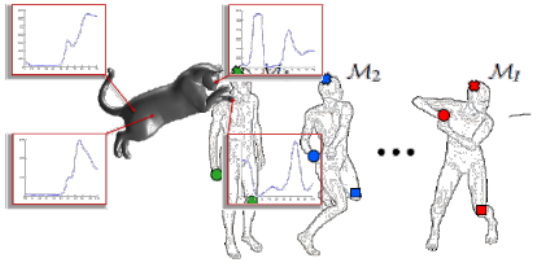
Seminar: Shape Analysis and Optimization

Preparation Meeting, 28.06.2018

Zorah Lähner, Thomas Möllenhoff, Matthias Vestner

What you will learn



Get an overview on research in Shape Analysis

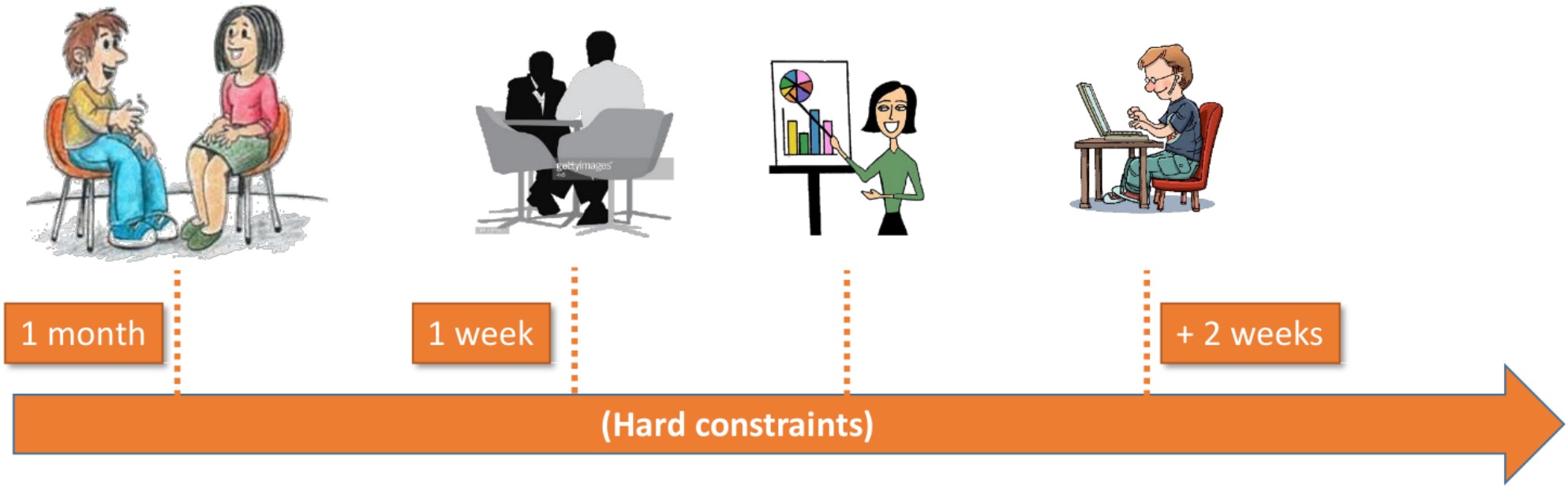
Be able to read and understand scientific publications

Prepare and give a talk

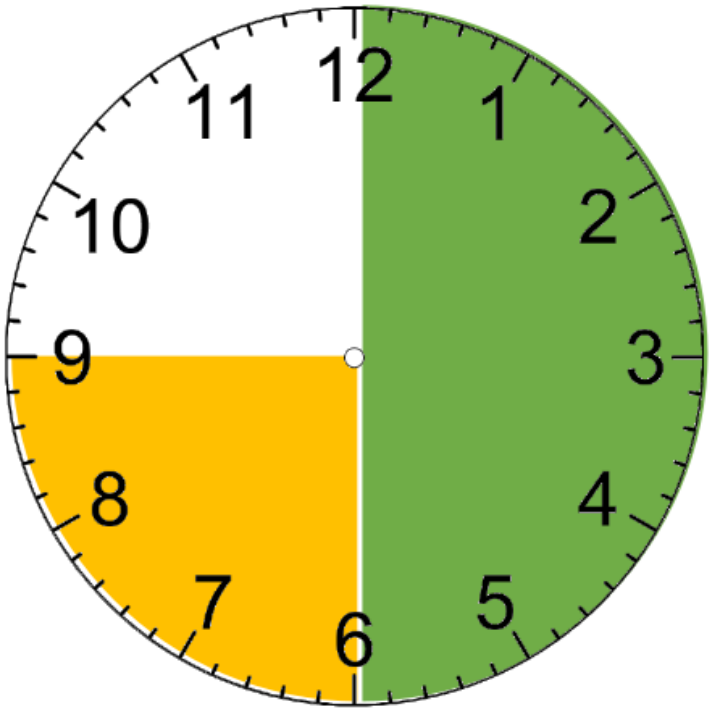
Write a scientific report

Preparation

- You do not need to (and should not) work on your topic alone
- Meet at least twice with your supervisor
- It is your responsibility to contact your supervisor for these meetings



Presentation



- ~20 slides
- use visualizations
- number your slides
- do not make slides full of text
- explain things you had problems understanding when first reading your paper in more detail
- reference the original authors

Recommended structure

1. Introduction of the problem
2. Approach
3. Results (if any)
4. Summary

Report

- Overview and main contributions of the assigned topic
- Not a copy of your assigned material, focus on parts that you found interesting but discuss them more in-depth or concepts you had to do additional work to understand
- The report is due 2 weeks after the talk and gives you the chance to make up for questions that were left
- 6-10 pages
- Latex template available on the homepage
- Use your text editor of choice if you must but keep the style similar to the template

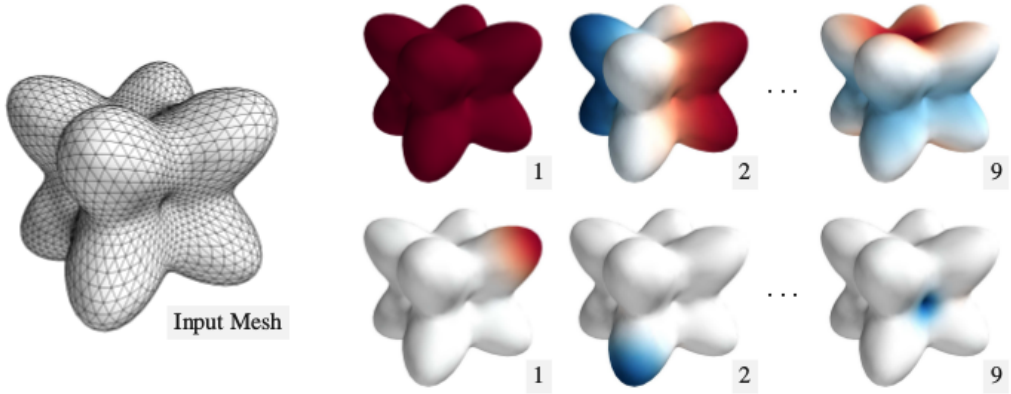
Evaluation Criteria

- Attendance at each meeting is necessary! Contact us **beforehand** if you have other appointments.
- Participation (questions, discussions) influences the final grade
- Report and presentation should be more detailed than the original paper

1. Choose the main aspects and interesting subtopics
2. Understand them in every detail
3. It may be necessary to check related articles or text books
4. Prepare the topic such that it is understandable to the other participants of the seminar

Topic Overview

Shape Matching – finding the same points on non-rigidly deformed shapes

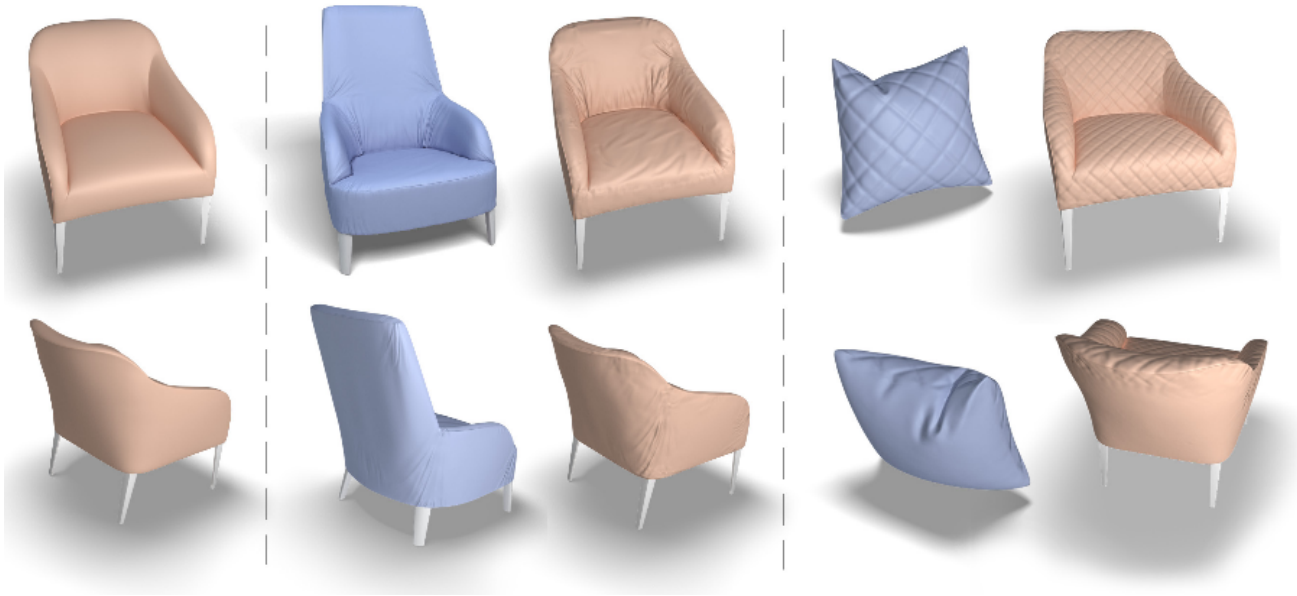


Spectral decomposition on manifolds and their applications

Topic Overview

Computer Vision & Artificial Intelligence

Cloth Modeling and Animation



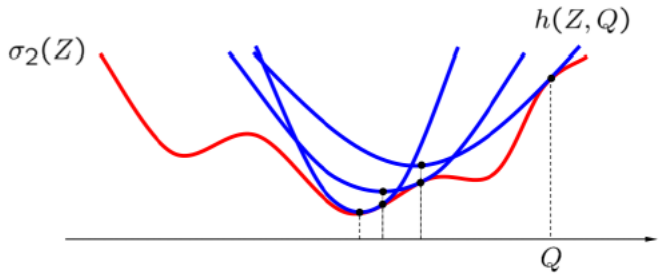
Learning Texture and Detail Transfer

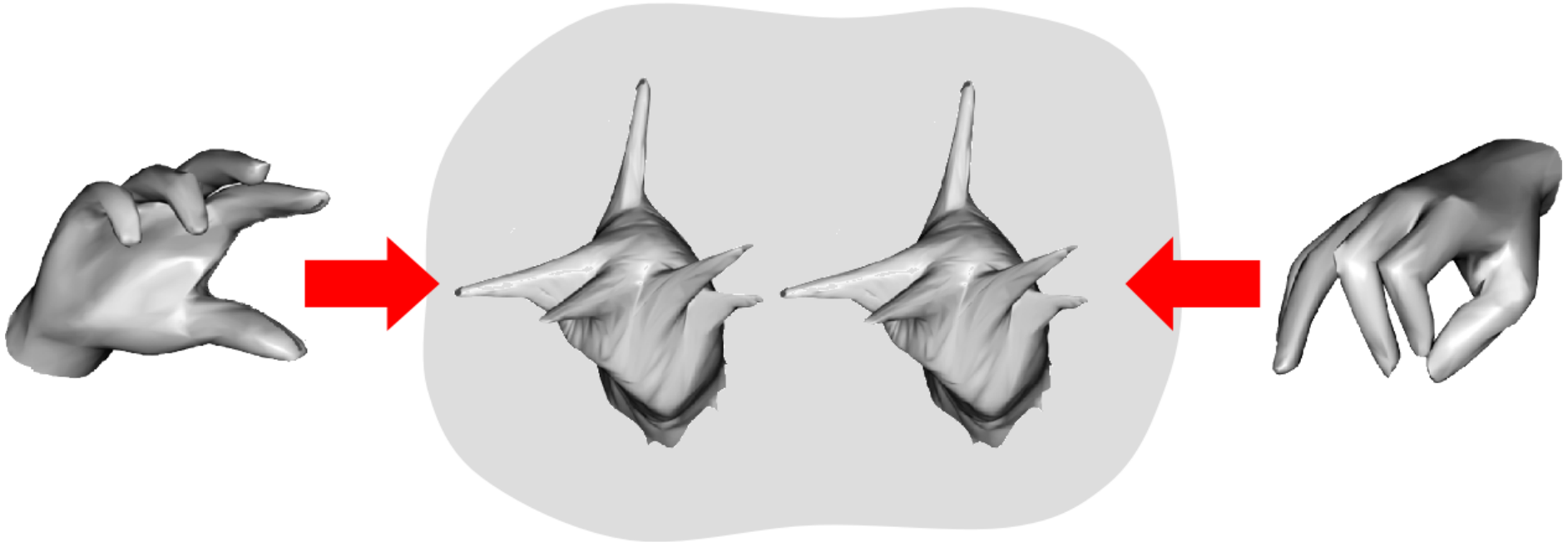
Topic Overview

Multidimensional Scaling Using Majorization: SMACOF in R

Jan de Leeuw
University of California, Los Angeles

Patrick Mair
WU Wirtschaftsuniversität Wien





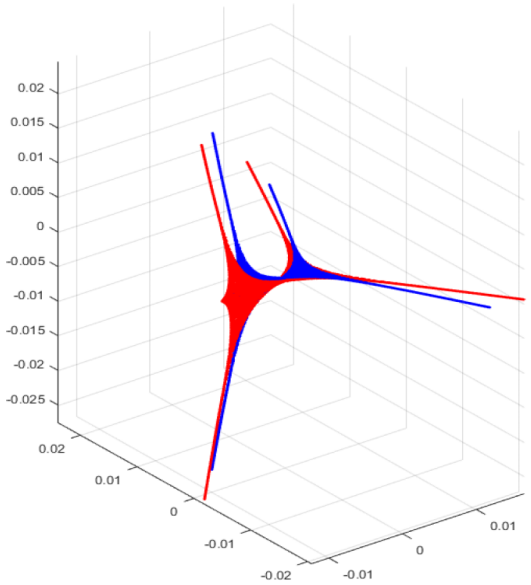
Topic Overview

Auction Algorithms for Network Flow Problems:

A Tutorial Introduction [1]

by

Dimitri P. Bertsekas[2]



$$\operatorname*{argmin}_{\mathbf{\Pi}\in\mathcal{P}_n} \|\mathbf{\Pi}F_{\mathcal{X}} - F_{\mathcal{Y}}\|^2$$

$$= \operatorname*{argmax}_{\mathbf{\Pi}\in\mathcal{P}_n} \langle \mathbf{\Pi}, F_{\mathcal{Y}}F_{\mathcal{X}}^{\top} \rangle$$

Topic Overview

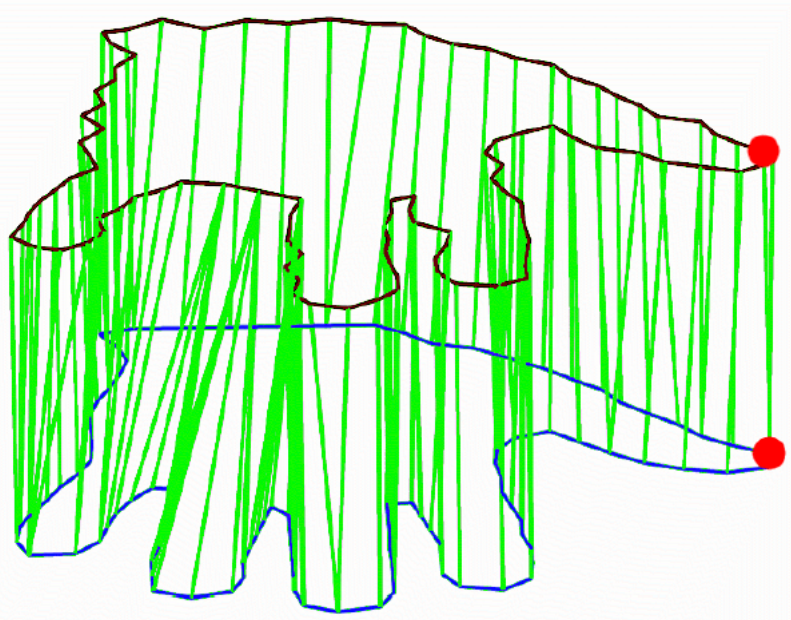
Computer Vision & Artificial Intelligence

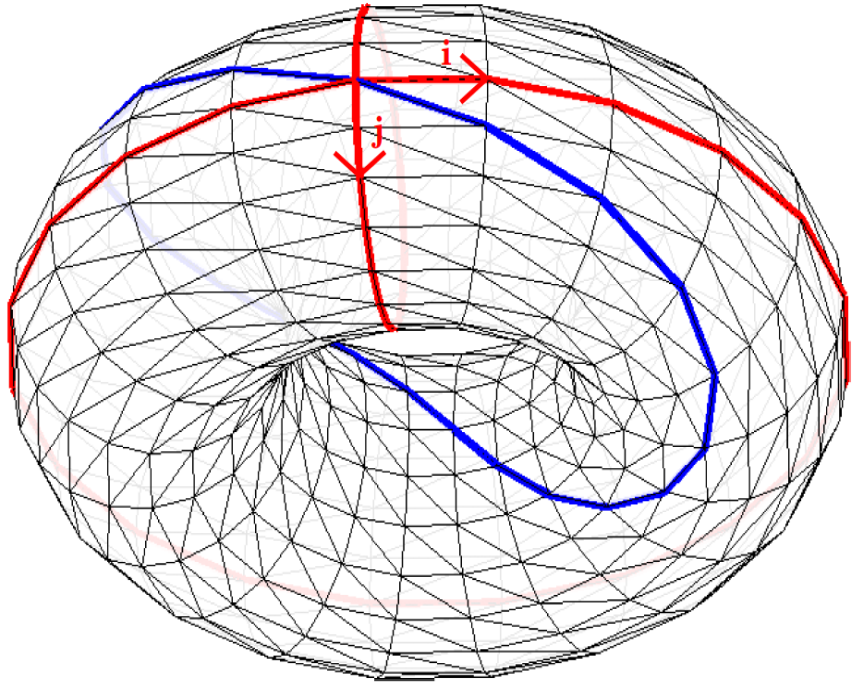
Fast Matching of Planar Shapes in Sub-cubic Runtime *

Frank R. Schmidt
Computer Science Department
University of Bonn, Germany

Dirk Farin
University of Technology
Eindhoven, The Netherlands

Daniel Cremers
Computer Science Department
University of Bonn, Germany



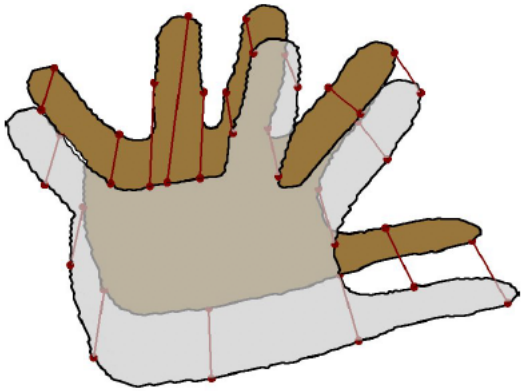


Topic Overview

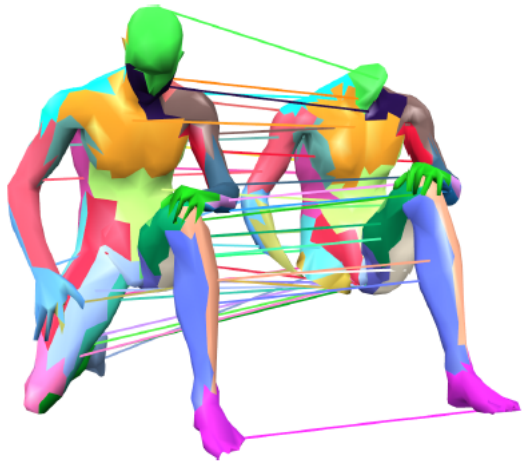
Geometrically Consistent Elastic Matching of 3D Shapes: A Linear Programming Solution

Thomas Windheuser[1], Ulrich Schlickewei[1], Frank R. Schmidt[2] and Daniel Cremers[1]

[1]Technische Universität München [2]University of Western Ontario



Elastic matching of planar shapes [18]



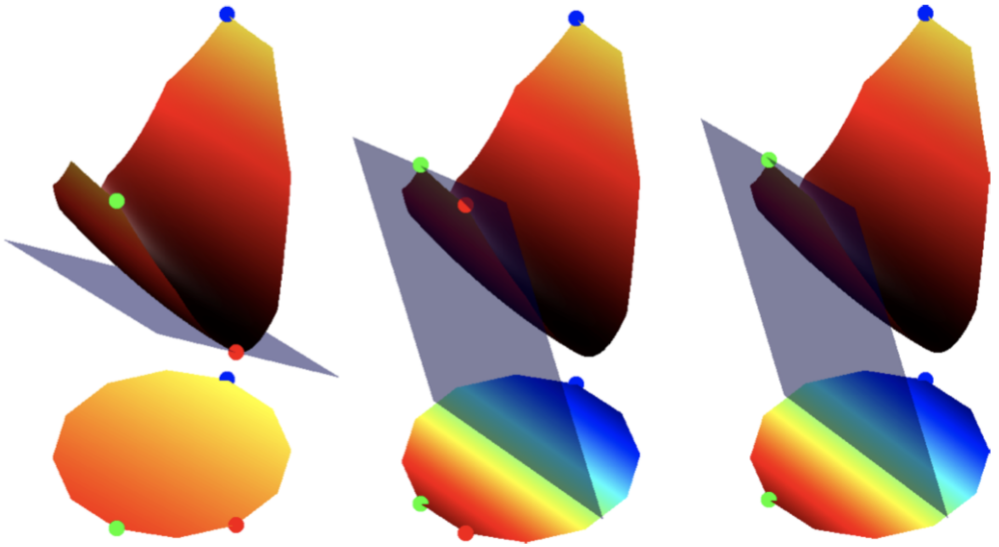
Proposed elastic matching of 3D shapes

Topic Overview

Computer Vision & Artificial Intelligence

Efficient Deformable Shape Correspondence via Kernel Matching

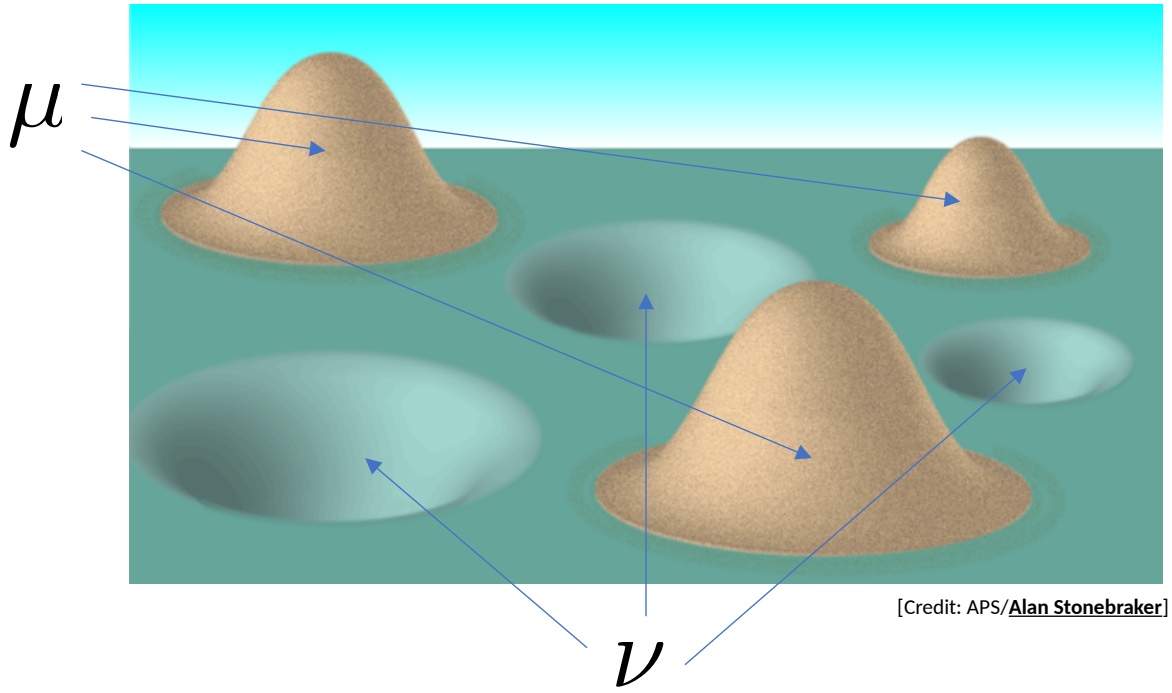
Matthias Vestner* TU Munich
Zorah Lähner* TU Munich
Amit Boyarski* Technion
Or Litany TAU
Ron Slossberg Technion
Tal Remez TAU
Emanuele Rodolà Sapienza University of Rome / USI Lugano
Alex Bronstein Technion / TAU / Intel
Michael Bronstein USI Lugano / TAU / Intel
Ron Kimmel Technion / Intel
Daniel Cremers TU Munich



Topic Overview

Computer Vision & Artificial Intelligence

Optimal Transport – A geometric toolbox to compare probability distributions



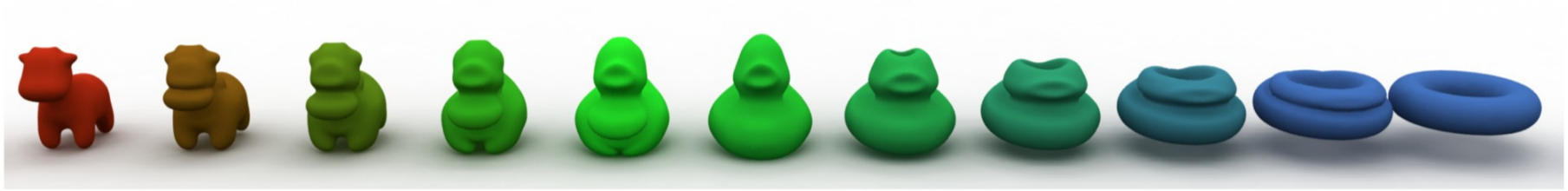
[Credit: APS/**Alan Stonebraker**]

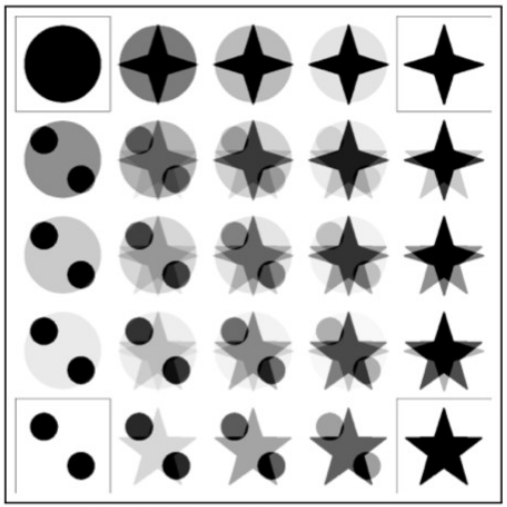
$$\inf_{T:X\to Y} \int_X c(x, T(x))d\mu(x) \quad \text{s.t.} \quad T_\sharp \mu = \nu$$

Topic Overview

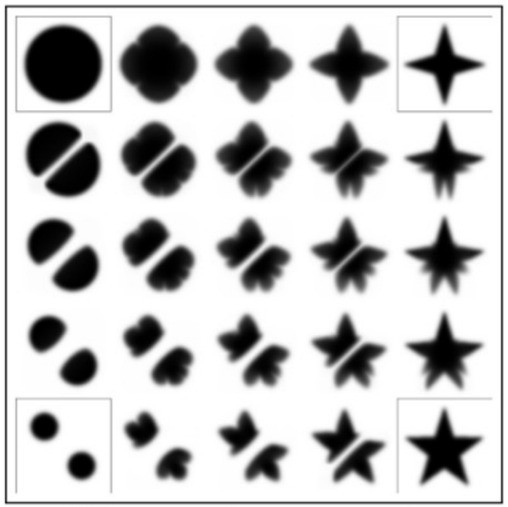
Computer Vision & Artificial Intelligence

Wasserstein Barycenters – geometric interpolation between shapes





Euclidean barycenter

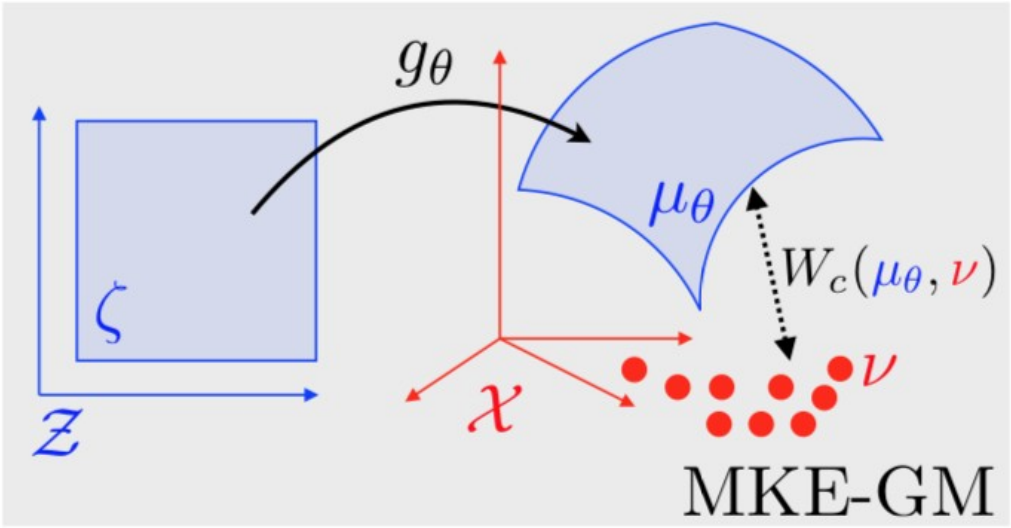


Wasserstein barycenter

Convolutional Wasserstein Distances: Efficient Optimal Transportation on Geometric Domains [Solomon et al., ‘15]

Topic Overview

Generative Modeling – “learn” a probability distribution



[Credit: Marco Cuturi]

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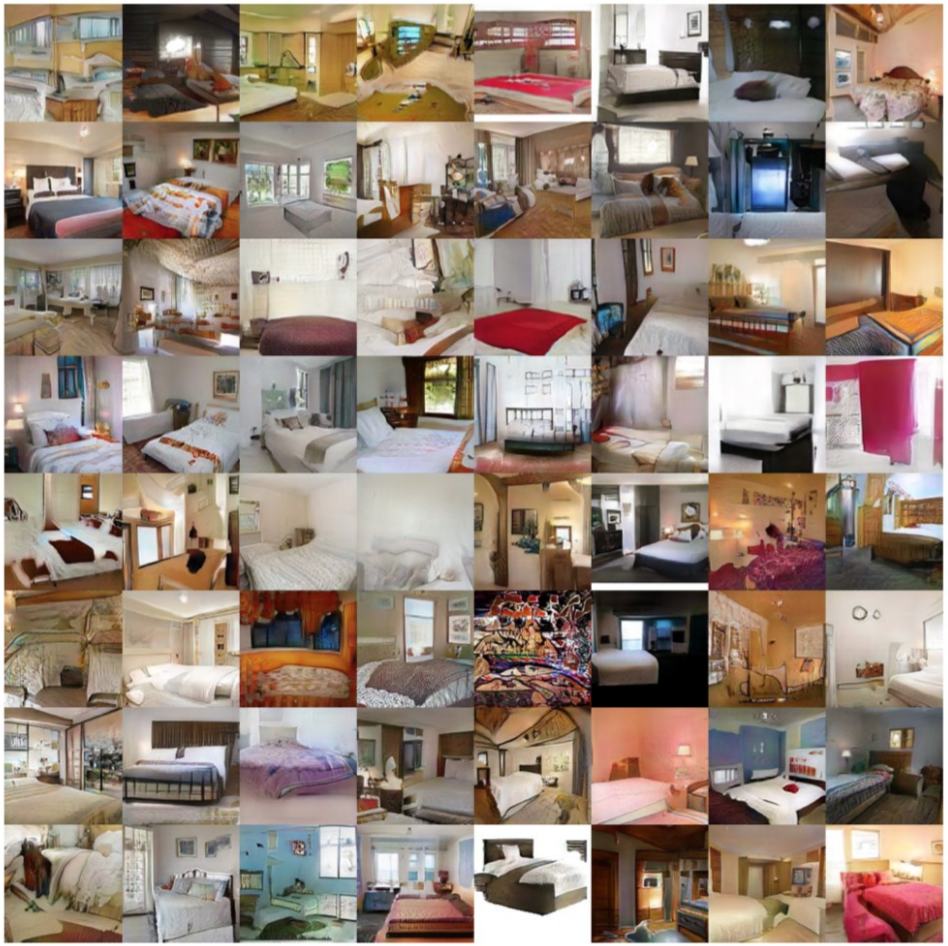
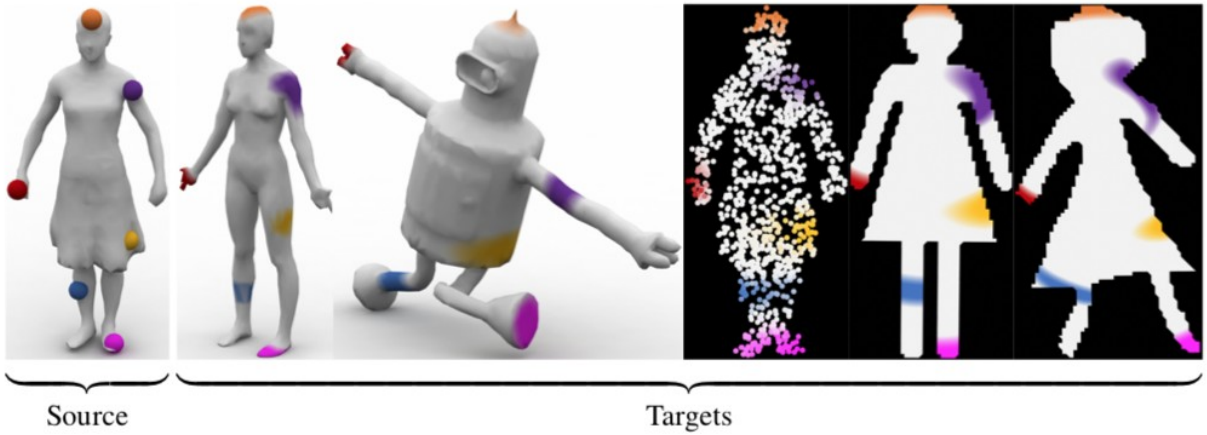
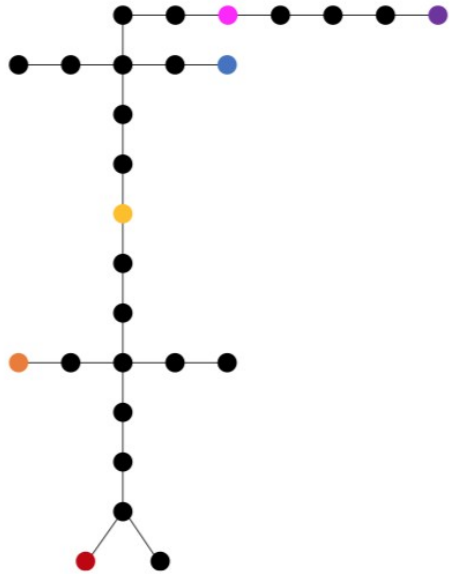


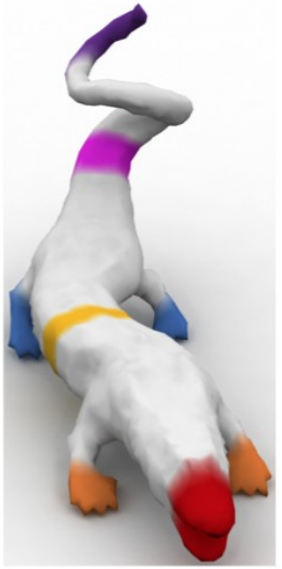
Wasserstein Generative Adversarial Networks [Arjovsky et al., ‘17]

Topic Overview

Shape Matching using the Gromov-Wasserstein Distance







Entropic Metric Alignment for Correspondence Problems [Solomon et al., ‘16]

Registration

- Computer Science students apply through the TUM Matching platform (matching.in.tum.de)
- Mathematics students apply through TUMonline
- There are 18 places in total, max. 6 for math the rest for cs students
- We gave around a list, students on it will have priority in the matching process
- Send your transcript of records to: shapeseminar@vision.in.tum.de

Assignment of Topics

- A complete list of topics will be available on the homepage next week
  - vision.in.tum.de/teaching/ws2018/seminar_shapeanalysis/
  - Password: ThisIsShape
- If you got assigned to this seminar, send us an email to shapeseminar@vision.in.tum.de with your **four** favorite topics
- Topics will be assigned by first come first serve

Any Questions?

Computer Vision & Artificial Intelligence

Do not forget to put your name in the list. Students who attended this meeting will have priority.

Email: shapeseminar@vision.in.tum.de

Webpage: vision.in.tum.de/teaching/ws2018/seminar_shapeanalysis/

Password: ThisIsShape