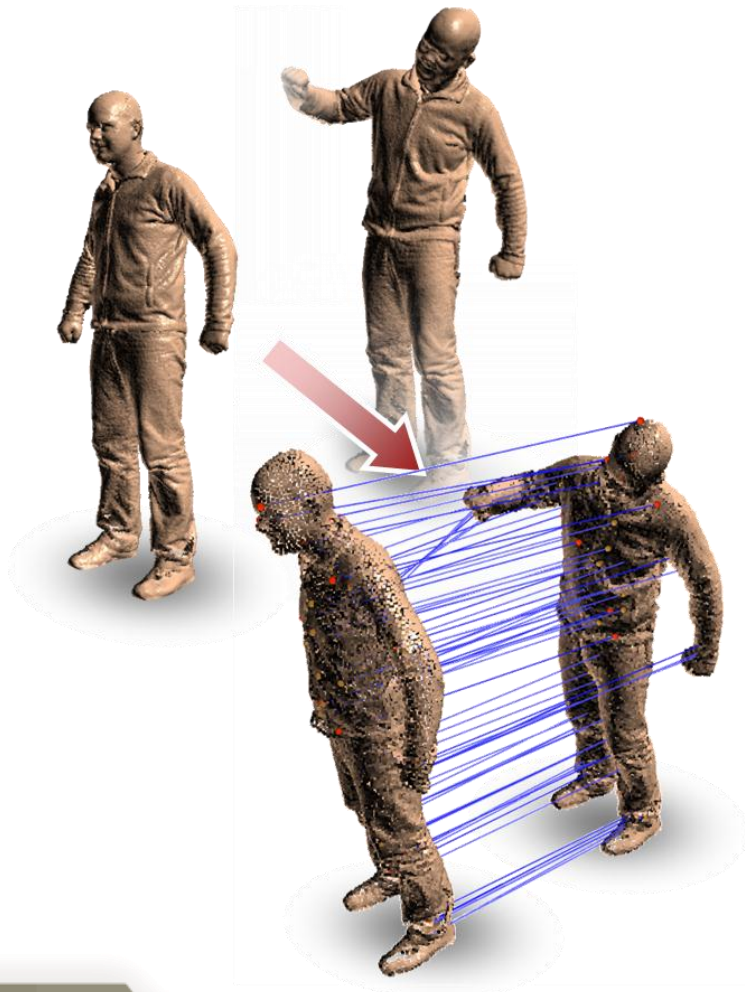


Computing Correspondences in Geometric Datasets



Introduction

Overview

Speakers & Topics

Presenters



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Course Webpage

- Updated slides
- Literature & references
- Additional material / data sets

Linked from:

- <http://www.mpi-inf.mpg.de/~mwand/>
- Available next week

Overview

- Introduction
- Problem Samples
 - Local Shape Matching
 - Global Shape Matching
 - Symmetry
- Conclusions and Wrap up

Introduction

- Problem statement and motivation (Michael)
- Example data sets and characteristics (Szymon)
- Overview: problem matrix (Szymon)

Rigid Local Matching

- Rigid ICP, variants, convergence

(Szymon)

Deformation Models

- Differential geometry background
- Deformation models

(Mark)

(Mark)

Local Deformable Shape Matching

- Variational models for deformable matching
- Animation reconstruction
- Advanced animation reconstruction

(Michael)

(Michael)

(Hao)

Global Rigid Matching

- The 4PCS algorithm

(Niloy)

Feature Detection and Description

- Extrinsic features

(Will)

Feature-Based Global Matching

- Graph cut based articulated matching
- Branch & Bound

(Will)

(Niloy)

Global Isometric Matching

- Intrinsic features (Niloy)
- Quadratic assignment model (Michael)
- Spectral matching (Will)
- Randomized matching algorithms (Michael)

Symmetry in Shapes

- Introduction, symmetry transforms (Szymon)
- Symmetry and regularity detection (Mark)
- Möbius Voting and Applications (Niloy)

Conclusions and Wrap-up

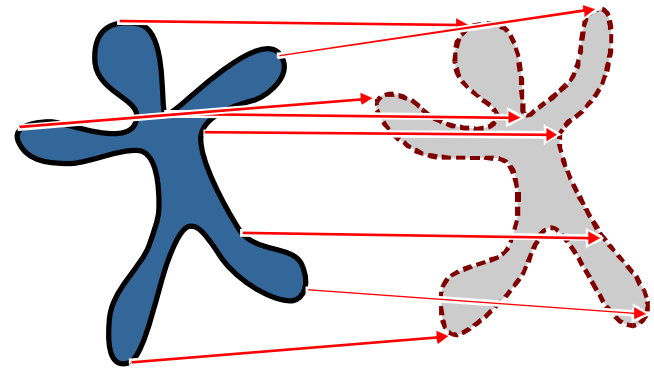
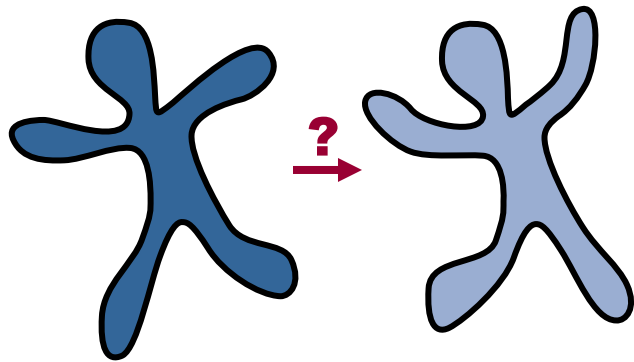
- Conclusions (Mark)
- Future work and open problems (Mark)

In the end:

- Q&A session with all speakers

Feel free to ask questions at any time

Problem Statement and Motivation



Correspondence Problems

- Are two piece of geometry *essentially* the same?
- If so, identify corresponding points (“dense correspondences”)

Correspondences:

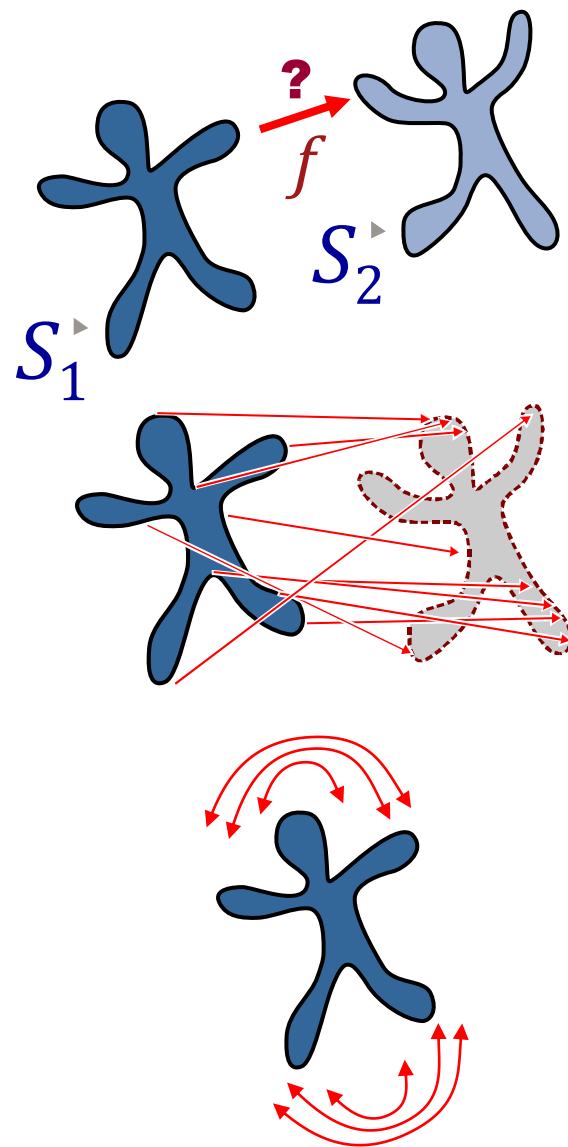
- Function $f: S_1 \rightarrow S_2$

Constraints on f :

- What are good correspondences?
- Rigid, elastic, semantic?

Problem variants

- Partial matching
- Self matching $S_1 = S_2$ (symmetry)



In this course:

- Rigid shape matching
- Deformable shape matching
- Animation reconstruction
- Symmetry detection

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Scan Registration



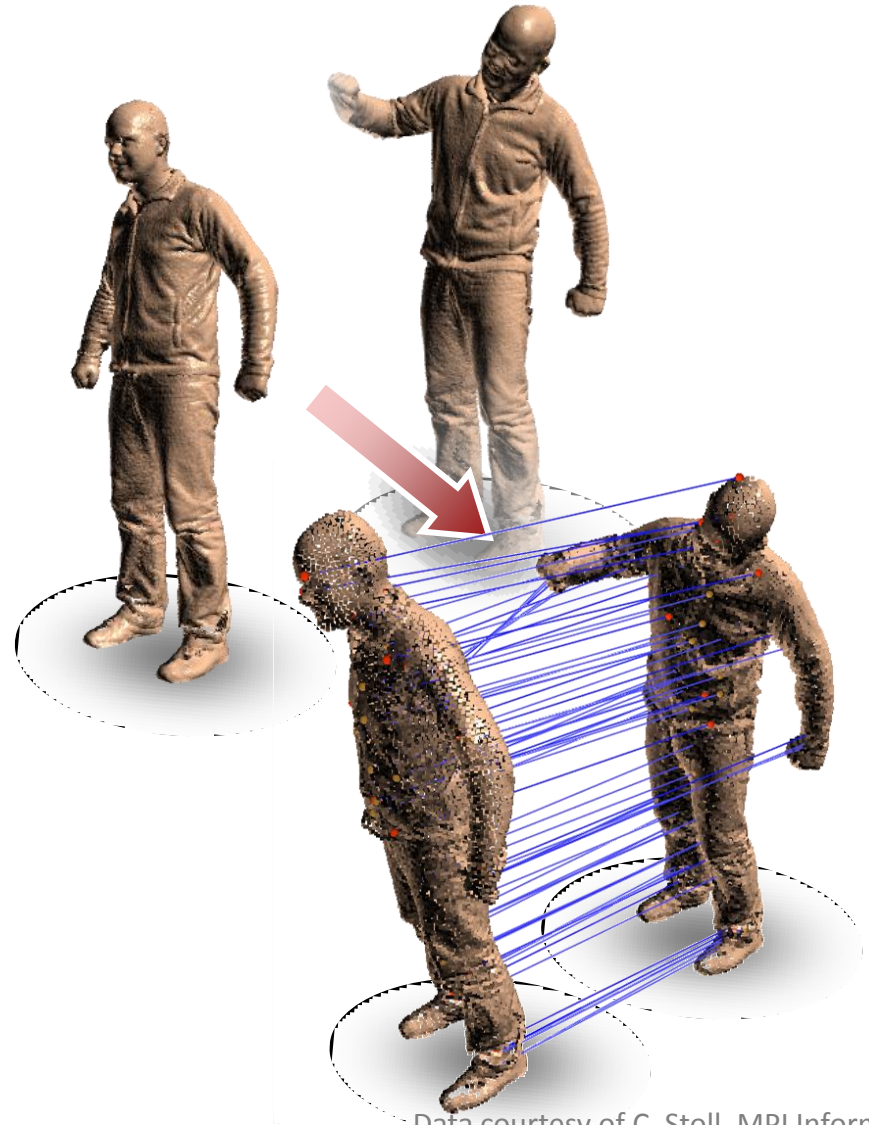
[Stanford 3D Scanning Repository]

In this course:

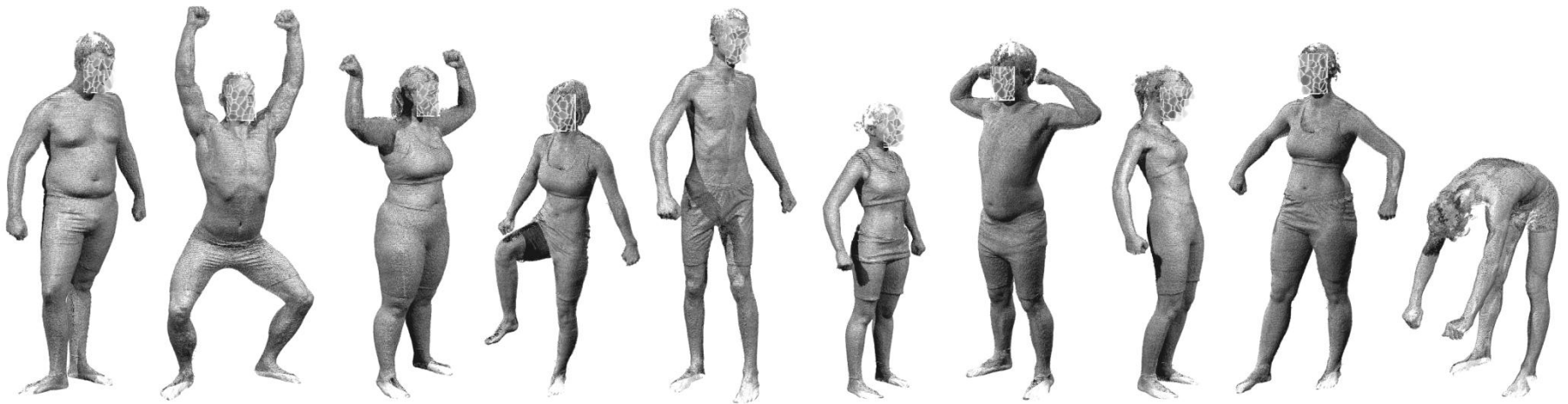
- Rigid shape matching
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Deformable Shape Matching

Full Body Scanning



Data courtesy of C. Stoll, MPI Informatik



Courtesy of N. Hassler, MPI Informatik

Morphable Shape Models

- Scan a large number of individuals
 - Different pose
 - Different people
- Compute correspondences
- Build shape statistics (PCA, non-linear embedding)

In this course:

- Rigid shape matching
- Deformable shape matching
- Animation reconstruction
- Symmetry detection

New technology

- 3D animation scanners
- Record 3D video
- Active research area

Ultimate goal

- 3D movie making
- New creative perspectives



Photo: P. Jenke, WSI/GRIS Tübingen

Example Acquisition Setup: Lightstage



[Vlasic et al., Siggraph Asia 2009]

Example Acquisition Setup: Lightstage



[Vlasic et al., Siggraph Asia 2009]

Reconstruction



input scans



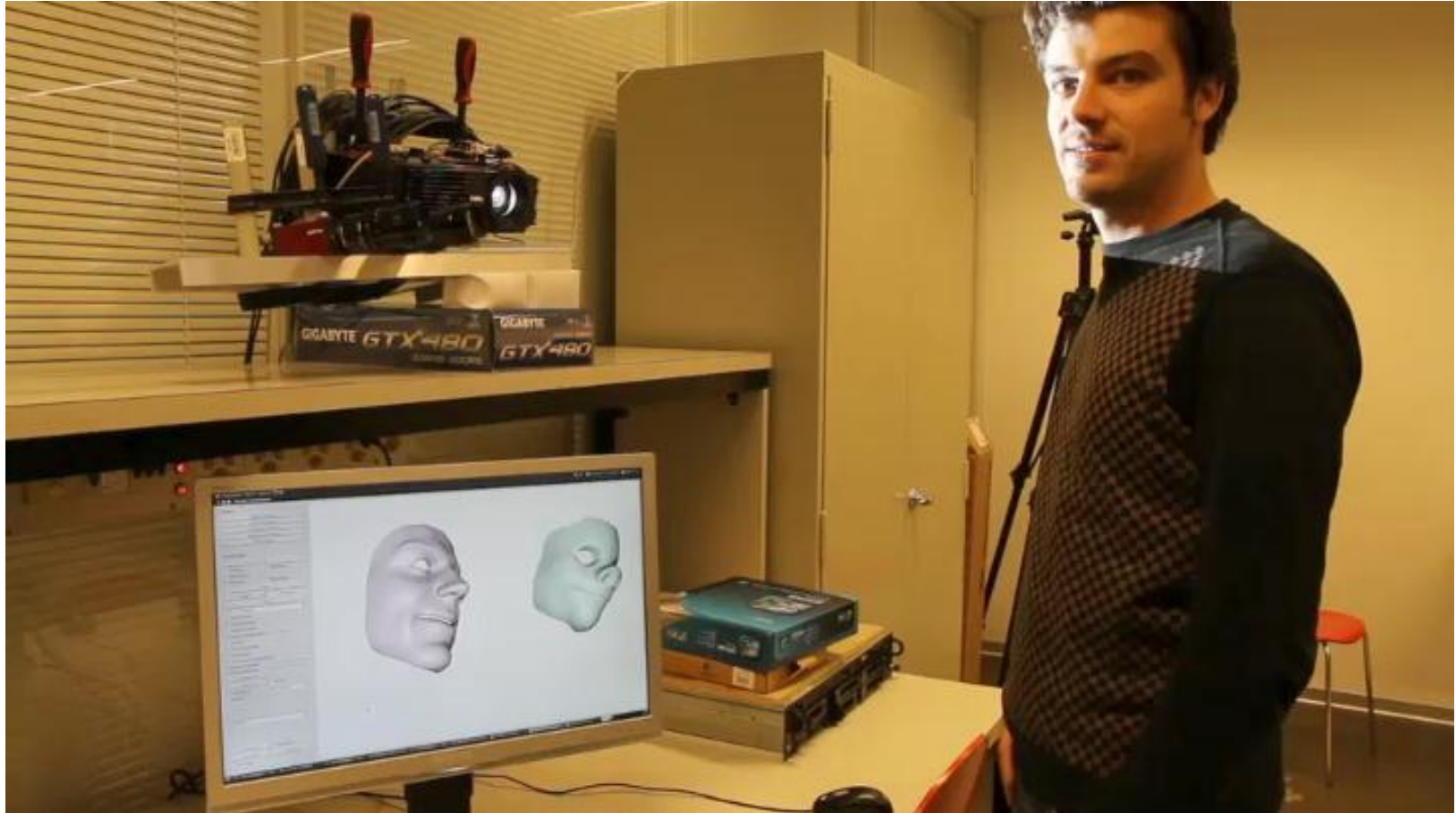
hole filled



resynthesized

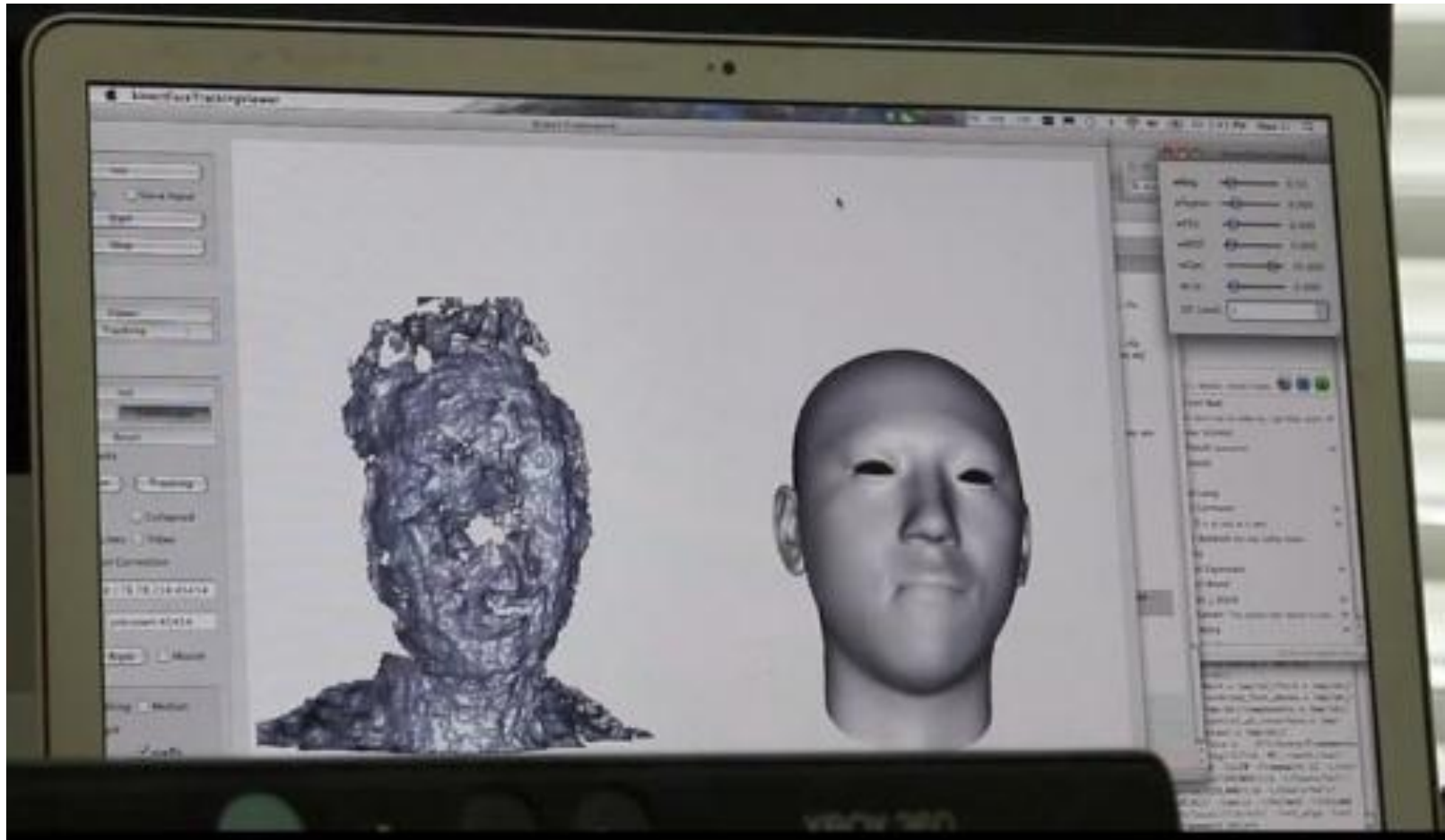
[Li et al., ACM TOG 2011]

Applications: Animation Transfer



[Li et al. 2010]

Application: Face Tracking with Kinect



[Weise et al. 2011]

Application: Face Tracking with Kinect



In this course:

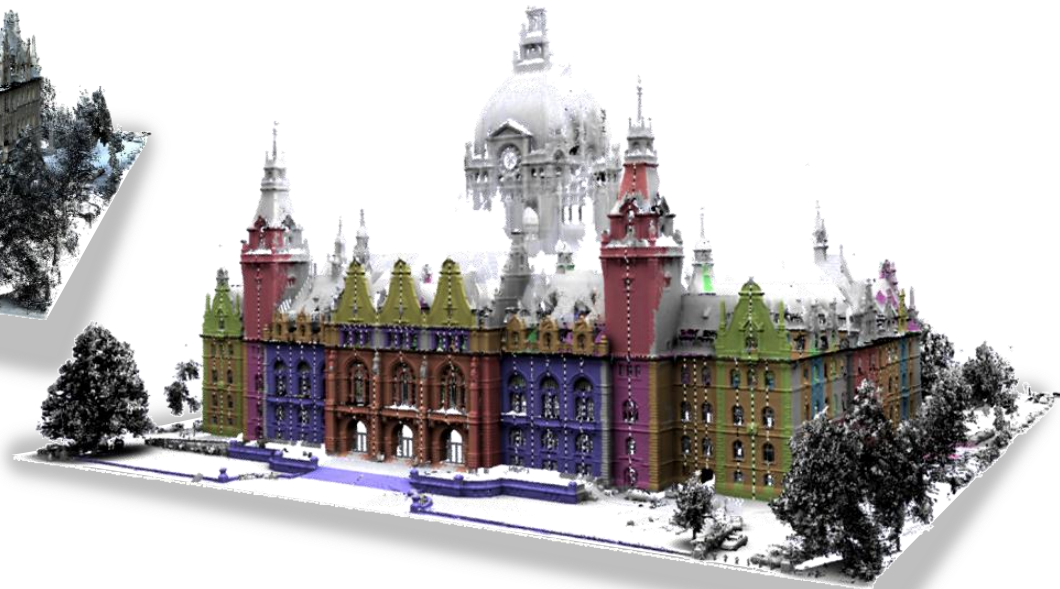
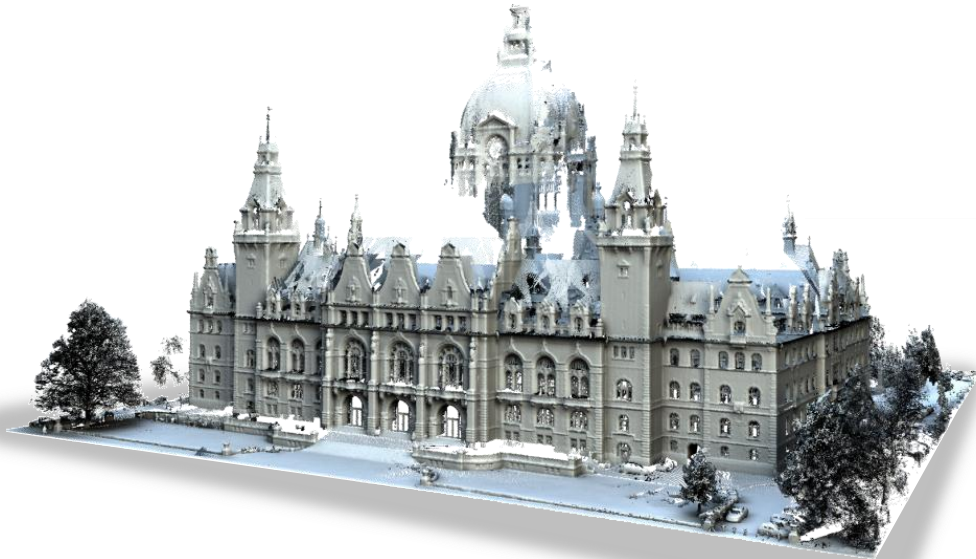
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Symmetry Detection



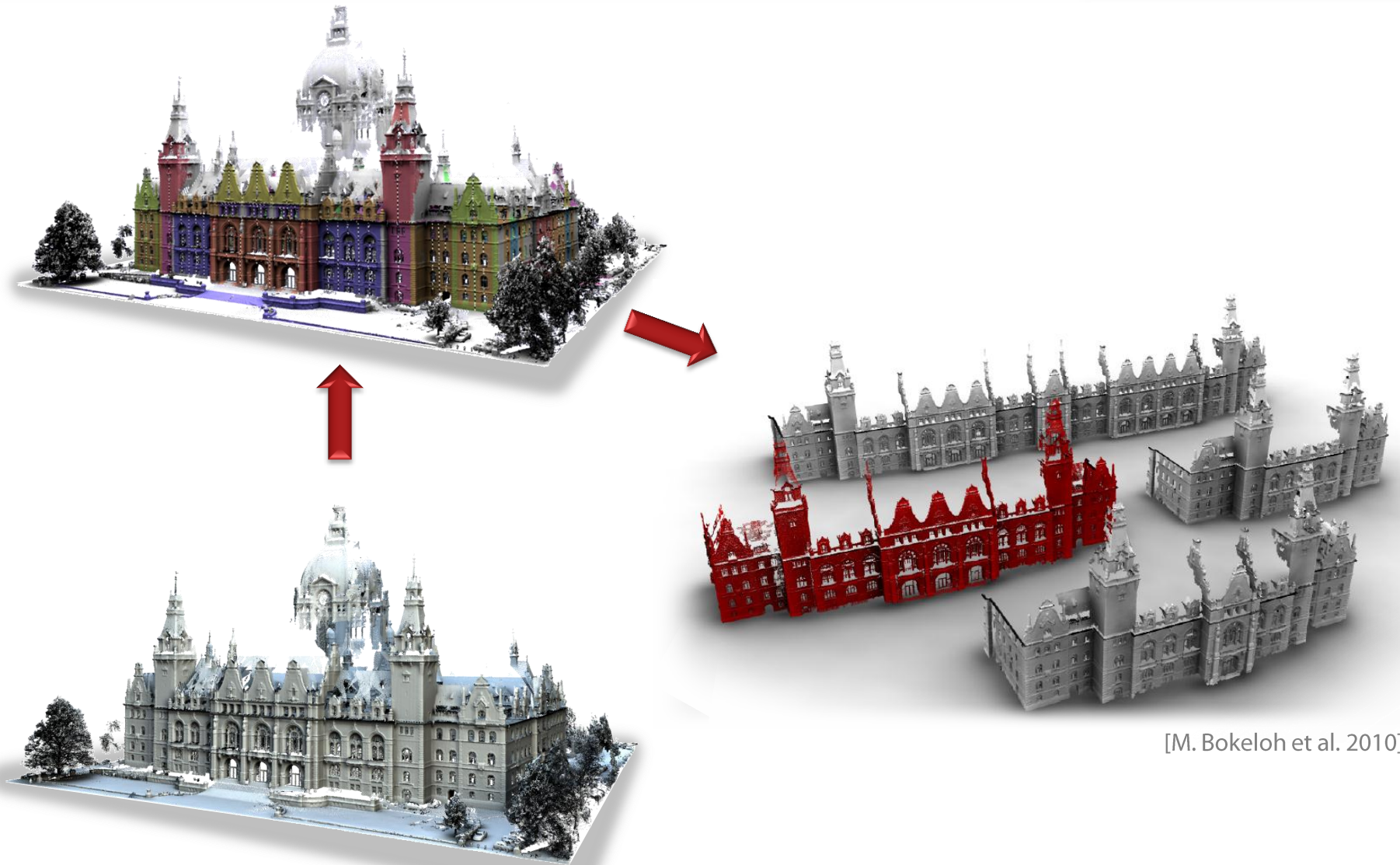
[N. Mitra et al. 2006]

Partial Symmetries of a 3D Scan



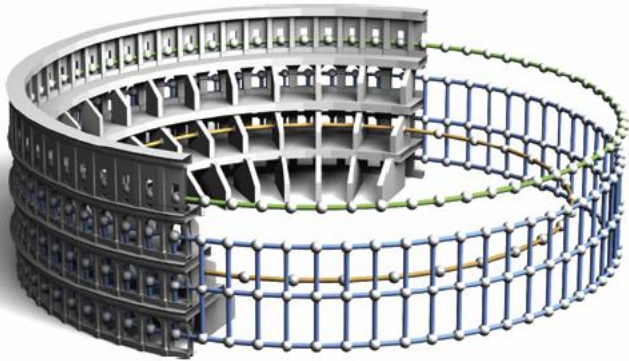
Data Courtesy of C. Brenner, IKG Hannover

Grammar from Correspondences

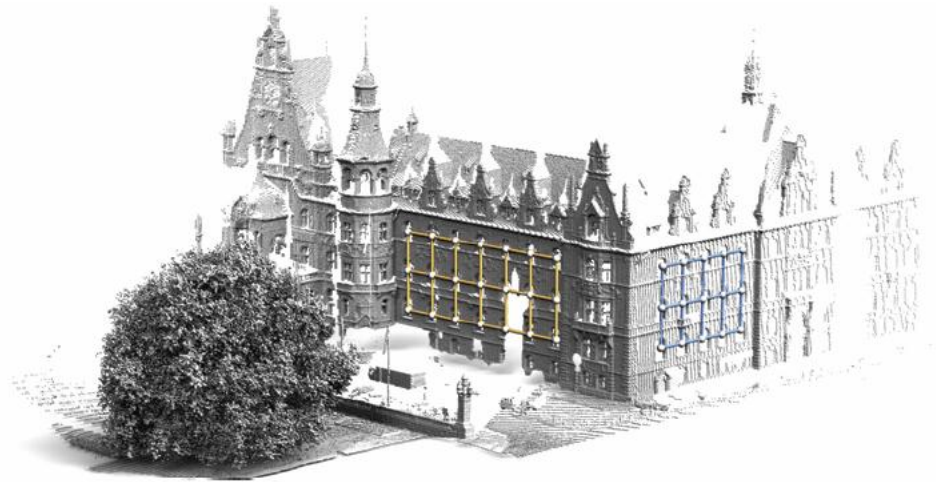


[M. Bokeloh et al. 2010]

Structural Regularity



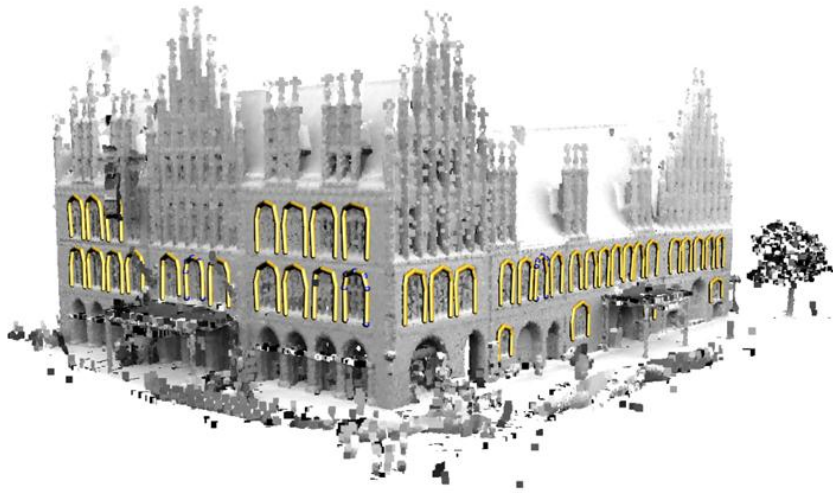
[M. Pauly et al. 2010]



[N. Mitra et al. 2010]



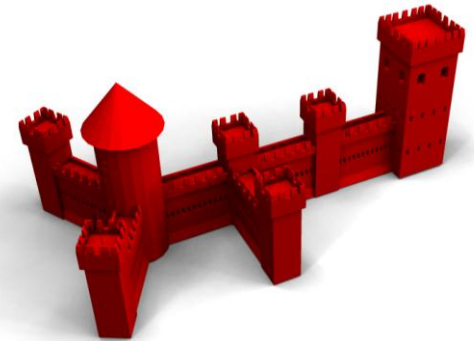
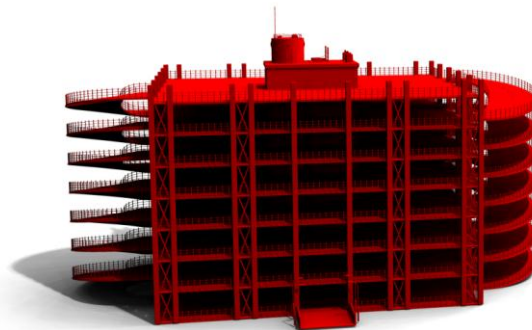
Semantic Symmetries



[M. Sunkel et al. 2011, data sets: IKG Hannover]

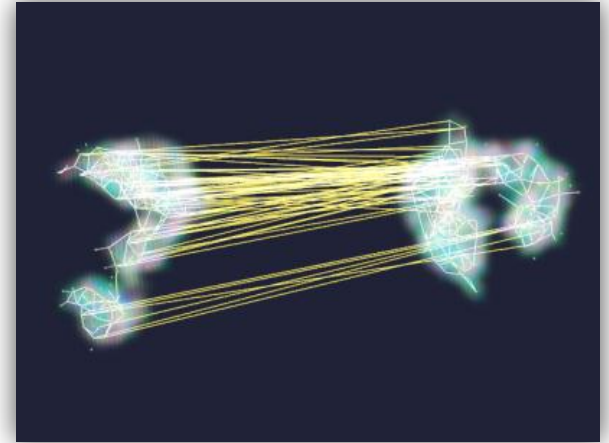
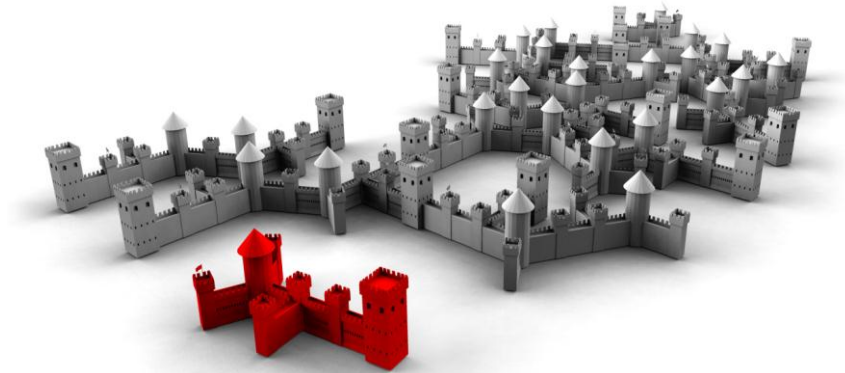
Philosophical question

- What is “structure”?
- Correspondences are a first step



[data sets: G. Wolf, Dosch]

Not just pretty pictures...



Geometry beyond graphics