Automatic rigging and skinning of 3D antique statue models

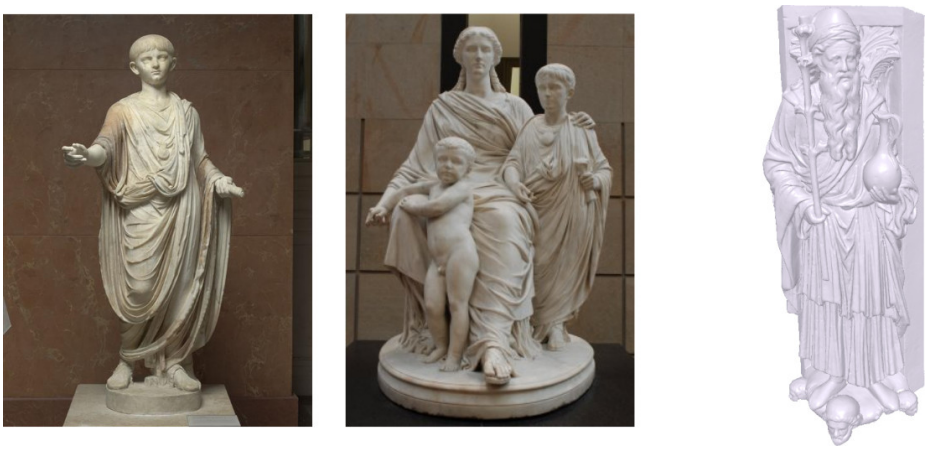

Figure 1: Examples of antique statues (left:real model, right: virtual model) wearing clothes that could be animated.

1- Context and objectives

Antique statues and engraving in rocks are fascinating pieces of history which survived through time. They depict both shapes and ancient lifestyle as seen in Fig. 1. Although constrained to be engraved as a single static shape, these art works commonly illustrate living animated scenes and therefore contain intrinsic visual information about animated story scenarios.

While 3D scanning technic is able nowadays to acquire the geometry of existing antique statue with high precision, generating the deformation and the animation of such virtual statue remains a scientific challenge, and two main one can be identified. First, the deformation should be applied on the character skin geometry which is not visible as the statues are generally wearing cloth layers such as long covering tunics. The hidden body skin must therefore be inferred from the available information. Secondly, the static model should be rigged in order to be deformed, i.e. associated with an embedded skeleton linked to the skin surface through skinning weights. This rigging part, usually designed *by hands* by skilled computer artists, should instead be computed in an automatic way from the various poses in which the statue has been captured. Both challenges will be tackled within this research project in order to lead to an **automatic generation of animable 3D character from a virtual static model of an antique statue wearing clothes**.

This project is part of the ANR eRoma in collaboration with the University of Lyon – LIRIS, the Musée Gallo-Roman de Lyon, and the Paris-Sorbonne University. Access to real Gallo-Roman data set and collaboration with historian experts is expected.

2- Previous works and methodology

Generating automatically a rigged model has been investigated for mesh sequences [LD14]. The case of static input is more challenging and requires the use of a-priori knowledge [Tay00, BP07, PYX+09, BTST12] on the model, or the use of user inputs such as sketches [MQW05, GCR13, GRGC15]. Both approaches may be investigated and evaluated within this internship.

Undressing a virtual character to infer the skin model is a less studied topic although early attempts have been made using statistical or parameterized template models [BB08, Has10, GCZZ12, PCKR14]. In the context of this project, we aim at mixing user inputs such as sketching annotations of the underlying shape and the cloth [GIZ09], possibly coupled to an automatic detection of the garment with respect to the property of developability of the surface.

This project will lead to a PhD topic on animating stories from 3D reconstructions of antique artworks applied to statues and engravings.

3- Requirements

We are looking for highly motivated candidates able to efficiently develop and experiment computer graphics and computer animation in a research context. Therefore, candidates should have a good background in computer programming, geometry, 3D modeling and animation.

4- Internship information

The internship will take place within the Inria Grenoble research center, in the Imagine research team, part of Laboratoire Jean Kuntzmann.

Inria Grenoble
Imagine, LJK
655 avenue de l'Europe
38330 Montbonnot.

5- Contact

Rémi Ronfard: remi.ronfard@inria.fr
Damien Rohmer: damien.rohmer@inria.fr
Stefanie Hahmann: stefanie.hahmann@inria.fr
Marie-Paule Cani: marie-paule.cani@inria.fr

References

[BB08] Alexandru O. Balan and Michael J. Black. The Naked Truth: Estimating Body Shape Under Clothing. *European Conference on Computer Vision (ECCV)*, 2008.

[BP07] Ilya Baran and Jovan Popovic. Automatic Rigging and Animation of 3D Character. *ACM Transactions On Graphics, Proc. ACM SIGGRAPH*, 26(3), 2007.

[BTST12] Gaurav Bharaj, Thorsten Thormählen, Hans-Peter Seidel, and Christian Theobalt. Automatically Rigging Multi-component Characters. *EUROGRAPHICS*, 31, 2012.

[GCR13] Martin Guay, Marie-Paule Cani, and Rémi Ronfard. The line of action: an intuitive interface for expressive character posing. *ACM Transactions on Graphics (Proc. ACM SIGGRAPH Asia)*, 32(6), 2013.

[GCZZ12] Yu Guo, Xiaowu Chen, Bin Zhou, and Qinping Zhao. Clothed and Naked Human Shapes Estimation from a Single Image. *Computational Visual Media*, 2012.

[GIZ09] Yotam Gingold, Takeo Igarashi, and Denis Zorin. Structured annotations for 2D to 3D modeling. *ACM Transactions on Graphics, ACM SIGGRAPH*, 28(5), 2009.

[GRGC15] Martin Guay, Rémi Ronfard, Michael Gleicher, and Marie-Paule Cani. Space-time sketching of character animation. *ACM Transactions on Graphics (Proc. ACM SIGGRAPH)*, 34(4), 2015.

[Has10] Nils Hasler. *Modelling Human Pose and Shape Based on a Database of Human 3D Scans.* PhD thesis, Max-Planck-Institut, 2010.

[LD14] Binh Huy Le and Zhigang Deng. Robust and Accurate Skeletal Rigging from Mesh Sequences. *ACM Transactions On Graphics, Proc. ACM SIGGRAPH*, 2014.

[MQW05] C. Mao, S. Qin, and D. Wright. A sketch-based gesture interface for rough 3d stick figure animation. *Sketch-Based Interfaces and Modeling (SBIM)*, 2005.

[PCKR14] Byoung-Keon Park, B. Corner, M. Kearne, and M. Reed. Estimating human body characteristics under clothing using a statistical body shape model. *DHM*, 2014.

[PYX+09] Junjun Pan, Xiaosong Yang, Xin Xie, Philip Willis, and Jian Zhang. Automatic rigging for animation characters with 3D silhouette. *Computer Animation and Virtual Worlds*, 20, 2009.

[Tay00] Camillo J. Taylor. Reconstruction of articulated objects from point correspondences in a single uncalibrated image. *Computer Vision Image Understanding*, 80(3):349–363, 2000.