
SMPL-X: A new joint 3D model of the human body, face and hands together

[Paper Page] [Paper] [Supp. Mat.]

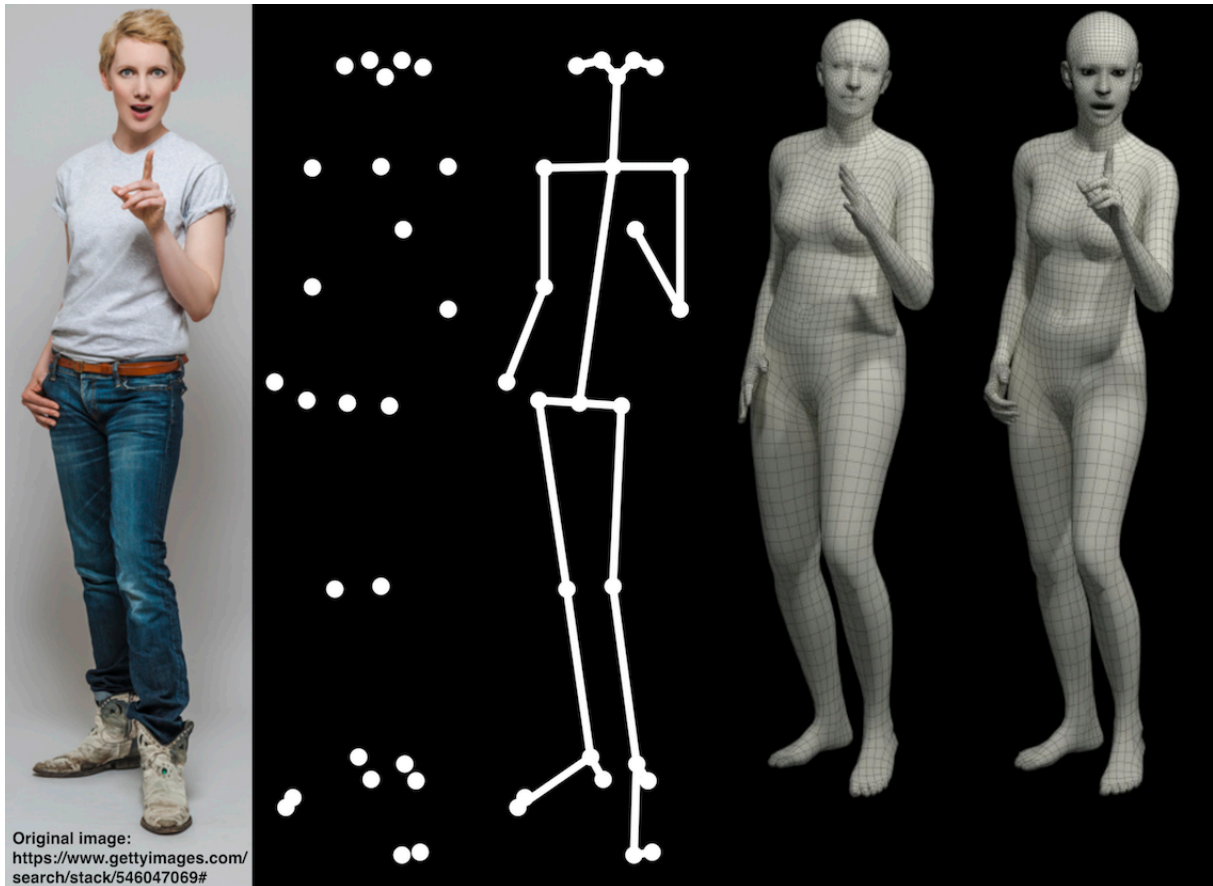


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Disclaimer

The original images used for the figures 1 and 2 of the paper can be found in this link. The images in the paper are used under license from gettyimages.com. We have acquired the right to use them in the publication, but redistribution is not allowed. Please follow the instructions on the given link to acquire right of usage. Our results are obtained on the 483×724 pixels resolution of the original images.

Description

SMPL-X (SMPL eXpressive) is a unified body model with shape parameters trained jointly for the face, hands and body. *SMPL-X* uses standard vertex based linear blend skinning with learned corrective blend shapes, has $N = 10,475$ vertices and $K = 54$ joints, which include joints for the neck, jaw, eyeballs and fingers. *SMPL-X* is defined by a function $M(\theta, \beta, \psi)$, where θ is the pose parameters, β the shape parameters and ψ the facial expression parameters.

News

- 3 November 2020: We release the code to transfer between the models in the SMPL family. For more details on the code, go to this readme file. A detailed explanation on how the mappings

were extracted can be found [here](#).

- 23 September 2020: A UV map is now available for SMPL-X, please check the Downloads section of the website.
- 20 August 2020: The full shape and expression space of SMPL-X are now available.

Installation

To install the model please follow the next steps in the specified order: 1. To install from PyPi simply run: `Shell pip install smplx[all]` 2. Clone this repository and install it using the `setup.py` script:

```
1 git clone https://github.com/vchoutas/smplx
2 python setup.py install
```

Downloading the model

To download the *SMPL-X* model go to this project website and register to get access to the downloads section.

To download the *SMPL+H* model go to this project website and register to get access to the downloads section.

To download the *SMPL* model go to this (male and female models) and this (gender neutral model) project website and register to get access to the downloads section.

Loading SMPL-X, SMPL+H and SMPL

SMPL and SMPL+H setup

The loader gives the option to use any of the SMPL-X, SMPL+H, SMPL, and MANO models. Depending on the model you want to use, please follow the respective download instructions. To switch between MANO, SMPL, SMPL+H and SMPL-X just change the `model_path` or `model_type` parameters. For more details please check the docs of the model classes. Before using SMPL and SMPL+H you should follow the instructions in `tools/README.md` to remove the Chumpy objects from both model pkls, as well as merge the MANO parameters with SMPL+H.

Model loading

You can either use the create function from `body_models` or directly call the constructor for the SMPL, SMPL+H and SMPL-X model. The path to the model can either be the path to the file with the parameters or a directory with the following structure:

1	<code>models</code>	—
2	<code>smpl</code>	
3		— <code>SMPL_FEMALE.pkl</code>
4		— <code>SMPL_MALE.pkl</code>
5		— <code>SMPL_NEUTRAL.pkl</code> —
6	<code>smpLh</code>	
7		— <code>SMPLH_FEMALE.pkl</code>
8		— <code>SMPLH_MALE.pkl</code> —
9	<code>mano</code>	
10		— <code>MANO_RIGHT.pkl</code>
11		— <code>MANO_LEFT.pkl</code> —
12	<code>smpLx</code>	—
13		— <code>SMPLX_FEMALE.npz</code> —
14		— <code>SMPLX_FEMALE.pkl</code> —
15		— <code>SMPLX_MALE.npz</code> —
16		— <code>SMPLX_MALE.pkl</code> —
17		— <code>SMPLX_NEUTRAL.npz</code> —
18		— <code>SMPLX_NEUTRAL.pkl</code>

MANO and FLAME correspondences

The vertex correspondences between SMPL-X and MANO, FLAME can be downloaded from the project website. If you have extracted the correspondence data in the folder *correspondences*, then use the following scripts to visualize them:

1. To view MANO correspondences run the following command:

```
1 python examples/vis_mano_vertices.py --model-folder $SMPLX_FOLDER --  
  corr-fname correspondences/MANO_SMPLX_vertex_ids.pkl
```

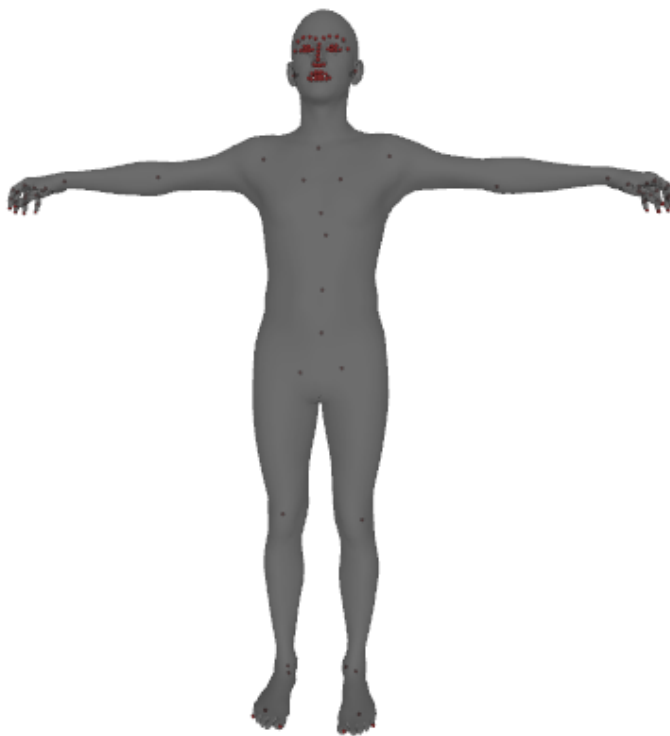
2. To view FLAME correspondences run the following command:

```
1 python examples/vis_flame_vertices.py --model-folder $SMPLX_FOLDER --  
  corr-fname correspondences/SMPL-X_FLAME_vertex_ids.npy
```

Example

After installing the *smplx* package and downloading the model parameters you should be able to run the *demo.py* script to visualize the results. For this step you have to install the *pyrender* and *trimesh* packages.

```
python examples/demo.py --model-folder $SMPLX_FOLDER --plot-joints=True --gender="neutral"
```



Modifying the global pose of the model

If you want to modify the global pose of the model, i.e. the root rotation and translation, to a new coordinate system for example, you need to take into account that the model rotation uses the pelvis as the center of rotation. A more detailed description can be found in the following link. If something is not clear, please let me know so that I can update the description.

Citation

Depending on which model is loaded for your project, i.e. SMPL-X or SMPL+H or SMPL, please cite the most relevant work below, listed in the same order:

```
1 @inproceedings{SMPL-X:2019,  
2   title = {Expressive Body Capture: 3D Hands, Face, and Body from a  
3     Single Image},  
4   author = {Pavlakos, Georgios and Choutas, Vasileios and Ghorbani,  
5     Nima and Bolkart, Timo and Osman, Ahmed A. A. and Tzionas,  
6     Dimitrios and Black, Michael J.},  
7   booktitle = {Proceedings IEEE Conf. on Computer Vision and Pattern  
8     Recognition (CVPR)},  
9   year = {2019}  
10 }
```

```
1 @article{MANO:SIGGRAPHASIA:2017,  
2   title = {Embodied Hands: Modeling and Capturing Hands and Bodies  
3     Together},  
4   author = {Romero, Javier and Tzionas, Dimitrios and Black, Michael  
5     J.},  
6   journal = {ACM Transactions on Graphics, (Proc. SIGGRAPH Asia)},  
7   volume = {36},  
8   number = {6},  
9   series = {245:1--245:17},  
10  month = nov,  
11  year = {2017},  
12  month_numeric = {11}  
13 }
```

```
1 @article{SMPL:2015,  
2   author = {Loper, Matthew and Mahmood, Naureen and Romero, Javier  
3     and Pons-Moll, Gerard and Black, Michael J.},  
4   title = {{SMPL}: A Skinned Multi-Person Linear Model},  
5   journal = {ACM Transactions on Graphics, (Proc. SIGGRAPH Asia)},  
6   month = oct,  
7   number = {6},  
8   pages = {248:1--248:16},  
9   publisher = {ACM},  
10  volume = {34},  
11  year = {2015}  
12 }
```

This repository was originally developed for SMPL-X / SMPLify-X (CVPR 2019), you might be interested in having a look: <https://smpl-x.is.tue.mpg.de>.

Acknowledgments

Facial Contour

Special thanks to Soubhik Sanyal for sharing the Tensorflow code used for the facial landmarks.

Contact

The code of this repository was implemented by Vassilis Choutas.

For questions, please contact smplx@tue.mpg.de.

For commercial licensing (and all related questions for business applications), please contact ps-licensing@tue.mpg.de.