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Silvia Biasotti and Marco Tarini (Editors)

Computer Graphics & Human-Computer Interaction Lab at University of Cagliari

Lucio Davide Spano and Riccardo Scateni

Dipartimento di Matematica e Informatica, Università di Cagliari

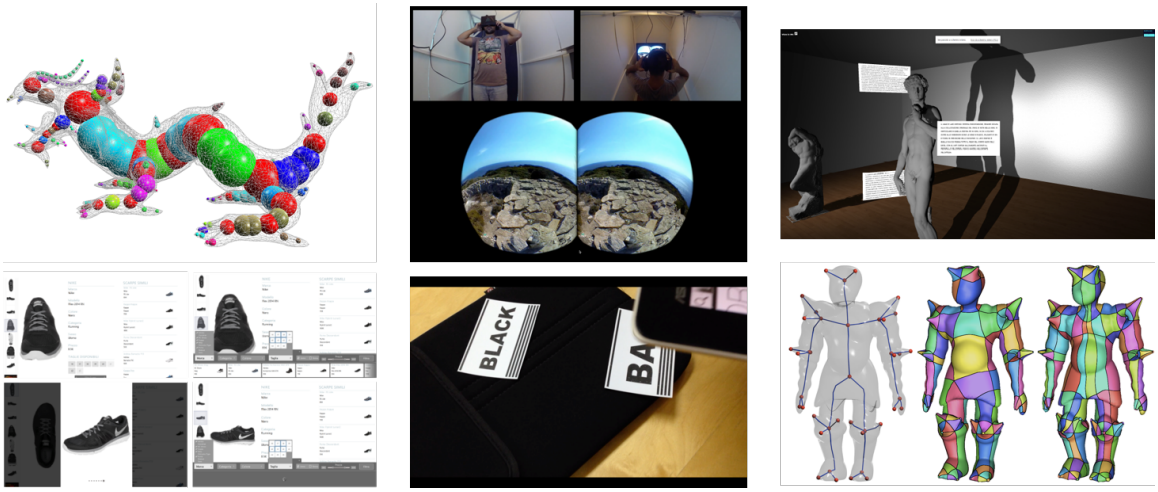

Figure 1: *A gallery of images taken from some of the most recent works published from our group.*

Abstract

We present here a brief summary of the research activities of the research group in Computer Graphics and Human-Computer Interaction of the University of Cagliari. The group is active at the Department of Mathematics and Computer Science by approximatively seven years and its activities spans mainly in the areas of geometry processing and natural interaction.

1. Introduction

The activity of the group of Computer Graphics and Human-Computer Interaction began at the University of Cagliari shortly before the activation of the doctoral program in Computer Science when, in 2008, the first Master students started to work on their theses centered on these subjects. It was with the first doctoral students, in 2009, that the group started to have a minimal structure that permitted to activate the two lines of research that, still today, are characterizing it. In the following years there has been a slight growth of the group that is now composed by two members of the faculty, Prof. Riccardo Scateni and Prof. Lucio Davide Spano, and, currently, two post-docs and five PhD students.

During this period the group participated in a national research program (PRIN) coordinated by the University of Verona aimed at finding new algorithms and techniques for the indexing and retrieval of three-dimensional shapes. It is now leading a regional research program whose goal is to help the tourists who are visiting a resort to perform a fitness

test to figure out which are the best activities to perform during their vacations [SSS*15a].

Most of the alumni of the group are now holding research and development position around the world: two of them are senior software engineers in start-ups of the ETHZ in the Zurich area; one is post-doc at the Queensland University of Technology, Brisbane, Australia; one, after a post-doc at the University of British Columbia, Vancouver, Canada, is now about to start a post-doc at CNR in Genoa; one is now a research fellow at CRS4 in Cagliari.

2. Geometry processing

The main sector of activity in Computer Graphics is Geometry Processing. The focus of the research is currently on the exploitation of results obtained in the past on the usage of curve-skeletons for the topological characterization of shapes [LS15] and the mapping of three-dimensional onto polycubes. We recently released an interactive tool for the creation, editing and repairing of curve-skeleton [BMUS15], The tool is mainly designed to help anybody working with curve-skeletons in the tedious work of manipulating them to repair the small errors that are quite always present. We designed it when working on a joint project for the generation of a coarse quad-layout for triangle meshes starting from their skeleton [ULP*ss]. This project is evolving towards the generation of volumetric hex-meshes built guided from the topology of the skeleton.

We are also working on a pipeline linking the rigging skeleton and the cage of a digital shape to obtain an interactive tool for animation. Another project underway is the optimization of poly-cubes the reduce the number of cubes in the complex to, consequently, reduce the number of singularities on the surface. Finally, we are developing a new method for the automatic redesign of triangle mesh to have an optimal shape in term of developing surface for fabrication purposes.

3. Natural interaction

Together with the development of new techniques and technologies for processing and visualization, there is the need for making them accessible to the largest number of users. One of the most important quest in Human Computer Interaction in these years is to exploit a number of devices that exited from the research laboratories for entering in the consumer market, such as Head Mounted Displays, tangibles, gesture recognition devices and so on, both from developers and the users point of view.

Considering the users, in our lab we exploit such devices for creating more natural interactions for different categories of users, in different domains. Using the Oculus Rift we created a virtual travelling experience in combination with a 360^o [FSSS15] video and a web-based teaching platform for Art History in high school classrooms [CSSS15]. Other work focused more on input systems in learning for children [SSS15b] and on the differences between controlling visualizations through multitouch and body gestures [TIS*13].

The challenge we are currently working on is how to include all such devices, which exploit a continuous input vocabulary into interface definition toolkits that are engineered for discrete events. This will help both developers and designers in creating more integrated interaction experiences.

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