Digital pipeline for mixed reality content at the RVM research team

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1 INTRODUCTION

The ICT research lab (CReSTIC) brings together more than one hundred researchers, including thirty PhD students. The RVM research team of the CReSTIC lab brings innovation in content creation, manipulation, and delivery. With its height academic researchers, the team works in bringing together different types of data and information in order to construct a rich **visual media.** The research builds on visual technology equipment (multiview camera systems, autosteroscopic displays, HDR displays, depth/motion sensors, VR technology) as well as high-performance computing equipment (supercomputers, SMP hybrid computers, clusters, hybrid computers, embedded computing chips). It participates in the definition of its characteristics through proof-of-concept development and demonstration of increased quality of experience**.** We develop here projects and objectives that are linked to the ISMAR conference topics.

2 RESEARCH AREAS

2.1 Capturing reality: Multi-video, HDR acquisition for 3D reconstruction and 3D display

Reality capture is addressed as a whole, considering both capture system and data processing. An originality of the team's work is to systematically aim at hybrid designs and purposes.

High-quality 3D display of video-based content is difficult to achieve with current state of the art showing remaining artefacts (ghosting, flickering, wrong allocated depth) and user discomfort. The RVM research searches solutions for adaptive acquisition and display technology to scene constraints and content as well as to usage properties. The advantage of considering acquisition together with 3D reconstruction is to be able to think of the capture system as a whole thus working on the concept of the acquisition methodology together with reconstruction algorithms. This recent direction taken by team members has proven to bring increased precision and robustness [1][4].

Research in high-dynamic range (HDR) imaging and depth imaging has long been conducted separately. Innovation from RVM team comes by enhancing colored pixels with depth and HDR information. Difficulty resides in that both need input of different nature [2][3].

Sought positions: (1) The RVM team is currently looking for a postdoc candidate to work on a newly funded national project (ANR ReVeRY). (2) Another research engineer position will be soon open to develop a multiview camera system. This is a transfer-to-industry funding.

2.2 Content enrichment, coding and interpretation:

Solutions are sought for the manipulation and innovative use of combined 3D/HDR/time variant content.

2.2.1 Computer-graphics animated models

From-reality 3D reconstructed data is often sparse and difficult-to-integrate in 3D dedicated software. New algorithms are to be set in order to organize 3D reconstructed data into spatio-time coherent models. While advances have been recently made to initiate usable from-reality captured models [5], robustness over content complexity and long action sequence remain a challenge. _Sought position: the RVM team in collaboration with the company XD Productions is currently looking for a PhD candidate to work on 3D modeling actor performance._

2.2.2 Realistic reflectance modeling, relighting and lighting compositing

Illumination compositing is an important visual component when considering realistically mixing synthetic and real content. Success is often linked to access of redundant and numerous scene data. **RVM** investigates algorithms that will choose the minimal level of input data in order to propose illumination decomposition of images. We currently investigate on facilitating illumination maps usage.

2.3 High-performance visualization

Modern acquisition devices generate ultra-high resolution data, that are very memory consuming and consequently cannot be directly visualized. RVM investigates new out-of-core methods to support these massive data in HPC context [6].

Virtual reality progressively becomes a standard part of the industrial workflow by allowing manufacturers to perform project review and assessment, while decreasing the need of expensive physical mockups. RVM looks for solutions to bring realism and interactivity for a reliable experience. RVM investigates light transport simulation using physically based methods in massively parallel environments. This work is supported by a national FUI project 3D Neurosecure and a collaborative project with PSA.

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