Computer Graphics and Vision Labs in Argentina

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ABSTRACT

This article describes the Computer Graphics and Vision research that are being developed by three universities' laboratories in Argentina: III-LIDI Institute of Computing Research at National University of La Plata, VyGLab Visualization and Computer Graphics Laboratory at South National University, and CGLab Computer Graphics Laboratory at National University of San Luis.

Keywords

Computer Graphics, Computer Vision, Argentina

1. III LIDI INSTITUTE OF COMPUTING RESEARCH

The III-LIDI Institute of Computing Research[i] belongs to the Informatic Faculty at National University of La Plata – *Universidad Nacional de La Plata (UNLP)* (Figure 1).

Figure 1. Informatic Faculty at UNLP (Argentina)

Current research topics include the design and implementation of virtual and augmented reality, and

interactive TV educational applications. Besides there is a great effort in human resource training so the group works in consolidating a posgraduate carreer in Image Processing, Computer Graphics and Vision.

Augmented Reality in Education

There are educational opportunities for Augmented Reality (AR) and Geolocation to enrich Teaching and Learning. One of the goals of the group is to study the incorporation of this technology in educational contexts of different educational levels, from kindergarten to university. The design of educational applications focusing on active learning involves the creation of scenarios to explore and interact with their real environment related with their interests and situations related to real life. Also it is needed to develop tools that allow teachers to use new technologies.

Virtual Reality in Education

One of the main applications of Virtual Reality (VR) are simulators, which provide the user with a realistic experience in the management of vehicles or machinery. Ship simulator was developed for educational and community outreach purposes. The virtual reality equipment consists in three LED TVs at an angle of 120 ° between adjacent screens, and

virtual reality glasses with tracking. Its main characteristic is the low-cost and its portability. This allows to move the equipment to sciences exhibitions which are visited by students and general public (Figure 2).

Figure 2. Ship simulator in a science exhibition

The group is also focused in the design and implementation of multi-resolution visualization of 3D terrain to improve realism taking advantage of the processing capabilities of the GPU and memory constantly growing.

Interactive Television

The group coordines the "RedAUTI Thematic Nework in Applications and Usability of Interactive Digital Television (IDTV)" - *ReAUTI Red de Aplicaciones y Usabilidad de la Televisión Digital Interactiva[ii]*- which is conformed of 39 iberoamerican research and development groups from Spain, Portugal and ten latinoamerican countries (Figure 3). The main goal is the design and implementation of applications, services and content production for IDTV, in its multiple platforms , open source to solve problems of the Latin American context.

Figure 3. Participants of RedAUTI Thematic Network in Applications and Usability of IDTV

Postgraduate Teaching

The Informatic Faculty creates in 2012 a new postgraduate carreer called "Specialization in Computer Graphics, Images and Computer Vision" with the aim of strengthen human resources in this areas. This carrer can be taken as the main step for a Phd student to route thesis work in this direction. The The teachers are both from domestic and also foreign universities.

2. VyGLab VISUALIZATION AND COMPUTER GRAPHICS LABORATORY

The Visualization and Computer Graphics Laboratory (VyGLab)[iii] belongs to the Computer Science and Engineering Department at South National University – *Universidad Nacional del Sur (UNS)* (Figure 4).

Figure 4. VyGLab at UNS (Argentina)

This group performs core and applied research in visualization and computer graphics. The main areas of expertise are volume modeling, augmented reality and visualization. Current research topics include volume modeling with wavelets, augmented reality books, outdoors augmented reality, semantic based visualization and information visualization.

Volume modeling

The group is working on the definition of wavelets over non nested tetrahedral grids, allowing the representation of functions defined on the irregular tetrahedrization of a volume. In this way, it is possible to represent different attributes of the volume object and its interior such as color, brightness, density, etc.

Outdoors Augmented Reality

The group is working on visualization of geological information in the field by means of tablets PC. This allows geologists to visualize existing geological data sets superimposed to the ground terrain as though they were part of the environment and to explore various above and under-ground phenomena associated with these datasets. This is a new

application area with strong potential for a wide spectrum of applications.

Augmented Reality Books

The group have developed an interactive and collaborative system for traditional books augmentation that allows the addition of AR content to any pre-existent traditional book (Figure 5). It is working on interactions with the book and it is experimenting with users to validate the proposals.
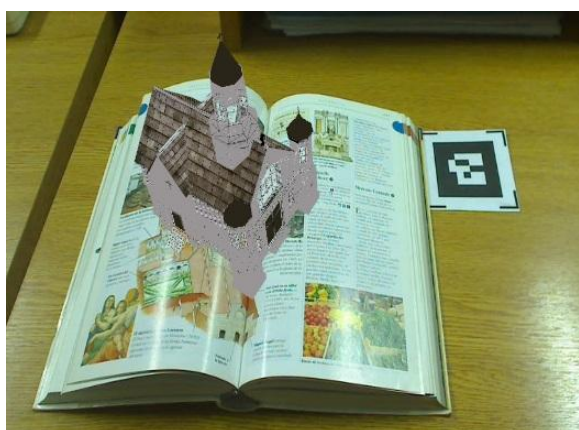

Figure 5. Augmented Reality Books

Semantic Based Visualization

Taking into account that data visualization process is a very complex exploration activity and, even for skilled users, the group is working on *semantic based visualization* in order to figure out how to assist users and designers throughout the stages of the visualization process. At this time our goal is to obtain a formal representation of the visualization field to establish a common visualization vocabulary, including the underlying semantics, and enable the definition of visualization specifications that can be executed by a visualization engine with ontological support.

Large Data Visualization

Related to *Information visualization* we are mainly dedicated to multidimensional visualization of large volume of data sets originating from the natural sciences, and in particular from the Geological Sciences (Figures 6-a and 6-b). This poses serious challenges with regard to analysis and interpretation without visual support. Visualization contributes significantly to the exploration and understanding of the meaning of these datasets; currently we are mainly dedicated to the visualization of mineral compositions and to the automatic visual analysis of geological samples by point counting.
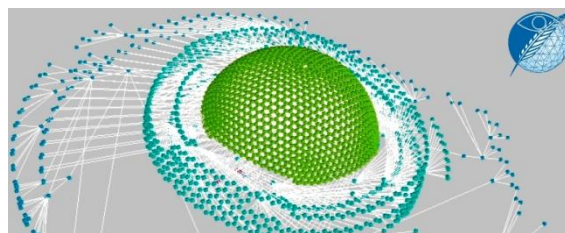
a)
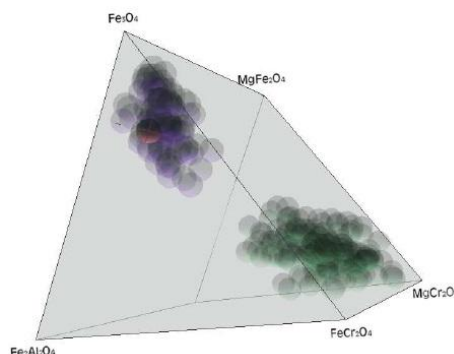
b)

Figure 6. Information Visualization

Computer Graphics and Visualization Teaching

In addition to the research activities the members of the group dedicate to computer graphics and visualization teaching. The teaching program includes several undergraduate courses: a required course in Computer Graphics included in the Computer Engineering Curricula and optional courses on Advanced Computer Graphics, Real Time Rendering, Information Visualization and Big Data Visualization that can be taken by students from different degree programs. It also includes advanced postgraduate courses in the same subject. These courses are included in the postgraduate curricula offered in several Universities across the country.

3. CGlab COMPUTER GRAPHICS LABORATORY

The Computer Graphics Laboratory (CGlab) is a research and development group at National University of San Luis – *Universidad Nacional de San Luis (UNSL)* (Figure 7). All researchers work in the Informatic Department corresponding to the Physics, Mathematics and Nature Sciences Faculty.

The former group started computer graphics research in 2001 with the study of Non-photorealistic Computer Graphics applications by image processing techniques. Through the years basic tools have been enlarged to include powerful computer graphics theory concepts and techniques. Later in 2012 the group was formally constituted.

Figure 7. National University of San Luis (Argentina)

CGlab's research lines are: Non-photorealism, Virtual Reality, Real Life Simulation, Video games, Training. Most representative projects are *ReTTrAc*, *CAVE-Vox* and *Be Civic*.

Real Time Traffic Accidents Simulation

ReTTrAc, acronym of *Real Time Traffic Accidents*, is part of the project called Alfa III GAVIOTA financed by the European Community Programme[iv]. It has brought together European and Latin American Computer Graphics, Engineering and Architecture research groups. The developed work is a general Virtual Reality computing platform that enables real time visualization of 3D scenarios for manufacturing, training and forensic simulations. The platform is able to treat static and dynamic 3D environments, allowing to share the experience of navigation in the scene among the users, even geographically distributed. The platform proposed was validated through real time 3D models manipulations and interaction in simulated car crashes.

Conversational Agents

CAVE-Vox is a conversational character as a question-answering assistant for task-generic applications into a Cave-like environment (Figures 8-9). This work develops software to design a virtual character and provides it with verbal skills interaction and locomotion. The proposed virtual character is based on open-source components and runs entirely into a Cave-like environment. The system design was validated by conducting human tests to measure the real time, realism, interaction ability and technical brilliance of conversation.

Figure 8. Cave environment at CGLAb UNSL

Figure 9. Virtual reality application running in a cave environment at CGLAb UNSL

Serious games

Be Civic project uses a serious game in a immersive learning environment for teaching civics. In order to improve the user's experience the game was developed to work in a cave-like immersive environment, using a conversational character for interaction. The game includes static and dynamic 3D environments, allowing to share the experience of navigation in the scene among the users, even geographically distributed.

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[i] III-LIDI http://weblidi.info.unlp.edu.ar

[ii] RedAUTI http://redauti.net

[iii] VyGLab http://vyglab.cs.uns.edu.ar

[iv] ALFA GAVIOTA http://www.alfagaviota.eu