

3D video technologies and services

Béatrice Pesquet-Popescu · Frédéric Dufaux ·
Touradj Ebrahimi · Shipeng Li

Published online: 19 October 2013
© Institut Mines-Télécom and Springer-Verlag France 2013

Three-dimensional (3D) video is largely perceived as the next major innovation in the domain of digital video. 3D video offers the perspective of a greatly enhanced quality of experience for the end user.

The underlying principles of stereopsis have been known for a long time, Hollywood experiencing a first short-lived golden era of 3D movies in the 1950s. In the last 10 years, 3D has regained significant interests, and 3D movies are becoming ubiquitous. Numerous major productions are now released in 3D, culminating with “Avatar,” the highest grossing film of all time. In parallel with the recent growth of 3D movies, 3DTV is attracting significant interests from manufactures and service providers, with an obvious multiplication of new 3D product announcements and services.

Nevertheless, in order to fulfill its promises, several technological challenges need to be addressed, going from content acquisition, to efficient representations, coding, transmission, display technologies, and applications.

3D video is targeting several domains encompassing 3DTV, digital cinema, immersive video conferencing, gaming, mobile, consumer electronics, defense and security, telemedicine, and industrial applications.

This special issue presents new technologies, solutions, and services for 3D video.

A first topic, concerning the 3D video content acquisition, is illustrated by the paper “Camera array image rectification and calibration for stereoscopic and autostereoscopic displays,” by

Vincent Nozick. Here, a nonlinear method is proposed for image rectification and also robust camera calibration for an arbitrary number of views with possibly different resolutions. In this case, the epipolar geometry is shown not to be sufficient for solving the problem.

Among the most explored topics in the last years are the efficient representations for 3D scenes, encompassing depth map representations. An interesting perspective is given in the paper “Edge-preserving interpolation of depth data exploiting color information,” by Valeria Garro, Carlo Dal Mutto, Pietro Zanuttigh, and Guido M. Cortelazzo, where the low resolution depth information from a time-of-flight camera is interpolated using the information from the standard color camera. Moreover, effective solutions are provided for critical issues such as the joint calibration between the two devices and the unreliability of the acquired data.

Coding and formats for 3D video and bitstream transmission are essential problems that need to be solved for the rapid adoption of these technologies by the industry. The paper “A study of depth/texture bit-rate allocation in Multi-View Video plus Depth compression,” by Emilie Bosc, Fabien Racapé, Vincent Jantet, Paul Riou, Muriel Pressigout, and Luce Morin investigates the rate allocation between depth and texture data, in particular, which are the elements impacting on the best bit-rate ratio between depth and color: total bit-rate budget, input data features, encoding strategy, and assessed view. In the same domain, the paper “Rate-Distortion Analysis of Multi-view Coding in a DIBR Framework,” by Boshra Rajaei, Thomas Maugey, Hamid-Reza Pourreza, and Pascal Frossard presents a new model for rate allocation at the encoder, taking into account both texture and depth information and preserving the main features of these images.

A tough issue in 3D video is the subjective and objective visual quality assessment, including human perception. A review of some important aspects for 3D services acceptance is done in the paper “How visual fatigue and discomfort

B. Pesquet-Popescu (✉) · F. Dufaux
Télécom ParisTech-LTCI/CNRS, Paris, France
e-mail: beatrice.pesquet-popescu@telecom-paristech.fr

T. Ebrahimi
EPFL, Lausanne, Switzerland

S. Li
Microsoft Research Asia, Beijing, China

impact 3D-TV Quality of Experience: a comprehensive review of technological, psychophysical and psychological factors,” by Matthieu Urvoy, Marcus Barkowsky, and Patrick Le Callet. It is discussed how, in 3D displays, the ocular and cognitive conflicts with real-world experience may cause fatigue and discomfort; these includes the accommodation—vergence conflict, the inadequacy between presented stimuli and observers depth of focus, and the cognitive integration of conflicting depth cues. This understanding provides guidance for the design of future 3D services and appliances.

Some artistic aspects of 3D experience are considered in the paper by Julien Maillard, Marc Leny, and H el ene Diakhat e “Enhancing the audience experience during sport events: Real-time processing of multiple stereoscopic cameras.” This paper presents a complete architecture realized during the SkyMedia project for the acquisition, calibration, disparity estimation, encoding, and finally the real-time transmission of the 3D streams from a running event in Turin, in 2012.

The security aspects for 3D video content are illustrated in the paper “Stereoscopic video watermarking: a comparative study,” by Afef Chammem, Mihai Mitrea, and Fran oise Pr eteux. It provides a comparative study of the main classes of 2D watermarking methods (spread spectrum, side information, hybrid) and of their related optimal stereoscopic insertion domains (view or disparity based). The comparison is done in terms of transparency, robustness, and computational cost. Here again, the perceptually relevant quality assessment is central, several subjective protocols and objective quality metrics being employed.

We would like to thank reviewers of the papers in this special issue whose help was essential for such a collection of high-quality contributions, and authors for considering submitting their work to this issue and their efforts and hard work during the preparation and revisions of the manuscript. Special thanks go to the staff of *Annals of Telecommunications* for their help and support from the beginning to the end.