

Eric Joris presentation at CVMP10

The presentation at CVMP10 in London last November really was stunning and had a great impact on audience, industry and academic alike. It was commented as "at the same time scholarly, theatrical, creative and thought provoking"



Picture by Tom Evans

The 3D audio technology reaches the theatres

The company **Immsound**, using Barcelona Media technology derived from research done in the 20203D Media project, is providing high quality 3D audio upmixing to theatres.



The first installations are at the cinema complex "Full HD" near Barcelona and in the Araujo Cinemas in Maringa, Brazil.



Multicamera system for super high resolution video that uses technology by Univ. of Hasselt

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New notions of spectatorship, presence and empathy

By **Eric Martrou** and **Kurt Vanhoutte**

Immersive and depth enabled cinematography is an answer to an old wish to evoke an immediate or authentic experience beyond the limits of representation: the wish for an (cinematographic) image in three dimensions. Due to the fast development of digital technology, this wish for an immediate experience seems to reach a point of culmination. 2020 3D Media aims at the production of networked technologies for the capture, production and display of sounds and images in three dimensions. By putting the spectator at the heart of the experience, it wants to create a heightened sense of presence, evoking the sensory experience of being submerged in the creative imagery.

This focus on the spatial characteristics of the image (threedimensionality) as well as on the interactive possibilities assumes new paths to the context of dramatic action. The prospect of interactive cinema makes the world beyond the frame accessible for the viewer who is transported to the inside of the image. The story world coincides with the physical and emotional space of the viewer / immersant. As a result of this altered disposition, interactive stereoscopic and immersive media require novel approaches of content creation.

Established cinematographic rules do not always apply. As the spectator gets more freedom of view direction and in future also view location, for instance, the movie maker loses control of what the spectator is going to see, and thus loses grip on the rhythm and associations (s)he wants the spectator to make. Interaction with and challenging of the spectator is the key to success. Unlike 3D computer

games, however, film-based media offer limited possibilities to pre-scripting animation in response to user interaction.

Research into changing conditions of narrativity and new notions of spectatorship, interactivity and empathy in immersive media, will give a better understanding how to create interesting content using immersive media.

A combined research approach of the two main axis of the project (immersion and depth enabled cinematography) is what we propose. In a parallel research the audience response and image strategies of depth and immersive cinematography will be investigated successively but with similar research questions as points of departure. The parallel organisation of this research allows comparing and differentiating both environments. This practice-based investigation aims at the setup of one environment that demonstrates and compares the best practices of both immersion and depth enabled cinema. The level of integration of both in one and the same test bed still needs to be decided and will largely depend on the degree in which an integrated and/or hybrid environment enables the partners to evaluate the technologies under field trial conditions.

(Complete report available on the website: **Spectator response factors, production, workflow and technology**)

DIGITAL PROJECTION AT ISE SHOW 2011, AMSTERDAM

Digital Projection Ltd. delivered a scintillating AV display at this year's ISE expo in Amsterdam. Displaying new single and 3-chip displays from an expanding product line, DPL demonstrated the flexibility of key DP products by presenting some in portrait mode and others in more traditional horizontal format. DPL also unveiled new single and 3-chip products to their international market, including the M-Vision Cine 3D and HIGHlite Cine 660.



Digital Projection used their Fusion 3D processor to seamlessly warp and blend each individual projector together. The dome feature was a stunningly realistic, immersive, and interactive experience for all which certainly created a buzz around the exhibition.

Stacking Projectors for Passive 3D

At first thought, the idea of utilizing two projectors to generate a 3D image seems like a very logical approach. After all, standard 60Hz projectors can be employed, on screen brightness is doubled and the application automatically benefits from redundancy for 2D applications. The dual projector 3D design, however, is very complex and creates numerous hazards in terms of installation flexibility and

Read the complete report at <http://digitalprojection.squarespace.com/journal>



Picture by Eric Joris

Currently commercially available omnidirectional cameras, such as from Point Grey, immersivemedia, Mycoy, Viewplus, fullview, and so on, are closed systems not easily incorporated into own software developments, are not compact, are not adaptable for media purposes, use expensive custom processing hardware, do not allow video-rate streaming, or are not full surround. For these reasons, it was decided to develop an appropriate omnidirectional camera system, or better: tools and methodology of constructing such camera system, within the 2020 3D media project. These developments are useful on their own, and important in order to feed the creation of post production tools, and later also the display system for surround video.

In the full version of the document, available at the project website, we report on our activities during the first project year. We have developed a prototype 4-megapixel omnidirectional camera system (shown in the figure below) and 1) a codec that allows real-time recording of the surround footage on commodity CPUs and internal laptop hard disks, 2) a calibration methodology and tools for the developed omnidirectional camera, 3) a real-time high quality Bayer demosaicker, and 4) real-time improved stitching algorithms. The following sections present each of these

Surround video polycamera system

**Report about the developments
by Philippe Bekaert,
University of Hasselt**

developments in turn. All algorithms run in real-time, which is important for interactive applications to be developed in further 2020 3D media research.

Compression for mobile surround video capture

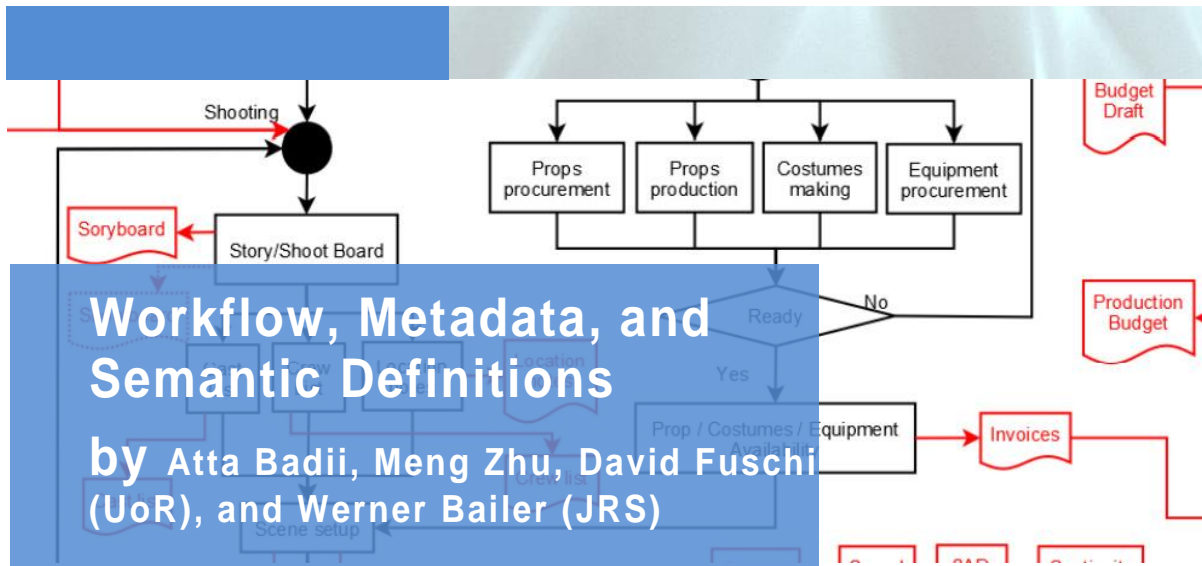
Surround video typically needs to be recorded at much higher resolution than regular film or video, as only a small fraction of the full sphere is being viewed at any time but the target screen resolution is fixed. A first prototype camera has been built, with a total resolution of four megapixels (figure 1). This is sufficient for a typical 3-SVGA projector surround video projection system. In practice, higher resolutions may be desirable. For this reason, the developed algorithms are designed to scale with resolution: their time complexity is log-linear, or better.

A first problem we encountered was that recording such high resolution footage requires either a hard disk array, or a powerful heavy server computer if currently available codecs are used for compression. While developing ad hoc compression and storage hardware would solve the problem and definitely would be useful, it would delay dependant research in the project.

(Complete report available on the website: [Surround video polycamera system](#))



Image by Philippe Bekaert



Workflow, Metadata, and Semantic Definitions

by Atta Badii, Meng Zhu, David Fuschi (UoR), and Werner Bailer (JRS)

The process that brings, a documentary, a commercial production or any other form of artistically rich content from an idea to the actual production and distribution of a feature film is a very complex and lengthy one. The number of actors involved, steps, inputs, outputs etc. is huge and it would be no surprise to find some of them to be missing when trying to list them all.

Additionally there is a significant shift in stages, performed actions and outcomes within the same process depending on the genre, the director, the producer and the adopted distribution channel(s). We have therefore tried to focus on the most stereotypical flow taking into account the most common actors, stages, steps and actions while remaining open to extensions and additions that may occur at present or in future. In any event as the project focuses on the development of tools and technologies that could be profitably applied in production, postproduction and distribution, our reference and implementation scenarios will be bound to these aspects notwithstanding that the other components of the flow have been analysed and their needs taken into account in the design of the proposed solution.

We have reported very schematically the entire flow with its major actions and involved actors. the process has been reported in a table where activities performed in parallel or starting in strict sequence but evolving mostly in parallel are

reported in parallel columns (where the last holds the most significant actors involved). Each line in the table corresponds to an operation that cannot evolve unless those of the previous line have been completed. The only exception to this policy has been applied to rights as they are dealt with throughout the entire process from its very beginning to its very end. For simplicity in this table we have simplified the stage that leads to the start of a production while retaining its main steps, similarly we have only mentioned the marketing phase and the distribution to emphasise the preproduction, production and postproduction phases. Such a choice has been motivated by the following considerations:

- (i) Unless pre-production is completed, it would be impossible to produce anything except some technical exercise or proof of concept.
- (ii) Unless production is progressing, it would be impossible to have anything to process, post-produce, pack, distribute and show.
- (iii) Unless post-production is completed, it would be impossible to have anything to pack, distribute and show.

(Complete report available on the website: **Workflow, Metadata, and Semantic Definitions Report**)

Dimension-3D format converter by Doremi

The versatility of Dimension 3D makes it suitable to fit into virtually all stereoscopic workflows:

- Allows for any 3D input stream format to be used with all types of display components currently available, including high end projectors and the latest generation of 3D ready LCD displays.
- Converts stereoscopic camera rig output to recorders and displays.
- Enables double stack 3D projection.
- By encoding the left and right eye streams into a single HDSI stream and back again the unit becomes ideal for recording 3D content on standard HD tape and server technologies.
- When coupled with Doremi's Nugget or V1 servers, a very cost effective 3D payout solution is provided especially in conjunction with the powerful Doremi Asset Management software commented.



A two line LCD display and function knob together simplify navigation through the Dimension-3D's menus. A USB connection for remote operation and an infrared remote control are also provided. Firmware can be upgraded via a SD card or via USB.

m3Di initiative

m3Di is proposing a standard for 3D metadata communication in order to make interoperable lenses, cameras, rigs and stereoscopic image processors used in 3D productions, in a way that all the products accomplishing that standard, would allow final customers to replace any item of the production chain with no major impact in the 3D workflow, giving freedom of choice and ensuring interoperability.

More information: <http://www.m3di.org>

Available for download from www.20203dmedia.eu

"Spectator response factors, production, workflow and technology requirements for stereoscopic and immersive video" by Eric Martrou, Mediapro and Kurt Vanhoutte, CREW

"Surround video polycamera system" By Philippe Bekaert, Hasselt University

Workflow, Metadata, and Semantic Definitions Report" by Atta Badii, Meng Zhu, David Fuschi (UoR), and Werner Bailer (JRS)

"Multi-label depth estimation for graph cuts stereo problems" by Nicolas Papadakis and Vicent Caselles

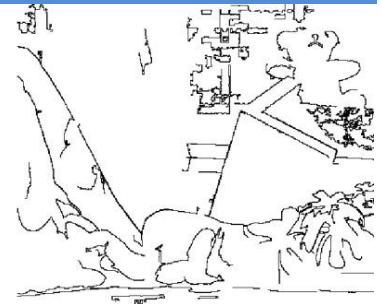


At the resources area of the website for public download.



Multi-label depth estimation for graph cuts stereo problems

Research paper by Nicolas Papadakis and Vicent Caselles



Extraction of the significant level lines of the image: An input image (left) is shifted to grey value (centre). Applying, the significant level lines of the grey level image are extracted to give a map of contours (right)

Depth estimation is a highly studied problem in computer vision. Applications such as stereomovies, 3D reconstruction or novel view synthesis are indeed all based on the same basic ingredient: Finding the depth of a scene seen from several cameras. All the methods giving good results on this problem and developed within the past 10 years and not be described here, as it would require half a book. Let us only underline that the approaches giving the more accurate results are often based on graph cuts and belief propagation minimizations, according to Middlebury database. In this work, we are interested in the seminal works on graph cut algorithm by Boykov, Kolmogorov et. al. in a series of papers. More precisely, in the application of graphic cuts to the depth estimation problem as presented in the last three papers.

Our approach can be considered as a combination of the ideas of with a slightly different energy presentation. We believe that the description of the energy models relative to stereo problems that can be found in the graph cuts literature presents some lacks of details that makes its implementation harder. Introducing an energy function that models the problem of depth estimation from a set of images in the more general way, we explain how the graph representability of the involved energies determines the occlusion management, and finally we recover the energy of as a specific case. In this paper we give a presentation of the problem which is well suited to fill-in all details of the graph construction.

The proposed energy is based on a multi-label formulation of plane sweeping. It contains four terms: a photo-consistency matching cost for

couples of corresponding pixels in pairs of images, a penalty on the colluded regions, a visibility constraint term and a regularization term. As usually in graph cut approaches, we use a regularization term based on the Potts model combined with a contours mask. When considering the actual best techniques dedicated to disparity estimation, it appears that most of them are strongly dependent on a previous segmentation of the images. We believe that segmentations may be difficult to control in real images and they do not always provide the results that one would like. For this reason we choose a contours mask, which is easier to control, especially if contours are computed as significant edges. This information can be easily added to the regularization term of the energy.

The use of hierarchical systems for warping techniques to obtain accurate estimations is a common technique in the variation (and partial differential equation) approaches to optimal computation or stereo, where perturbations around the current solution permit to obtain faster and more accurate solutions, but it has not been adapted to the graph cuts context.

(Complete paper available on the website: **Multi-label depth estimation for graph cuts stereo problems**)

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