Ecole Doctorale STIC

Sciences & Technologies de l'Information et de la Communication

MINES ParisTech

Université Nice SOPHIA ANTIPOLIS

ED STIC - Proposition de Sujets de Thèse

pour la campagne d'Allocation de thèses 2015

Axe Sophi@Stic :	aucun
Titre du sujet :	User-centered sketch interpretation
Mention de thèse :	Informatique
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Description du sujet :

* Context and challenges *

Sketches and 3D models are fundamental ingredients of the early stages of product design. On the one hand, sketching is visceral and quick, offering designers complete freedom in their exploration of shape. On the other hand, 3D models are necessary input for rapid prototyping technology but require time and precision to be produced. Because of these different goals and requirements, sketches and 3D models are often created by different practitioners, requiring numerous discussions and iterations to ensure that the 3D models capture the original design intent.

Sketch-based modeling algorithms [1,2,3] aim at facilitating the transition from 2D sketches to 3D models. However, despite significant progress over the past two decades, few of these tools

have been adopted by professional designers. A major limitation of existing methods is that they require designers to adopt specific drawing techniques, such as vanishing points and construction lines, at a stage where artists rather want to draw freely without external distraction. The goal of this PhD is to lift these restrictions by adopting a data-driven approach to sketch understanding, where we will rely on training sets of 3D objects and sketches to learn the techniques proper to each user.

* Our approach *
Similarly to speech recognition systems that require a training phase to adapt to the accent of an individual, users of our approach will first train the system by drawing known shapes using their own techniques. We will use this training set to identify the user-specific features that best relate a drawing and the 3D shape it represents. As an example, our system should automatically detect if an artist convey smooth surfaces by drawing shading, or if he relies on vanishing points to lay down the main structure of an object.

* Research plan *
The first part of the PhD will be to build a large dataset of drawings and their corresponding 3D shapes. The second part of the PhD will focus on extracting relevant shape features from the 3D objects and measure their correlation with the lines that people draw. While the extraction of feature lines like contours and silhouettes have been well studied in the literature [4], professional designers also draw other construction lines that are less well understood. Given pairs of known 3D shapes and drawings created by the user, we plan to use machine learning algorithms to train our system to predict the relation between the user-drawn lines and the properties of the geometry they represent. Finally, if time permits, we will consider the problem of recovering the 3D shape that best satisfies the geometric properties that our algorithm predicts for each line.

* References *
[1] Analytic Drawing of 3D Scaffolds
Ryan Schmidt, Azam Khan, Karan Singh, Gord Kurtenbach,
Siggraph Asia 2009
http://www.dgp.toronto.edu/~rms/pubs/DrawingSGA09.html

[2] CrossShade: Shading Concept Sketches Using Cross-Section Curves
Cloud Shao, Adrien Bousseau, Alla Sheffer, Karan Singh,
Siggraph 2012
http://www.crossshade.com/

[3] True2Form: 3D Curve Networks from 2D Sketches via Selective Regularization
Baoxuan Xu, William Chang, Alla Sheffer, Adrien Bousseau, James McCrae, Karan Singh,
Siggraph 2014
http://www-sop.inria.fr/reves/Basilic/2014/XCSBMS14/

[4] Where Do People Draw Lines?

Forrester Cole, Aleksey Golovinskiy, Alex Limpaecher, Heather Stoddart Barros, Adam Finkelstein, Thomas Funkhouser, Szymon Rusinkiewicz
Siggraph 2008
http://gfx.cs.princeton.edu/pubs/Cole_2008_WDP/

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