Dense Human Body Corresponces Using Convolutional Networks

Lingyu Wei[1]   Qixing Huang[2]   Duygu Ceylan[3]   Etienne Vouga[4]   Hao Li[1]

University of Southern California[1]   Toyota Technological Institute at Chicago[2]   Adobe Research[3]   University of Texas at Austin[4]

full-to-full correspondences   full-to-partial correspondences   partial-to-partial correspondences   error (in cm): 0 — 20
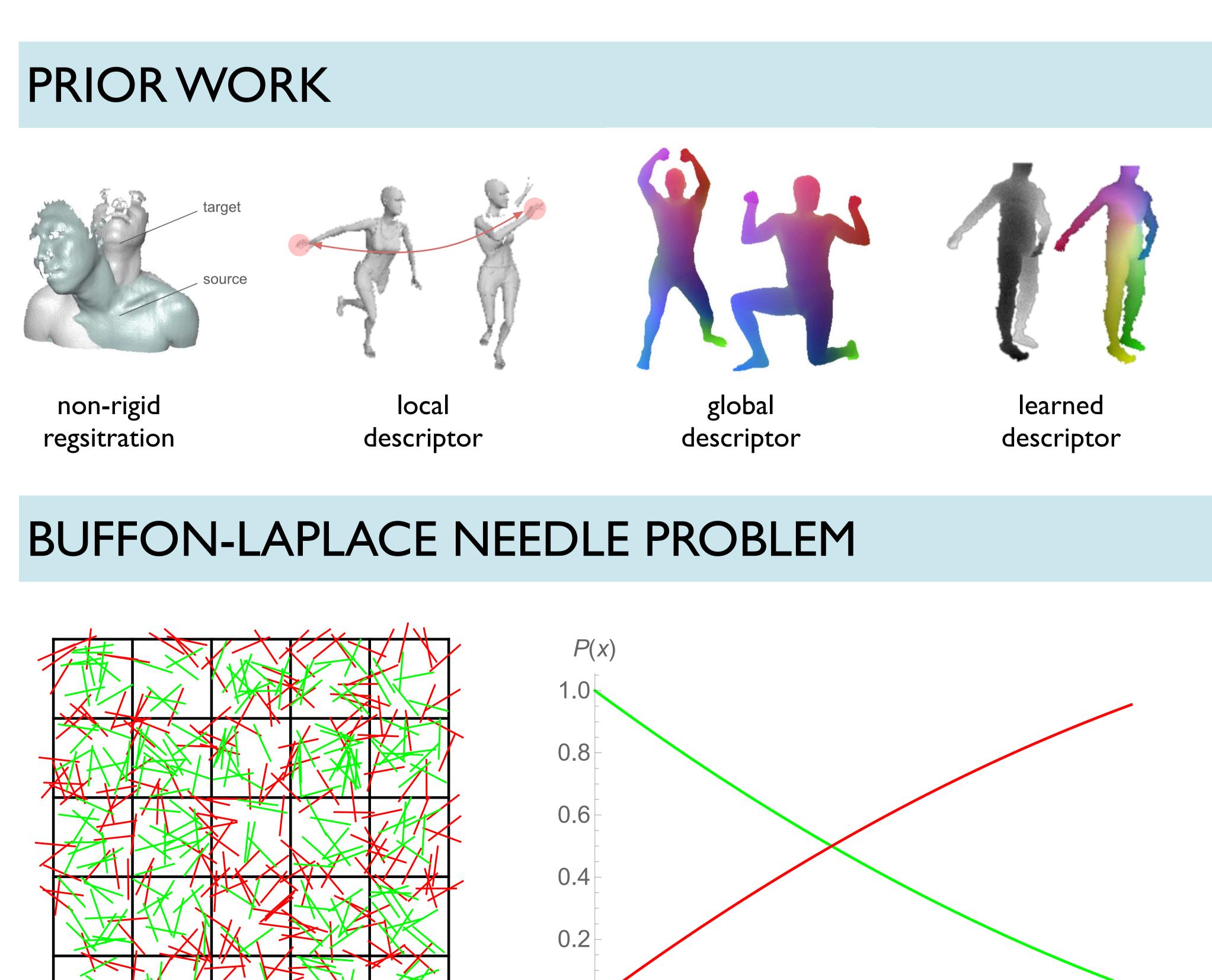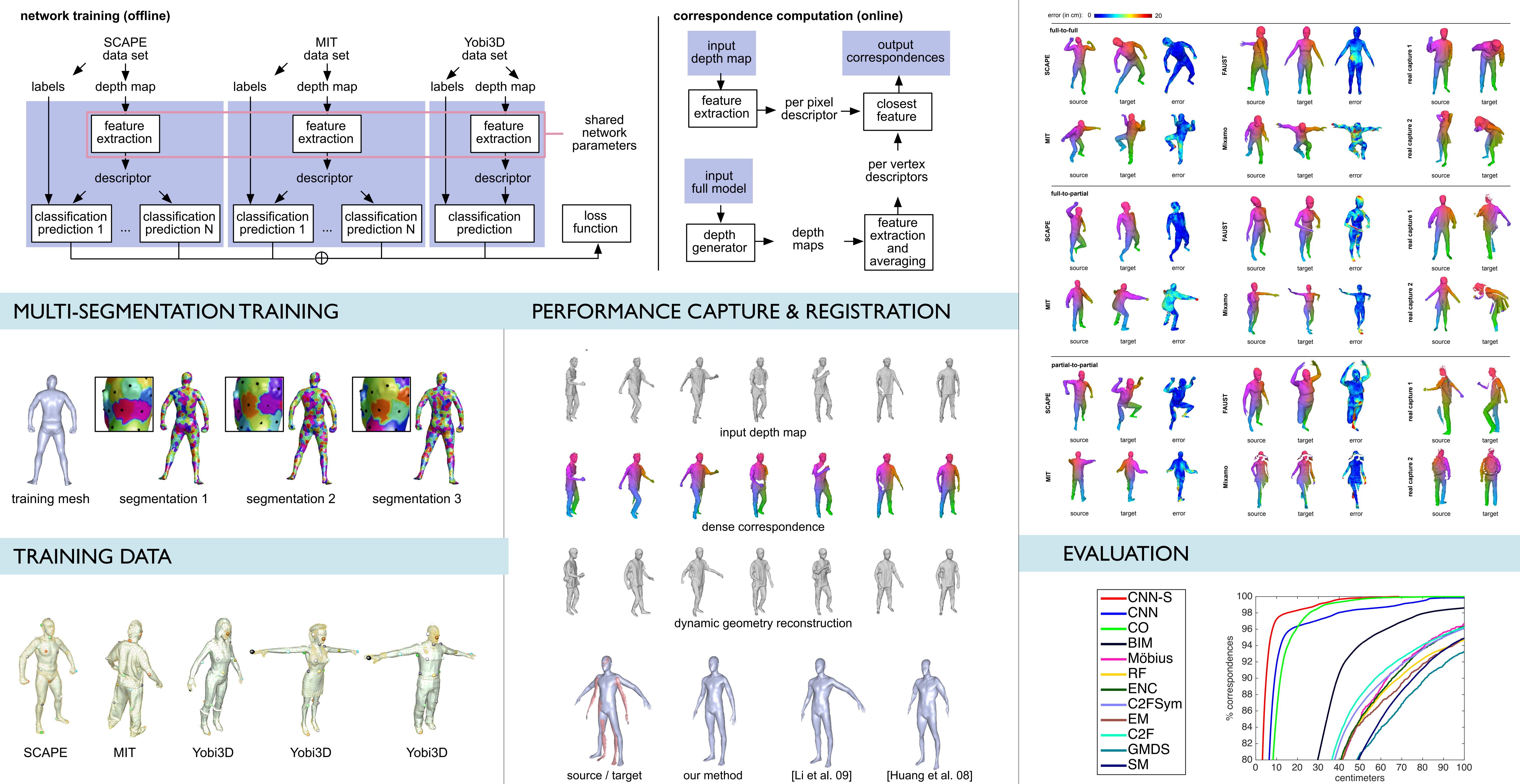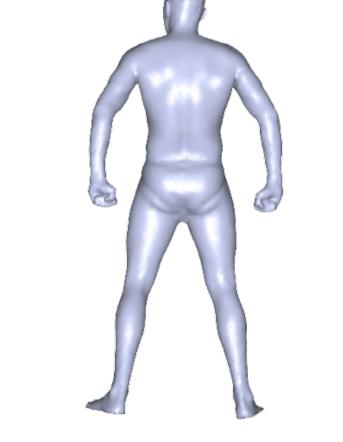
ABSTRACT

We propose a deep learning approach for finding dense correspondences between 3D scans of people. Our method requires only partial geometric information in the form of two depth maps or partial reconstructed surfaces, works for humans in arbitrary poses and wearing any clothing, does not require the two people to be scanned from similar viewpoints, and runs in real time. We use a deep convolutional neural network to train a feature descriptor on depth map pixels, but crucially, rather than training the network to solve the shape correspondence problem directly, we train it to solve a body region classification problem, modified to increase the smoothness of the learned descriptors near region boundaries. This approach ensures that nearby points on the human body are nearby in feature space, and vice versa, rendering the feature descriptor suitable for computing dense correspondences between the scans. We validate our method on real and synthetic data for both clothed and unclothed humans, and show that our correspondences are more robust than is possible with state-of-the-art unsupervised methods, and more accurate than those found using methods that require full watertight 3D geometry.
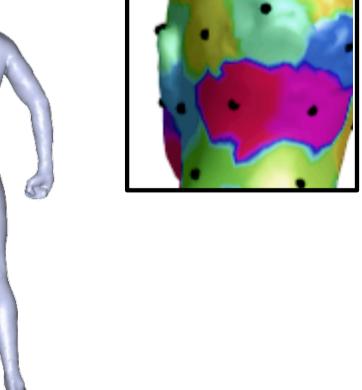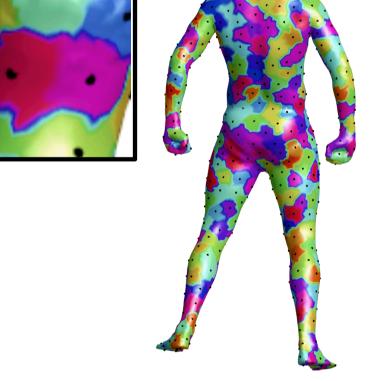
PRIOR WORK
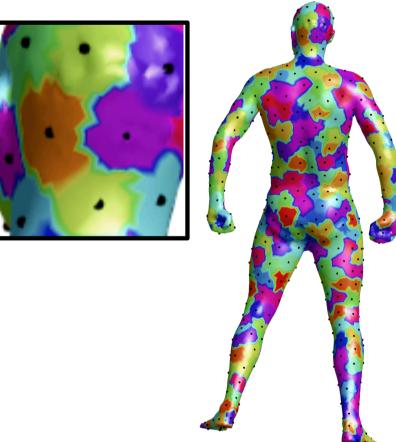

non-rigid regsitration   local descriptor   global descriptor   learned descriptor

BUFFON-LAPLACE NEEDLE PROBLEM

DEEP LEARNING FRAMEWORK FOR HUMAN BODY CORRESPONDENCE COMPUTATION

network training (offline)

correspondence computation (online)

MULTI-SEGMENTATION TRAINING

training mesh   segmentation 1   segmentation 2   segmentation 3

TRAINING DATA

SCAPE   MIT   Yobi3D   Yobi3D   Yobi3D

PERFORMANCE CAPTURE & REGISTRATION

input depth map

dense correspondence

dynamic geometry reconstruction

source / target   our method   [Li et al. 09]   [Huang et al. 08]

RESULTS

error (in cm): 0 — 20

full-to-full

full-to-partial

partial-to-partial

SCAPE   MIT   FAUST   Mixamo   real capture 1   real capture 2

source   target   error   source   target

EVALUATION

CNN-S
CNN
CO
BIM
Möbius
RF
ENC
C2FSym
EM
C2F
GMDS
SM