SHREC'16: Matching of Deformable Shapes with Topological Noise

Z. Lähner[1], E. Rodolà[1,2], M. M. Bronstein[2], D. Cremers[1], O. Burghard[3], L. Cosmo[4], A. Dieckmann[3], R. Klein[3], Y. Sahillioglu[5]

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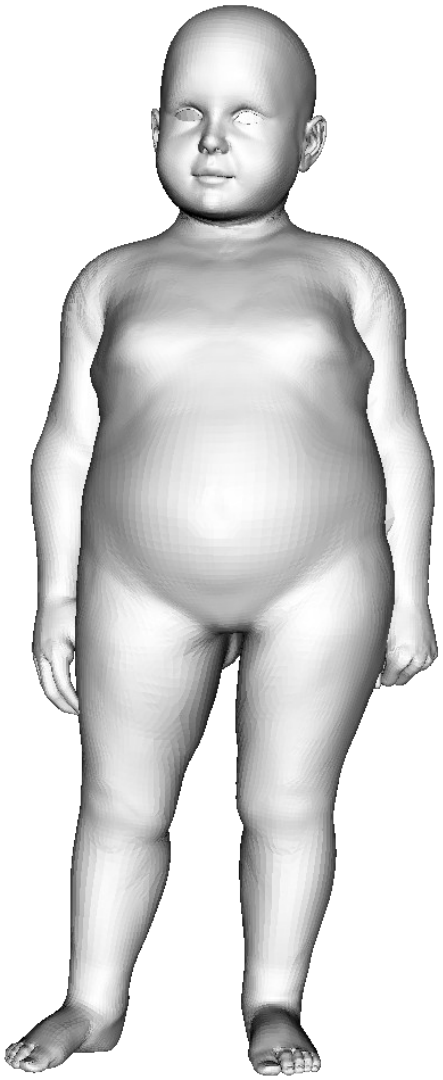
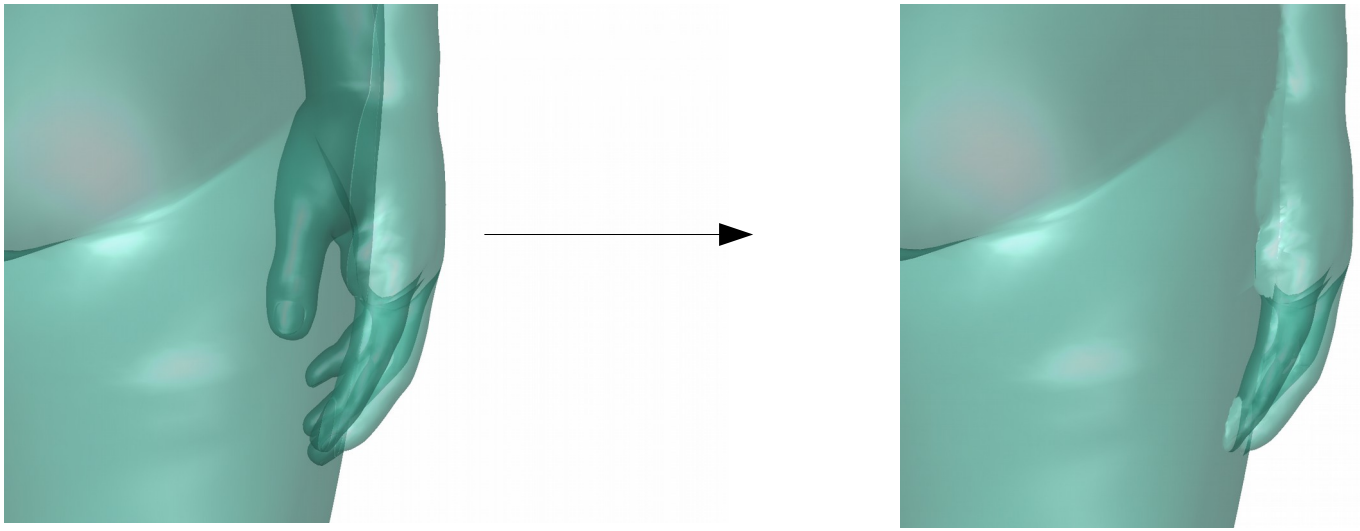
3DOR, Lisbon

[1] Technical University of Munich
[2] University of Lugano
[3] University of Bonn
[4] Università Ca' Foscari Venezia
[5] Middle East Technical University

Real Scans

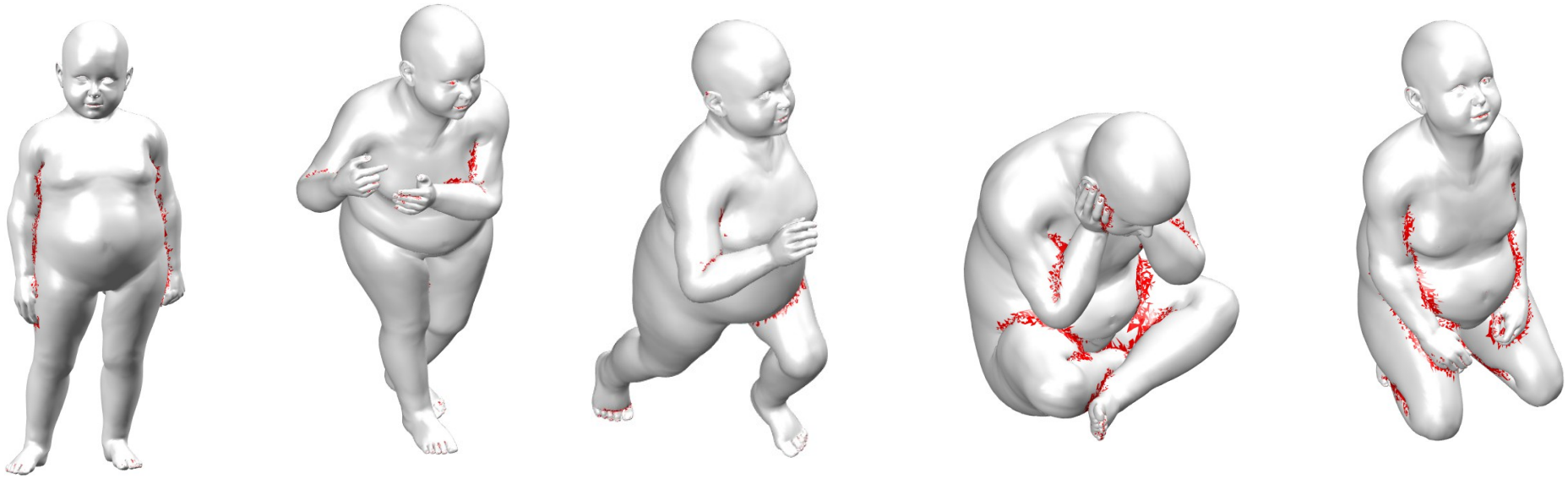
The Dataset





- Shapes from the KIDS data set
- Merged self-intersecting parts to form the outer hull

The Dataset



- Two resolutions: ~60-80k and ~10k vertices
- Indicator Map of unmatched points
- Left-Right Map
- Download at in.tum.de/~laehner/shrec2016/

The Contest

- Task: Provide pointwise correspondences for 90 pairs of shapes of the same class with topological noise
- 15 shapes with ground-truth correspondence to a null shape are given as training data
- Separate evaluation for the high and low resolution data set

Evaluation

- Following the Princeton protocol

$$\varepsilon(x) = \frac{d_{\mathcal{N}}(y, y*)}{\text{area}(\mathcal{N})^{0.5}}$$

- How large is the deviation from the ground truth w.r.t. to the diameter of the shape?

Methods and Results

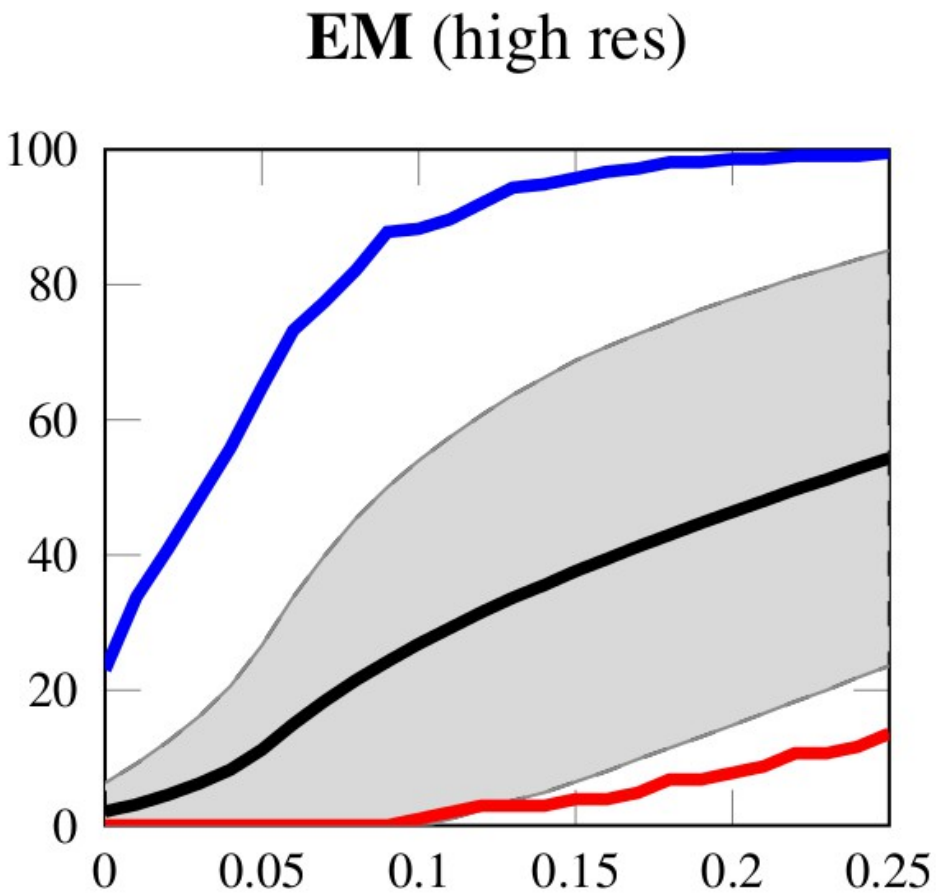
Multidimensional Scaling (EM)

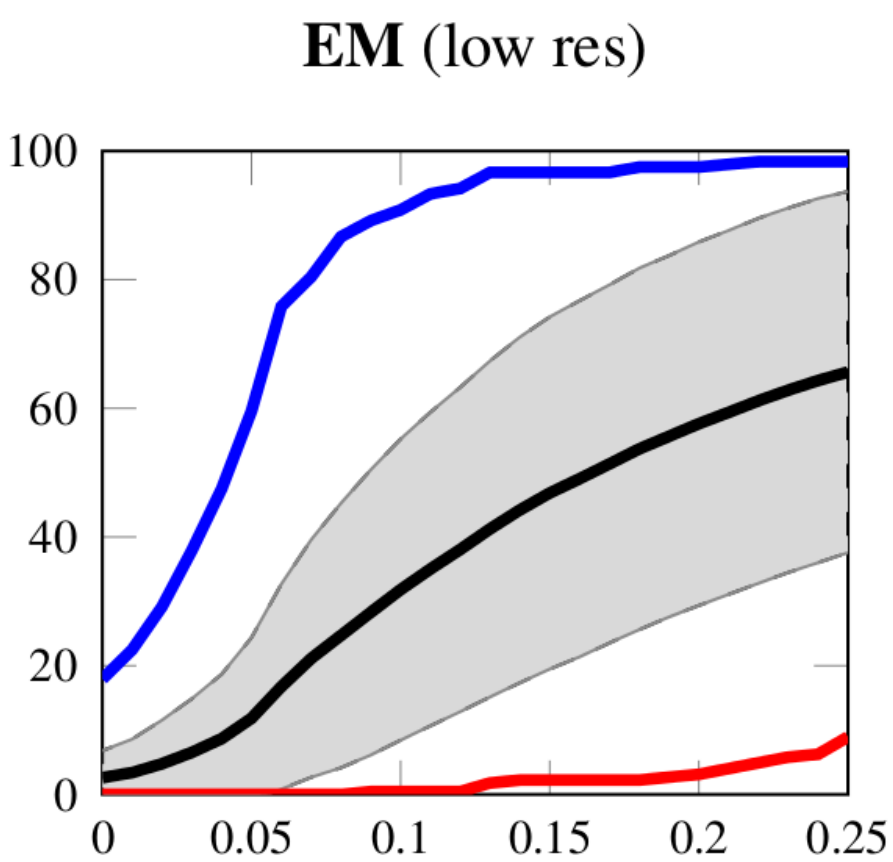
- Based on:

- Sahillioglu Y., Yemez Y.: *Minimum-distortion isometric shape correspondence using EM algorithm*, IEEE Trans. on Pattern Analysis and Machine Intelligence, 2012

- Lipman Y., Rustamov R., Funkhouser T.: *Biharmonic distance* , ACM Transactions on Graphics, 2010

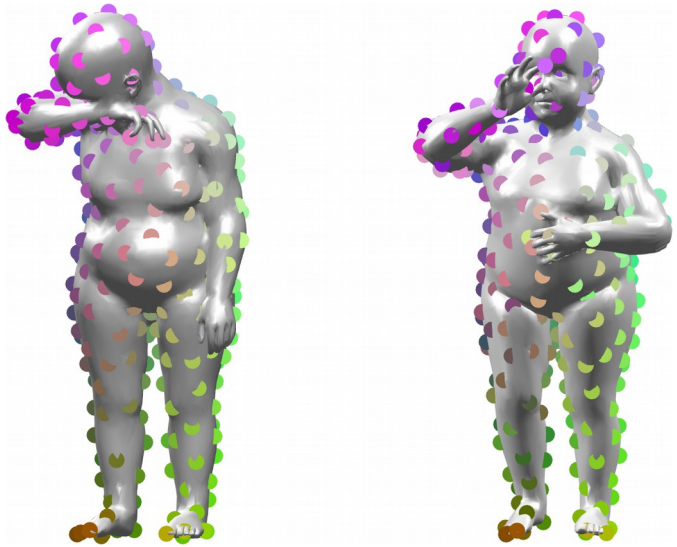
EM: Princeton Protocol

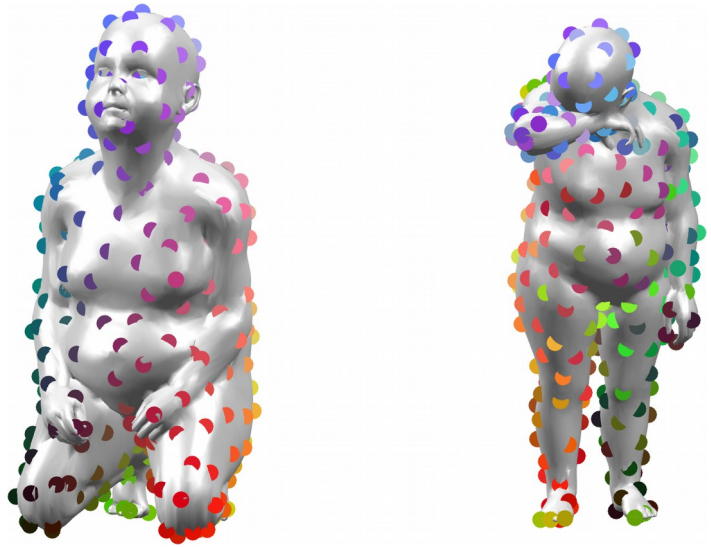




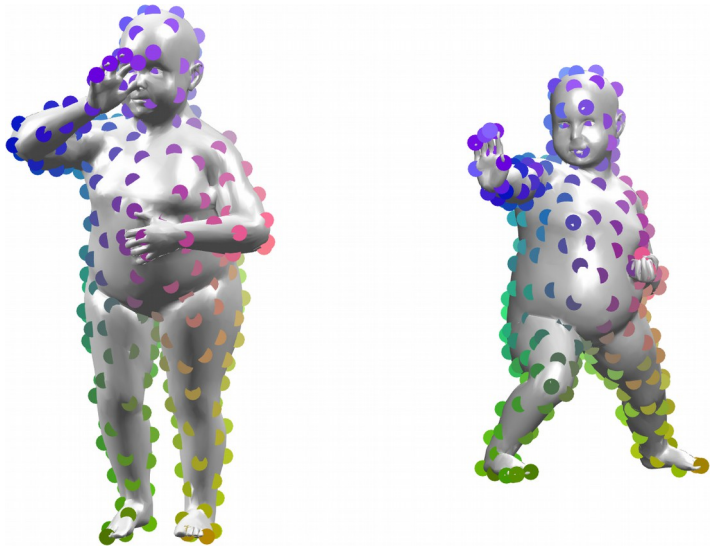
EM: Examples

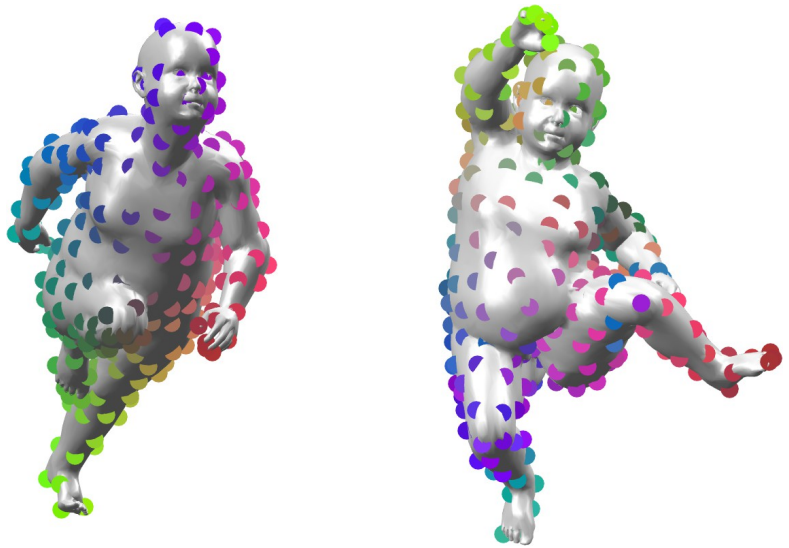
High Resolution





Low Resolution





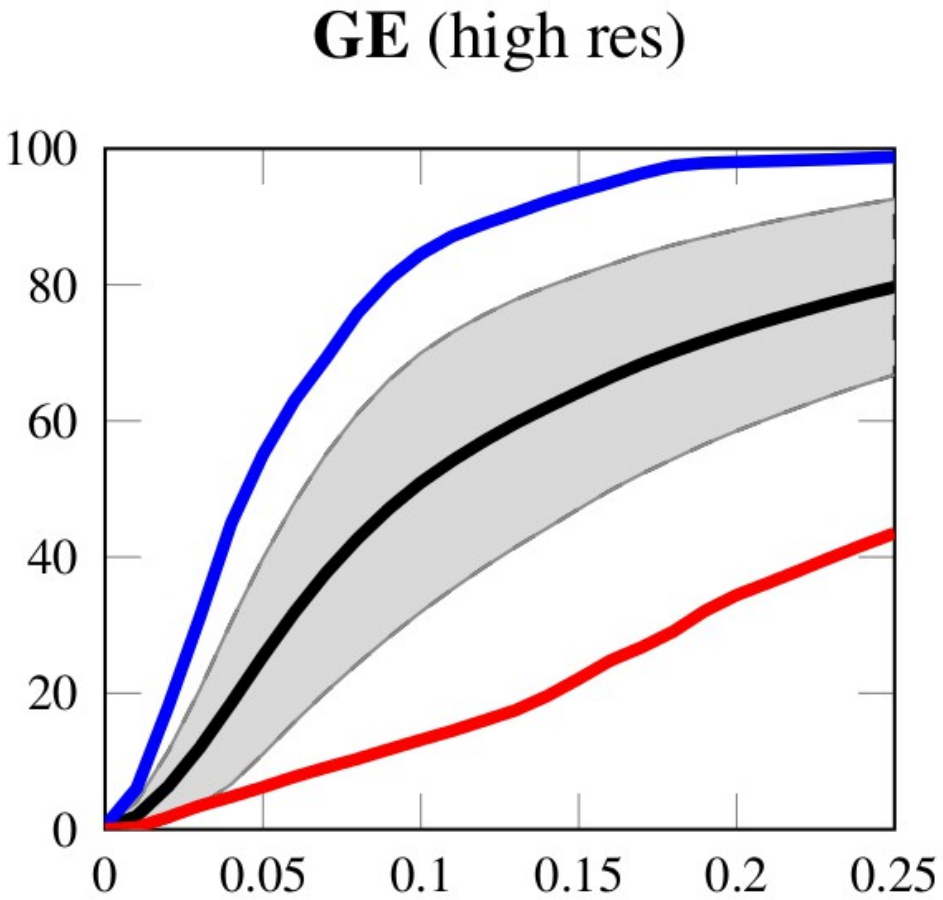
Best Matching

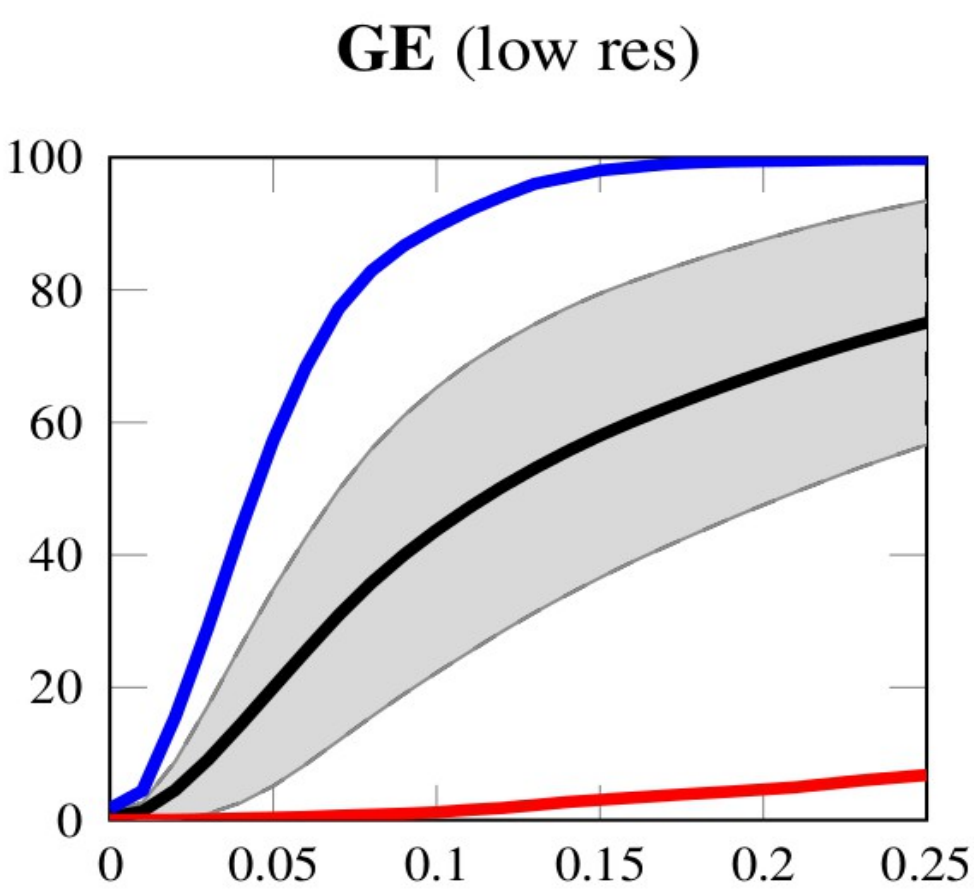
Worst Matching

Green's Function (GE)

- Starts with four user-given matches
- Solves Green's function: $\Delta g_x = \delta_x$
- Participants: Oliver Burghard, Alexander Dieckmann, Reinhard Klein (University of Bonn)

GE: Princeton Protocol





GE: Examples

High Resolution




Low Resolution



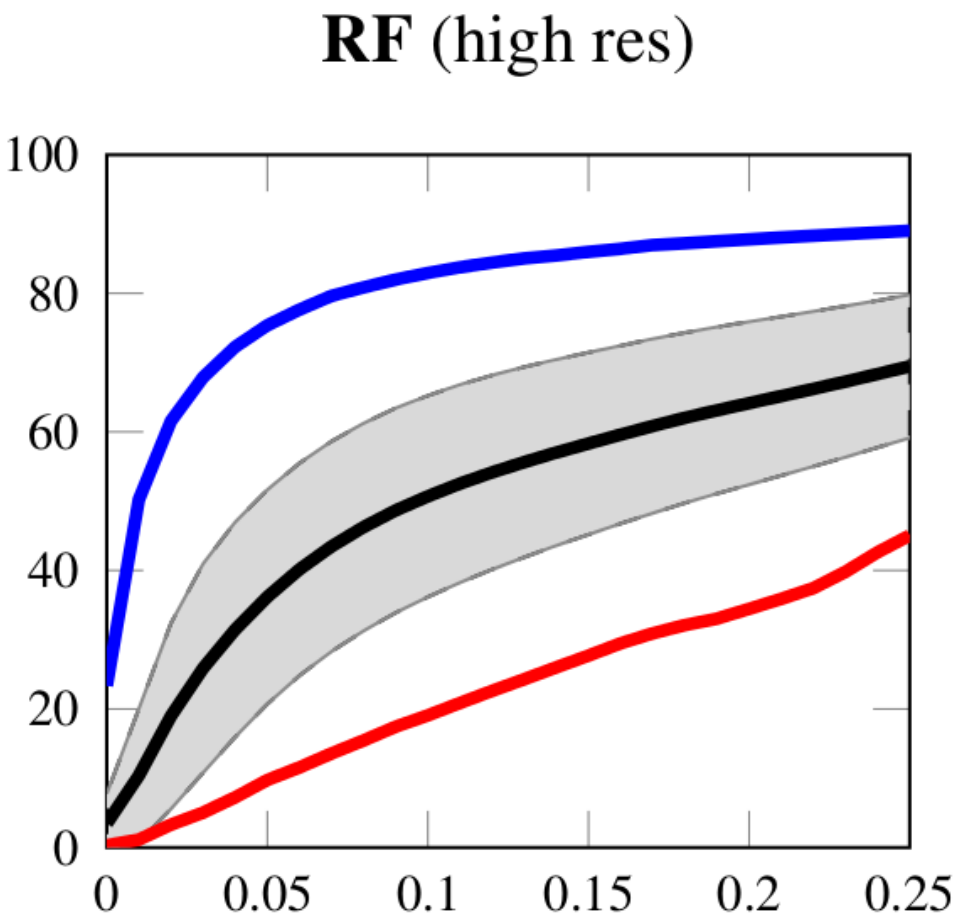

Best Matching

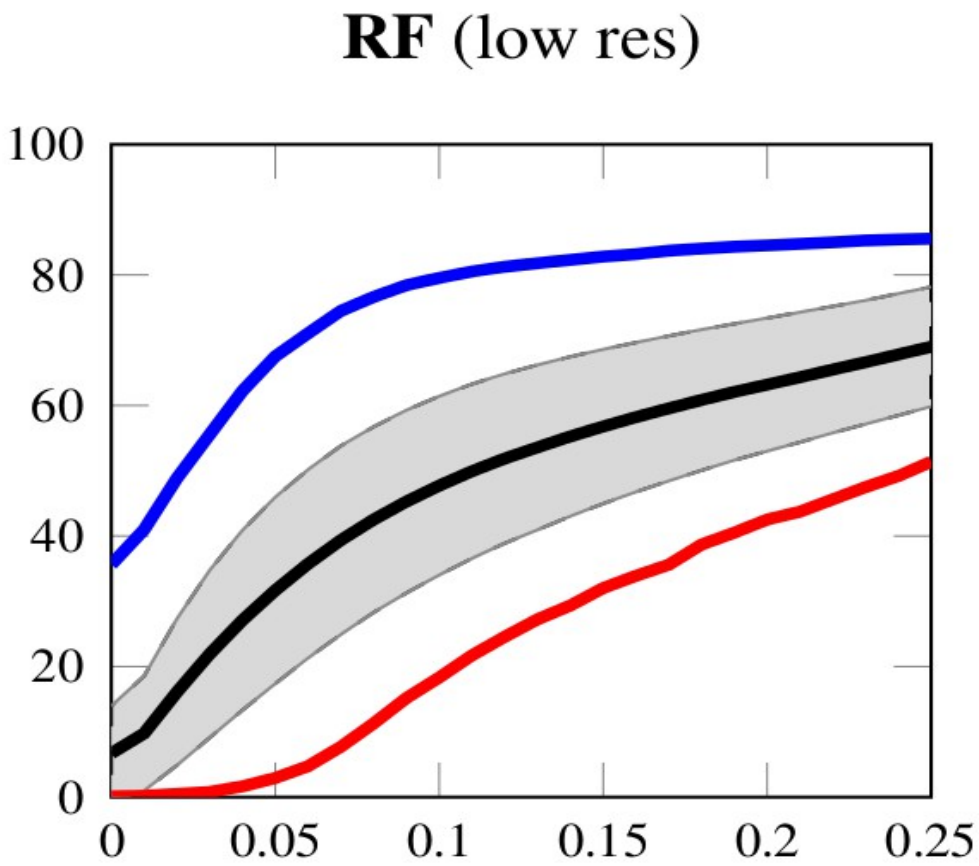
Worst Matching

Random Forests (RF)

- Uses the training set to train a Random Forest
- Based on: Rodolà E., Rota Bulò S., Windheuser T., Vestner M., Cremers D.: *Dense non-rigid shape correspondence using random forests*, In Proc. CVPR, 2014
- Sun J., Ovsjanikov M., Guibas L.: *A concise and provably informative multi-scale signature based on heat diffusion*, In Proc. SGP, 2009

RF: Princeton Protocol





RF: Examples

High Resolution

Low Resolution



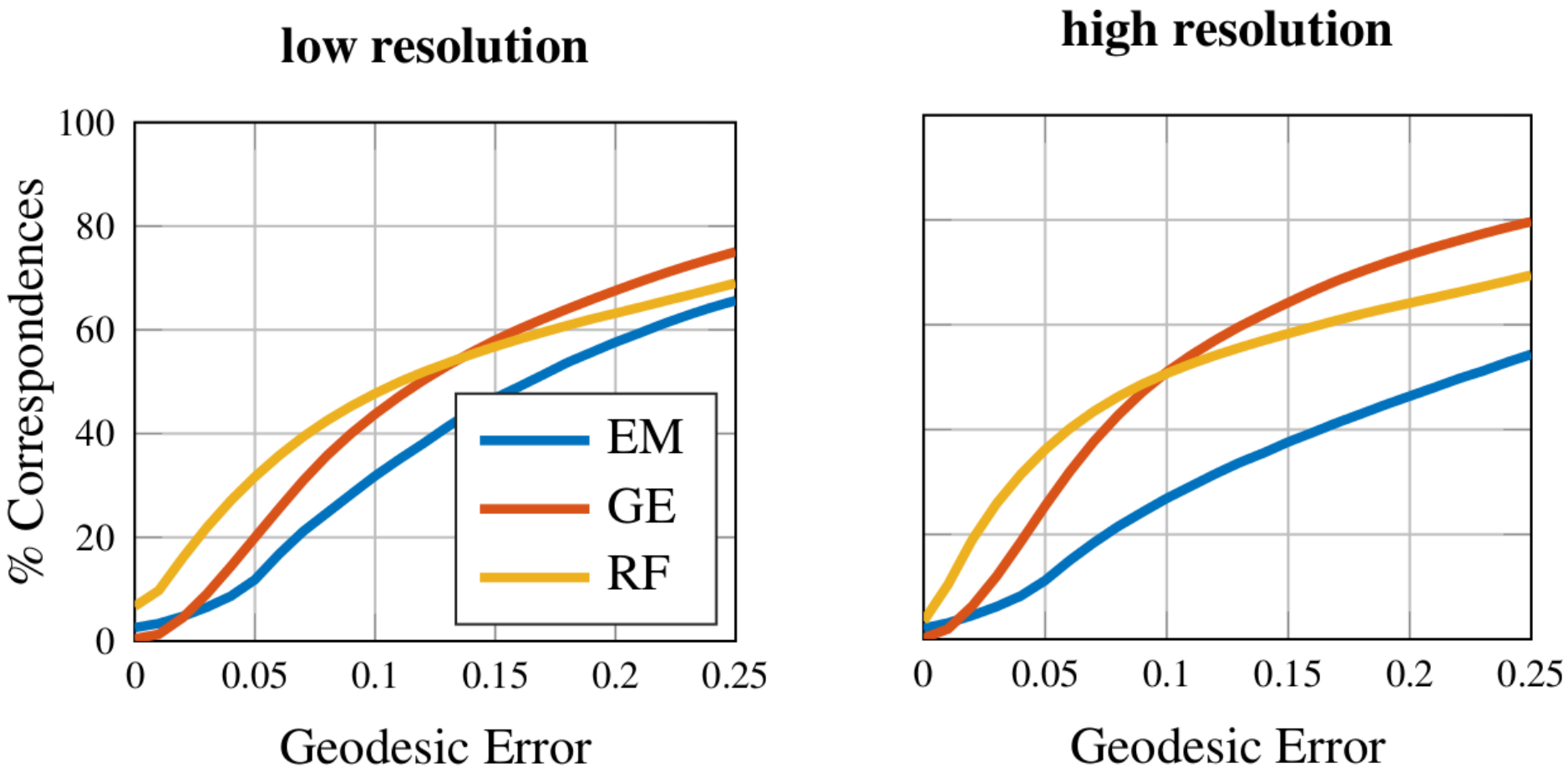





Best Matching

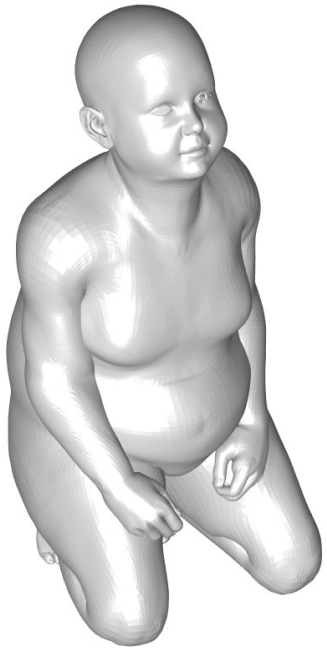
Worst Matching

Comparisons



Conclusions

- No method performs really well on average and there is quite some space for improvement
- There are some shapes on which all methods perform badly



Thank you for your attention!