CRS4 Visual Computing

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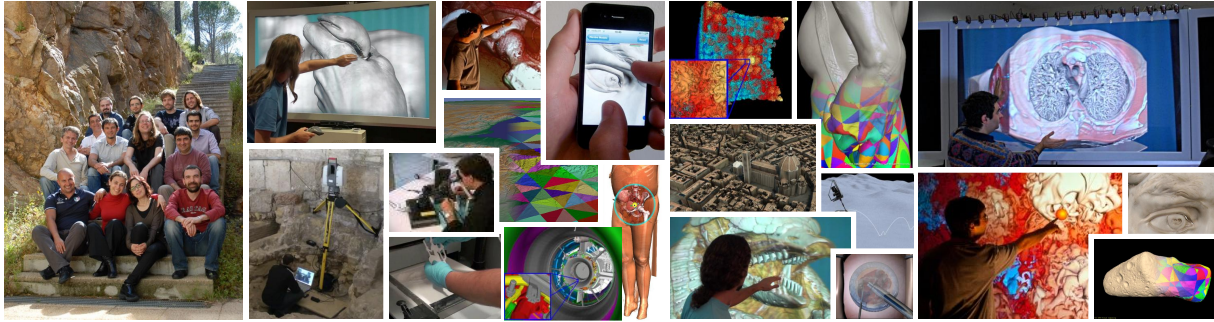
Abstract
This short presentation illustrates Visual Computing activities at the CRS4 research center. Research activities span many areas of computer graphics and computer vision, the primary focus being the study and development of scalable technology for acquiring, creating, distributing and exploring massive models, as well as for integrating them in real-time interactive visual simulations and virtual environments, both in local and distributed settings.

1. Introduction

CRS4 is a leading Italian research center focusing on state-of-the-art computational technologies and on their application to several areas: biomedicine, biotechnology, information society, energy and environment, cultural heritage. The center started its operations in 1992 under the direction of Nobel Laureate Carlo Rubbia, and is currently directed by Paolo Zanella, former director of CERN computing division. Current staff is of 187 people.

Enrico Gobbetti joined CRS4 in 1996, where he established, and, since then, directed the research program in Visual Computing, which has gradually become one of the leading Italian research programs in the domain. Research activities span many areas of computer graphics and computer vision, the primary focus being the study and development of scalable technology for acquiring, creating, distributing and exploring massive models, as well as for integrating them in real-time interactive visual simulations and virtual environments, both in local and distributed settings. Recent research achievements include novel solutions for: effectively combining acquired colorimetric and geometric information; rendering and streaming terrains and urban environments; processing, distributing, and rendering massive 3D meshes and point clouds; compression-domain rendering of massive scalar volumes; visualization of massive data on remote, web, and mobile devices; interactive surface and volume visualization on novel light field displays.

2. Staff

The main research lab is complemented by a technology transfer lab dedicated to 3D digitization/data presentation for cultural heritage. Current members are the following:

Enrico Gobbetti	Director
Katia Brigaglia	Adm. Assistant (part-time)
Cinzia Sardu	Adm. Assistant (part-time)
Fabio Marton	Senior Researcher
Marco Agus	Researcher
Ruggero Pintus	Researcher
Fabio Bettio	Senior Engineer
Antonio Zorcolo	Engineer
Giovanni Pintore	Engineer
Marcos Balsa Rodriguez	ESR/ITN Fellow
Alberto Jaspe Villanueva	ESR/ITN Fellow
Roberto Combet	Technical Staff, 3D scanning
Emilio Merella	Technical Staff, 3D scanning
Alex Tinti	Technical Staff, 3D scanning

3. Facilities

Rooms and locations. CRS4 is located in building 1 of the POLARIS Science and Technology Park, about 40Km West of Cagliari, Sardinia, Italy.

Equipments and platforms. The group has advanced facilities, many of them acquired and supported through extramural funds, that are used for research and technology transfer activities. Dedicated computational and network resources, which include high speed networks and hybrid GPU/CPU clusters, are complemented by state-of-the-art user interaction and visualization hardware. Acquisition devices include PHANToM force feedback arms, custom camera arrays, long-, medium-, and short-range scanners, as well as commercial and custom-made 3D trackers used for developing interactive 3D applications. The range of available display devices goes from 3D printers, to high resolution visualization walls and experimental light-field displays delivering fully 3D interactive images to multiple naked-eye observers.

4. Collaborations

Funding. CRS4 is a public research organization supported by the regional government. In addition, the activities of the Visual Computing group at CRS4 are heavily supported through extramural funding. Since its establishment in 1996, the group secured about 8M € of external funding. Of these, in excess of 4M € are from international grants (mostly EU projects), about 800K € from industrial collaborations (mostly from technology transfer activities related to terrain rendering, surgical simulation, and point cloud management), while the rest are from national or regional grants.

Important recent industrial partners. Many of the enabling technologies developed by the group have been used in as diverse real-world applications as cultural heritage computing, Internet geoviewing, visual simulations, scientific data analysis, and surgical training. Stable industrial partners include Holografika (Hungary), Diginext (France), Gexcel (Italy). Technology transfer activites also target the public sector (Italian regional geoviewing system, cultural heritage applications).

Important recent academic partners. Many of the research activities are carried out in the framework of international collaborations. Current academic partners include ISTI-CNR, U. Zurich, U. Rostock, Chalmers U., Johns Hopkins Applied Physics Labs. In addition, the group's members are active in the Eurographics community (current EG Italian Chapter EXC members, organization and chairing of EG 2012, EGPGV 2012, EGPGV 2013).

5. Projects

Right now, it's only a notion. But I think I can get money to make it into a concept. And later turn it into an idea. (Woody Allen, Annie Hall, 1977).

Well, we even get funding to implement our ideas... Currently active externally funded projects are the following:

- *MONTEPRAMA1: 3D digitization of the Mont'e Prama statues.* Funded by MIBAC/ArcheoCAOR. (Start: 2012/07, duration: 9 months). Geometric and colorimetric acquisition and surface reconstruction. Application to the Mont'e Prama statues complex.
- *DIVA: Data Intensive Visualization and Analysis.* Funded by EU Seventh Framework Program under grant 290277 (start 2011/09, duration: 48 months). European doctoral collegium for training the next generation of visualization scientists.
- *INDIGO: Innovative Training and Decision Support for Emergency Operations.* Funded by EU Seventh Framework Program under grant 242341. (Start: 2010/05, duration: 36 months).
- *GEXCEL-MPCMV: Massive Point Cloud Management and Visualization.* Funded by Gexcel on an industrial grant (start 2011/03). Study and development of technology for coloring massive point clouds from photographic data.
- *RATMAN-RER3D: Rapidly Adaptive Terrain Models Available on the Net: Reuse.* Funded by SardegnaIT under grant D. Lgs. 82/05. Technology transfer project – open source solution for terrain rendering based on the BDAM framework.

6. Future of the lab

Prediction is very difficult, especially about the future (Niels Bohr et al.), even though it's easy to guess that *in the long run we are all dead* (John Maynard Keynes). In the meantime, we'll work on enabling technologies for creating and exploring massive datasets. The major focus will be on spatial data and data embedded in 3D space, which have a strong impact in a wide range of application domains.

7. Selected recent publications

Our research is widely published in major journals and conferences. Five selected recent publications (2012-2013) are listed as references.

References

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