

Shape from Selfies : Human Body Shape Estimation using CCA Regression Forests

Endri Dibra^{1,3}, Cengiz Öztireli^{1,3}, Remo Ziegler², Markus Gross^{1,3}

Contributions

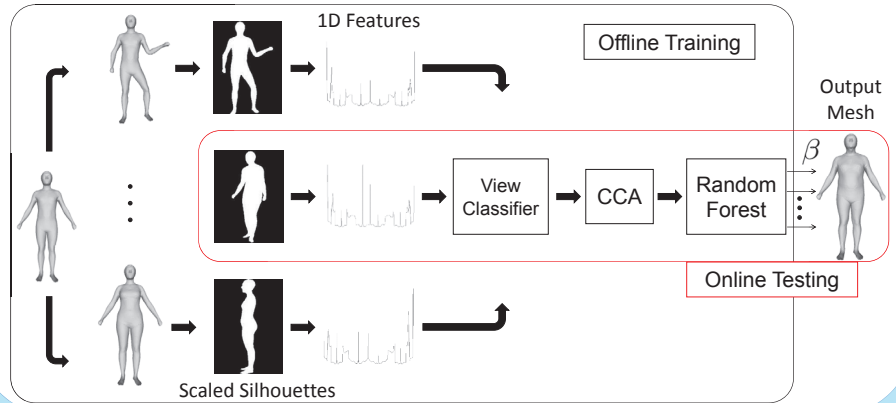
Goal : Fast and Automatic Human Shape Estimator from Silhouettes

- Require no pose estimation or known camera calibration
- Assume mild self occlusion (e.g. Selfie like poses)
- Automatic mapping from silhouette to 3D body shape in ms

Proposed Solution

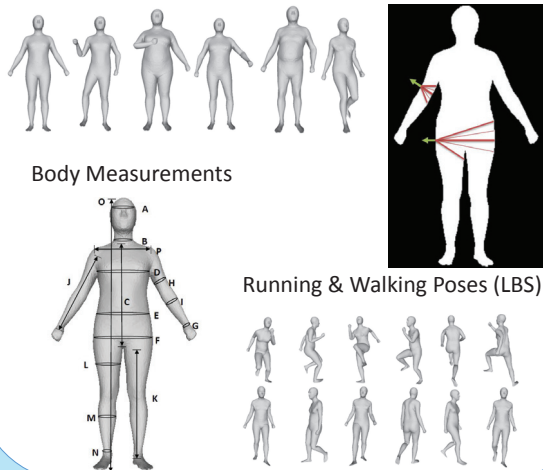
- Extract **novel silhouette features** capturing global and local information, robust to silhouette noise
- Classify Viewing Direction with a Random Forest Classifier
- Project features from two complementary views into correlated **CCA spaces** to obtain more discriminative ones
- Train a **Random Forest Regressor** from projected features to 3D mesh spaces learned from Scape [1]

Full Pipeline

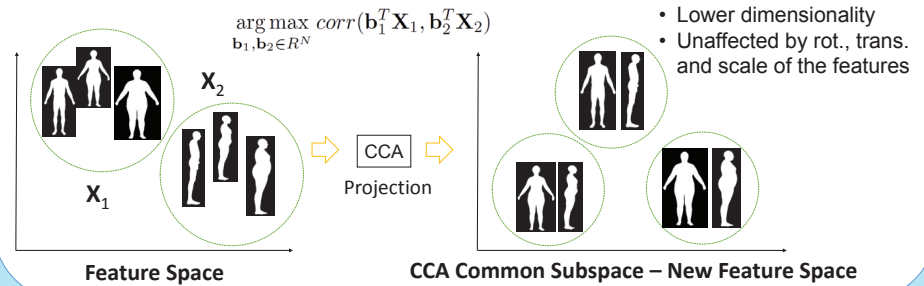


Data Generation

Scape [1] Generated Meshes Silhouette Features



Canonical Correlation Analysis (CCA)



Quantitative Comparisons

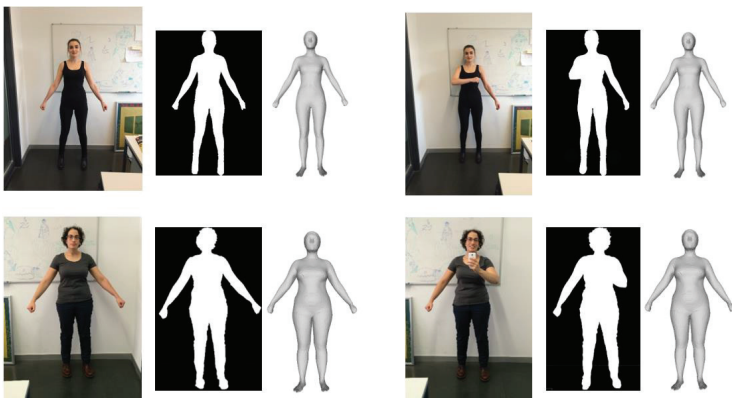
Table 1: Comparisons to state-of-the-art methods, variations of our method (RF, CCA-RF-1, CCA-RF-2) and ground truth, via various measurements illustrated on the right. Errors are represented as Mean±Std. Dev over 1500 unseen meshes and are expressed in millimeters. Note that we operate under a significantly more general setting than the state-of-the-art methods.

Measurement	[2]	[3]	[4]	RF	CCA-RF-1	CCA-RF-2	GT
A. Head circumference	10±12	23±27	50±60	16±13	13±10	8 ± 8	13±9
B. Neck circumference	11±13	27±34	59±72	13 ± 10	10±8	7 ± 7	6±6
C. Shoulder-blade/crotch length	4±5	52±65	119±150	22±18	18±9	18 ± 17	14±11
D. Chest circumference	10±12	18±22	36±45	38 ± 31	30±24	25 ± 24	24±24
E. Waist circumference	22±23	37±39	55±62	35 ± 28	29±25	24 ± 24	16±14
F. Pelvis circumference	11±12	15±19	23±28	33 ± 26	30±25	26 ± 25	14±12
G. Wrist circumference	9±12	24±30	56±70	10 ± 8	6±5	5 ± 5	5±5
H. Bicep circumference	17±22	59±76	146±177	16 ± 13	13±11	11 ± 11	9±10
I. Forearm circumference	16±20	76±100	182±230	14 ± 11	11±9	9 ± 8	8±8
J. Arm length	15±21	53±73	109±141	19 ± 14	15±12	13 ± 12	8±8
K. Inside leg length	6±7	9±12	19±24	26 ± 19	23±18	20 ± 19	9±9
L. Thigh circumference	9±12	19±25	35±44	22 ± 18	19±16	18 ± 17	11±11
M. Calf circumference	6±7	16±21	33±42	18 ± 13	14±12	12 ± 12	7±8
N. Ankle circumference	14±16	28±35	61±78	10 ± 7	18±6	6 ± 6	5±5
O. Overall height	9±12	21±27	49±62	60 ± 45	50±42	43 ± 41	14±11
P. Shoulder breadth	6±7	12±15	24±31	15 ± 14	13±6	6 ± 6	12±11

Table 2: Columns 1-3 show accuracy gain of applying CCA for the Frontal, Side and Frontal Side view altogether, over raw features. (VE) shows the error due to 10 degree view change and (VG), the gain of applying CCA. (N) is the error due to silhouette noise. (P12) shows the error of testing on 12 poses different from the training one, and the rest (Columns 8-11) demonstrate the errors while gradually adding more difficult poses than the training ones. Mean and Std. Deviation is computed over all the body measurements.

Measurement	(F)	(S)	(FS)	(VE)	(VG)	(N)	(P12)	(P1)	(W)	(R)	(PWR)
Mean (mm)	4.9	5.2	6.6	2.2	1.8	2.3	9.3	1.7	1.6	3.9	8.5
Std. Deviation (mm)	2.4	2.6	4.0	1.9	1.5	1.8	5.6	1.0	1.0	2.3	5.2

Shape Estimations



References

- [1] Anguelov, D., Srinivasan, P., Koller, D., Thrun, S., Rodgers, J., Davis, J.: Scape: Shape completion and animation of people. In: SIGGRAPH (2005)
- [2] Boisvert, J., Shu, C., Wuhrer, S., Xi, P.: Three-dimensional human shape inference from silhouettes: reconstruction and validation. In: Machine Vision Applications (2013)
- [3] Chen, Y., Kim, T.K., Cipolla, R.: Inferring 3d shapes and deformations from single views. In: ECCV (2010)
- [4] Xi, P., Lee, W., Shu, C.: A data-driven approach to human-body cloning using a segmented body database. In: Pacific Graphics (2007)