

DCGI Laboratories at CTU Prague

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Abstract

The Department of Computer Graphics and Interaction (DCGI) covers education and research activities in Computer Graphics and Human-Computer Interaction areas at the Czech Technical University in Prague (CTU). This paper presents the staff, laboratories, projects, and selected scientific achievements of the DCGI.

1. Introduction

The Department of Computer Graphics and Interaction (DCGI) was founded in 2008. One of the most important impacts leading to establishing DCGI was the organization of the Eurographics 2007 conference in Prague. This event was managed by members of the Computer Graphics Group (CGG), a predecessor of DCGI. The new Department has then brought the CGG group together with HCI oriented experts and artistic activities concentrated around the Institute of Intermedia (IIM).

The following areas of expertise are currently covered by DCGI members:

- Realistic image synthesis. Analysis, representation, and rendering of complex 3D scenes. Simulation and rendering of natural phenomena. Virtual and augmented reality. Algorithms for cartoon animation.
- Multimodal user interfaces (visual, audio, haptic, gestures). Special user interfaces (mobile, industrial, iDTV). Accessibility (blind people, elderly people).
- Virtual and mixed realities, multimedia, net art, interactive installations, electronic and generative music synthesis, motion-capture and distributed sensing.

2. Staff

The key persons are listed in alphanumerical order according to their specialization:

Computer Graphics: Roman Berka, Jiří Bittner, Ladislav Čmolík, Petr Felkel, Vlastimil Havran, Jaroslav Sloup, Lucie Svobodová, Daniel Sýkora, Jiří Žára,

Human-Computer Interaction: Ivo Malý, Zdeněk Míkovec, Pavel Slavík, Adam Sporka.

The DCGI has 10 PhD students, 2 postdoctoral fellows, 4 engineers, and 4 administrative staff. The overall number of employees including several external collaborators is 40.

3. Facilities and Laboratories

The DCGI is located in Building E of the CTU campus at Karlovo nám. 13, Praha 2, 121 35, Czech Republic. In addition to regular office rooms, one PC classroom and one consulting room belongs to the DCGI. All common computing platforms are used for research and education purposes.

The research is performed around three laboratories. The first two are placed directly within the DCGI area, the last one is located at different part of Prague (Dejvice) due to its special requirements on space, acoustics and lighting.

VRLAB – Virtual Reality Lab. The VRLab is the main lab of the computer graphics group at DCGI. It serves for experiments in virtual and augmented reality as well as for tests of advanced rendering and interaction techniques. It is equipped with a stereoscopic projection wall, a tracking system, and two types of augmented reality setups.

ULAB – Usability Lab. The lab has been established in 2004 in cooperation with Sun Microsystems. It was the very first professionally equipped usability lab in the country, consisting of one test room and one observation room. As the CTU students traditionally participate during their study in research projects, the lab is intensively used both for research and education in the area of usability testing and user interface design.

IIM – Institute of Intermedia. The Institute has been established in 2007 as a cooperative platform of three Prague universities: CTU, Academy of Performing Arts, and Academy of Arts, Architecture and Design. The goal of the IIM is to create a common platform for students of art and technical disciplines, scientists and freelance artists to cooperate on common projects and experiments. The activities of IIM cover the fields of virtual reality, multimedia, stereoscopy, light design, and audio-visual performances. The Institute is equipped with CAVE VR system (5 screens), a highly flexible large stage with professional lighting and acoustic subsystems, green screen for experiments, and a number of technologies for motion capturing (see www.iim.cz).

4. Projects and Publications

DCGI participates in a number of EU and national projects. The following list represents a selection of the most interesting currently running ones.

ARGIE. The goal of the ARGIE project (Global Illumination for Augmented Reality in General Environments) is computing realistic images mixing a real scene with virtual objects while using only a very limited amount of a priori information about the real scene. The project aims at designing methods and algorithms for computing different global illumination components in augmented reality including illumination effects like shadows, diffuse, glossy and specular reflections and caustics [BMSW11], [HH11].

OPALIS. The goal of the OPALIS project (Optimal Algorithms for Image Synthesis) is the design of new methods for analysis and description of the computational complexity of realistic image synthesis. We aim at describing the essence of the light transport using a characterization of the representative light paths and designing new class of adaptive progressive rendering algorithms that will exploit importance sampling in path space and depending on their setting they will be applicable for both realistic rendering as well as real-time rendering. The first results were published in [VHS12].

VERITAS. The VERITAS project funded by the 7th FP EU programme aims to develop, validate and assess tools for built-in accessibility support at all stages of product development, including specification, design, development and testing. The goal is to introduce simulation based and virtual reality testing at all stages of assistive technologies product design and development into various applications that handicapped users can use [PMSS11]. For more information see veritas-project.eu.

V3C – Visual Computing Competence Center. We are proud to become one of the Competence Centers funded by the Technology Agency of the Czech Republic. V3C is a long-term project (8 years) which started in the mid of 2012. It aims to accelerate a transfer of research results from universities to industrial applications. The V3C research and

development concentrate on automobile and movie industry. It combines computer graphics, image processing, and user interfaces in order to develop efficient, complex, and user-friendly applications on various computing platforms. Thanks to this project, the DCGI has joined its activities with another important research group – CMP (Center for Machine Perception) at CTU Prague.

ToonPaint. The aim of this recently and successfully finished project supported by the EU Marie Curie program in 2010-2012 was to develop practically usable tools that will make the traditional cartoon animation production pipeline less tedious and more cost effective. In addition, a new enhancement technique to increase visual richness of resulting imagery while keeping the look of hand-drawn animation was developed. The project has been considered by EU commission as outstanding. The most important outputs are presented in [SBCv*11] and [JSH12].

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