

Task Description

Goal : Human 3D Body Shape Estimation from Silhouettes

Scenarios Considered :

- Shape from “Selfies”
- Single View
- Poses in mild self-occlusion
- Health Monitoring
- One or Two Views
- Neutral Pose



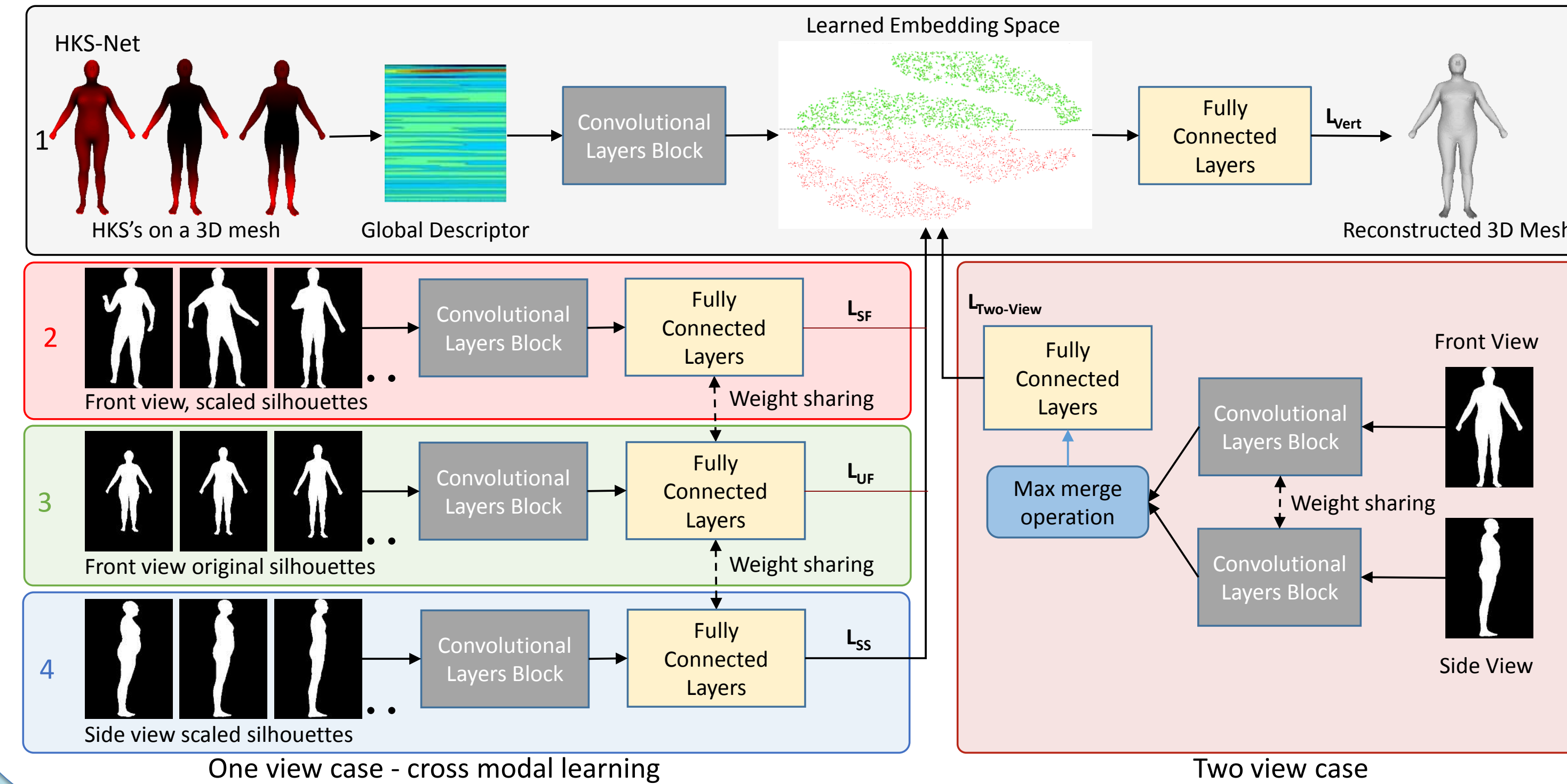
Contributions :

- A novel architecture for shape estimation from silhouettes
- Three core components :
 - Generative** - Inverts a pose invariant 3D shape descriptor to reconstruct its neutral shape
 - Predictive** - Maps 2D silhouettes to 3D body shapes
 - Cross-Modal** - Leverages from multi-view information to boost single view predictions
- State-of-the-art system for human body shape estimation

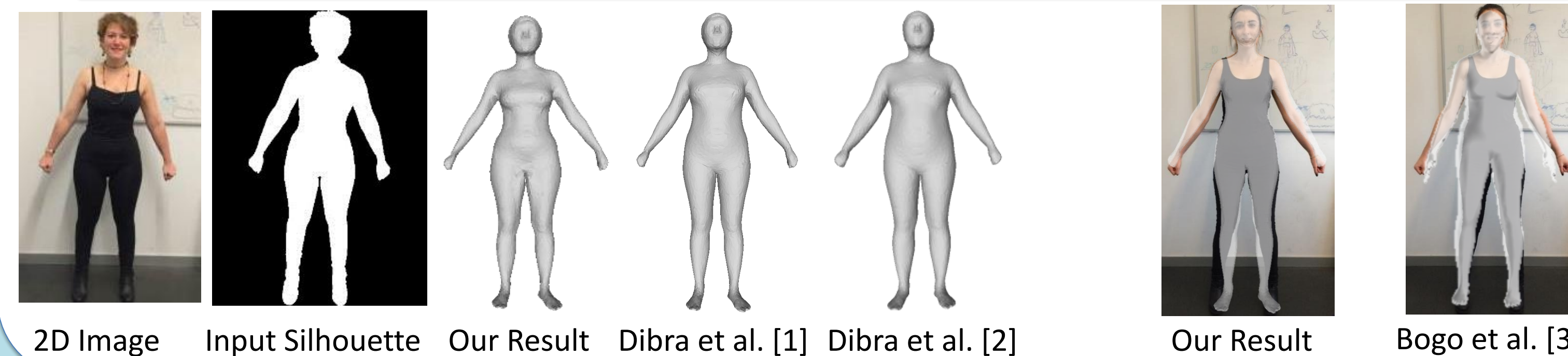
Qualitative Results



Full Pipeline



Qualitative Comparison with Related Work



References

- [1] Dibra, E., Jain, H., Öztireli, C., Ziegler, R., Gross, M.: HS-Nets : Estimating human body shape from silhouettes with convolutional neural networks. In: 3DV (2016)
- [2] Dibra, E., Öztireli, C., Ziegler, R., Gross, M.: Shape from selfies : Human body shape estimation using cca regression forests. In: ECCV (2016)
- [3] Bogo, F., Kanazawa, A., Lassner, C., Gehler, P., Romero, J., Black, M.J.: Keep it smpl: Automatic estimation of 3d human pose and shape from a single image. In: ECCV (2016)
- [4] Boisvert, J., Shu, C., Wuhrer, S., Xi, P.: Three-dimensional human shape inference from silhouettes: reconstruction and validation. In: Mach. Vision App. (2013)
- [5] Chen, Y., Kim, T.K., Cipolla, R.: Inferring 3d shapes and deformations from single views. In: ECCV (2010)
- [6] Xi, P., Lee, W., Shu, C.: A data-driven approach to human-body cloning using a segmented body database. In: Pacific Graphics (2007)

Quantitative Results

Name	Training Input	Test Input	Architecture
SF-1	Scaled Frontal View (SFV), Neutral Pose	SFV	2
SF-1-P	SFV, Various Poses	SFV	2
SFU-1	SFV, Unscaled Frontal View (UFV)	SFV	2 3
SFS-1	SFV, Scaled Side View (SSV)	SFV	2 4
SFUS-1	SFV, UFV, SSV	SFV	2 3 4
SFUS-HKS-1	SFV, UFV, SSV, projected HKS (PHKS)	SFV	1 2 3 4
SF-SS-2	SFV, SSV	SFV, SSV	5
UF-US-2	UFV, Unscaled Side View (USV)	UFV, USV	5
UF-US-HKS-2	UFV, USV, PHKS	UFV, USV	1 5

Table 1. Nomenclature for the various experiments and respective architectures

Measurements	SF-1-P	SF-1	SFS-1	SFU-1	SFUS-1	SFUS-HKS-1	HS-Net-1-S [1]	CCA-RF [2]
A. Head circumference	4.3±3.5	3.9±3.1	3.7±2.9	3.7±2.9	3.9±2.9	3.1±2.6	4±4	8±8
B. Neck circumference	2.2±1.8	2.3±1.8	2.3±1.8	2.3±1.8	2.2±1.7	2.1±1.7	8±5	7±7
C. Shoulder-blade/crotch length	6.2±4.9	6.1±4.8	5.3±4.2	5.3±4.1	5.4±4.1	4.9±3.8	20±15	18±17
D. Chest circumference	6.7±5.4	6.7±5.3	5.9±4.9	5.9±4.7	5.8±4.8	5.8±4.8	13±7	25±24
E. Waist circumference	8.1±6.1	7.8±6.2	7.5±5.9	7.5±5.9	7.5±5.7	6.4±5.2	19±13	24±24
F. Pelvis circumference	9.3±7.5	8.8±7.2	8.4±6.7	8.2±6.6	8.1±6.5	7.1±5.9	19±14	26±25
G. Wrist circumference	2.1±1.7	2.1±1.7	1.9±1.6	1.9±1.6	1.9±1.6	1.7±1.5	5±3	5±5
H. Bicep circumference	3.9±3.1	3.3±2.6	2.9±2.4	2.9±2.4	2.9±2.5	2.9±2.5	8±4	11±11
I. Forearm circumference	3.1±2.4	2.9±2.3	3.1±2.3	2.7±2.3	2.9±2.3	2.6±2.2	7±4	9±8
J. Arm length	4.1±3.1	3.8±2.9	3.3±2.5	3.3±2.5	3.2±2.5	2.9±2.4	12±8	13±12
K. Inside leg length	7.3±5.1	6.8±5.2	6.2±4.8	6.5±4.9	5.7±4.5	5.4±4.3	20±14	20±19
L. Thigh circumference	6.3±4.9	6.3±5.5	5.8±4.9	5.7±4.7	5.8±4.8	5.8±4.9	13±8	18±17
M. Calf circumference	3.6±2.9	3.5±3.1	3.3±2.7	3.3±2.6	3.5±2.8	2.9±2.5	12±7	12±12
N. Ankle circumference	2.1±1.5	2.1±1.7	1.9±1.5	1.8±1.4	2.1±1.5	1.6±1.3	6±3	6±6
O. Overall height	12.6±9.9	12.4±9.9	11.2±8.6	10.9±8.4	10.4±8.1	9.8±7.7	50±39	43±41
P. Shoulder breadth	2.3±1.9	2.3±1.8	2.2±1.2	2.2±1.9	2.1±1.7	1.9±1.7	4±4	6±6

Table 2. Body Measurement errors comparison with shapes reconstructed from **one scaled frontal silhouette**. The nomenclature is presented in Table 1. The measurements are illustrated above. Errors are expressed as Mean +/- Std. Deviation in Millimeters.

Measurements	SF-SS-2	UF-US-2	UF-US-HKS-2	HS-2-Net-MM [1]	Boisvert et al. [4]	Chen et al. [5]	Xi et al. [6]
A. Head circumference	3.9±3.2	3.3±2.6	3.2±2.6	7.4±5.8	10±12	23±27	50±60
B. Neck circumference	1.9±1.7	2.0±1.6	1.9±1.5	5.3±3.1	11±13	27±34	59±72
C. Shoulder-blade/crotch length	5.1±4.1	4.3±3.5	4.2±3.4	9.9±7.0	4±5	52±65	119±150
D. Chest circumference	5.4±4.8	5.8±4.3	5.6±4.7	19.1±12.5	10±12	18±22	36±45
E. Waist circumference	7.5±5.7	7.6±5.9	7.1±5.8	18.4±13.2	22±23	37±39	55±62
F. Pelvis circumference	8.0±6.4	8.0±6.4	6.9±5.6	14.9±11.3	11±12	15±19	23±28
G. Wrist circumference	1.9±1.6	1.6±1.4	1.6±1.3	3.8±2.7	9±12	24±30	56±70
H. Bicep circumference	3.0±2.6	2.6±2.1	2.6±2.1	6.5±4.9	17±22	59±76	146±177
I. Forearm circumference	3.0±2.4	2.9±2.1	2.2±1.9	5.5±4.2	16±20	76±100	182±230
J. Arm length	3.3±2.6	2.4±1.9	2.3±1.9	8.1±6.4	15±21	53±73	109±141
K. Inside leg length	5.6±5.1	4.3±3.8	4.3±3.8	15.6±12.4	6±7	9±12	19±24
L. Thigh circumference	5.8±5.1	5.1±4.3	5.1±4.3	13.7±10.8	9±12	19±25	35±44
M. Calf circumference	3.9±3.2	3.1±2.1	2.7±1.9	8.5±6.5	6±7	16±21	33±42
N. Ankle circumference	2.1±1.5	1.6±1.1	1.4±1.1	4.6±3.2	14±16	28±35	61±78
O. Overall height	10.6±8.6	7.2±6.1	7.1±5.5	25.9±20.4	9±12	21±27	49±62
P. Shoulder breadth	2.2±1.8	2.1±1.8	2.1±1.8	5.6±3.9	6±7	12±15	24±31

Table 3. Same as in Table 2, however with shapes reconstructed from **two views** at the same time.

