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MUSCADE Focus

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Special points of interest:

- MUSCADE at 3D World Forum
- The position statement is on 3D video on Light-field displays.
- MUSCDE is represented at several events including ICIP 2010, CVMP 2010 and NEM Summit

Inside this issue:

3D Video on Light-field Displays

Position Statement submitted by Péter Tamás Kovács of Holografika, Hungary

Capturing and displaying stereoscopic 3D content is becoming more and more common, even though there is plenty of room for improvements. Looking ahead in the 3D display field shows that stereoscopic 3D displays will eventually be replaced by others providing more freedom to the users in terms of field of view, motion parallax, all without glasses. A natural progression of 3D display technologies can be forecasted, starting from active stereo, passive stereo, to autostereoscopic displays of various kinds, including autostereoscopic, multi-view and light-field displays. Transmitting information-rich multi-view or light-field video content is much more challenging, resulting in a major increase in complexity even in the simplest cases. That's the reason why the MUSCADE project targets the whole range of 3D displays, and seeks ways to achieve as realistic 3D representations on these displays as possible.

The most common solutions today for 3D displaying are active or passive stereoscopic glasses, which are cheap and easily available. However, like all stereoscopic systems they can only provide 3D view for a single, fixed position (this is also true when multiple people are watching, as they all see the same image). Autostereoscopic displays can show different 3D images to multiple directions, but the most widespread displays (lenticular or parallax barrier systems) have limited light ray count (3D resolution). These can provide continuous view in a narrow Field Of View (FOV), however viewers moving may experience jumps when leaving or entering viewing zones. Light-field display technology is capable of providing 3D images featuring continuous motion parallax for a wide viewing zone for multiple viewers.

HoloVizio displays [1] are capable of displaying high quality horizontal parallax light fields. The HoloVizio principle can also be extended to have both horizontal and vertical parallax. The approach used by this technology is quite different from that of stereoscopic, multiview, volumetric and holographic systems. It uses a specially arranged array of optical modules and a holographic screen. Each point of the holographic screen emits light beams of different colour and intensity to the various directions. The light beams generated in the optical modules hit the screen points in various angles and the holographic screen makes the necessary optical transfor-

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3D Video on Light-field Displays

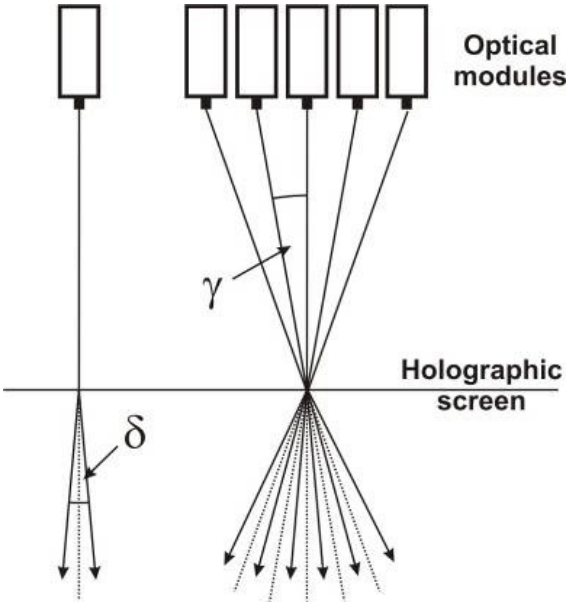

Figure 1. HoloVizio light-field generation principle. The light beams generated in the optical modules hit the holographic screen in various angles

mation to compose these beams into a continuous 3D view, as shown in Fig. 1. With proper software control, light beams leaving the pixels propagate in multiple directions, as if they were emitted from the points of 3D objects at fixed spatial locations.

Light-field display technology can be implemented in both small-scale and large-scale display systems. A 50 Mpixel large-scale system [2] has been developed with a screen diagonal above 1.8m (see Fig. 2). The display's optical system consists of compact projection modules arranged in horizontal rows. The system has a high angular resolution; approximately 50 independent light rays originate from each pixel. A PC-based render cluster provides 50Mpixels to the display in real-time (using GPUs for most image generation tasks).

Using this technology it is possible to build displays that have excellent image resolution of 1920x1080 or beyond, large FOV above 100 degrees, large

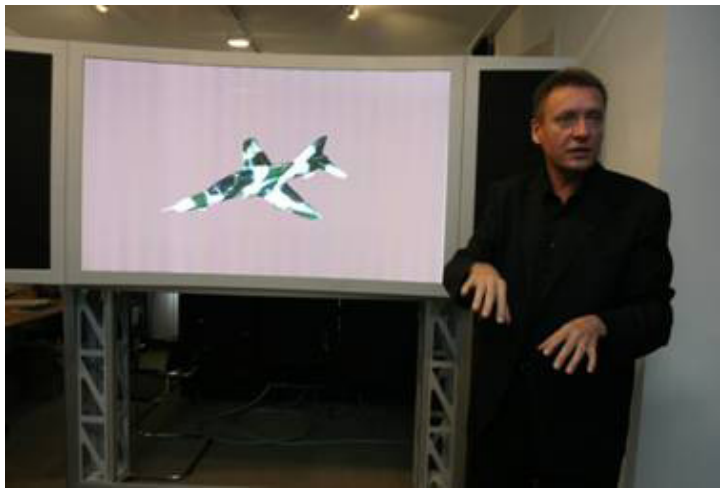

Figure 2. Large-scale HoloVizio light-field 3D display projecting 50Mpixels

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Field-of-Depth, and at the same time the number of pixels are in the range of hundreds of millions, which demonstrate the scalability of the system very well. Being projection based, and using a high number of optical engines pointing towards the same screen, this technology will always dominate 3D display technologies based on flat screens in terms of pixel count by at least one order of magnitude.

"Light-field display technology can be implemented in both small-scale and large-scale display systems"

True light-field content is not a common resource, as capturing with tens or hundreds of cameras is not very practical. Using traditional multi-view content results in suboptimal viewing experience on light field displays, as these are captured with very narrow FOV. Angular resolution is also lower than desirable, at least when compared to the capabilities of current light-field displays, which provide both wide FOV, and fine angular resolution. The

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3D Video on Light-field Displays

continued...

issue of angular resolution can be compensated by using intermediate view generation methods, but on the other hand, increasing the FOV by extrapolation is very challenging after a certain extent, and provides visibly incorrect results.

In the MUSCADE project, the developed camera system allows capturing on a wider baseline using identical satellite cameras, thus providing a 3D representation on a wider field of view than previous approaches. Coupled with high-quality disparity estimation, efficient Multi-View plus Depth with 4 cameras (MVD4) representation and compression, and on the receiving side efficient view generation/rendering methods, it can provide the basis for transmitting wide baseline light-field content to future homes (Fig. 3).

REFERENCES

[1] Balogh, T., "The HoloVizio System," Proc. SPIE 6055, 60550U, 2006.

[2] Balogh, T., Forgacs, T., Agocs, T., Bouvier, E., Bettio, F., Gobbetti, E., Zanetti, G., "A Large Scale Interactive Holographic Display," IEEE VR2006, Virginia, USA, 2006.

Figure 3. MVD4 content from the first MUSCADE test shoot displayed on HoloVizio

MUSCADE features at ICIP 2010

ICIP 2010, Hong Kong, China, 26-29 September 2010 :

Link: https://www.securecms.com/ICIP2010/Papers/PublicSessionIndex3.asp?Sessionid=1113

Anil Fernando of University of Surrey organised a MUSCADE special session on "3D Video Quality Assessments" on 29th September 2010 during the IEEE International Conference on Image Processing (ICIP 2010) in Hong Kong, China on 26-29 September 2010. The session programme comprised presentations of eight research papers, including two paper presentations by the MUSCADE partners, namely HHI and UNIS. The session was well attended by more than 150 participants.

Submitted by: UNIS

" Anil Fernando of University of Surrey organised a MUSCADE special session on '3D Video Quality Assessments' "

Holografika at 6th China International 3D World Forum & Exhibition

Link: http://www.c3dworld.org/english.htm

Introduction of the MUSCADE project within the framework EU FP7 programme and presentation about the 3D light-field technology were made by Tibor Balogh, Holografika CEO, at the "International 3D Fair 2010 China-Korea-Japan-USA Joint Workshop and Exhibition on 3D Displays, Contents and Applications" and "6th China International 3D World Forum & Exhibition" that was held in Shanghai, China on 3-5 November 2010. The presentation was part of the "Next 3D Display Technology Standards and Research" section within the conference (Fig. 4).

With the support of the Ministry of Industry and Information Technology and the Ministry of Commerce, China 3D Industry Association (C3D), Japan 3D Consortium (3DC), Korea 3D Fusion Industry Consortium (3DFIC) and USA 3D@Home Consortium prepared and organised the global international 3D industry communication and commerce platform. During these two days, 500 professional persons from more than 300 3D industry associations and related technology and research companies, 3D electronics and professional program chain users, 3D electronics and applications users, 3D electronics end-users, 3D information technology industry users, 3D content operation organisations and investment institutions attended the meeting and had a deep discussion on it.

" The presentation was part of the "Next 3D Display Technology Standards and Research" section within the conference"

For further info on this demonstration, please visit: http://insightmedia.info/conferences/c3d-forum.php

Submitted by: Holografika

Figure 4. Tibor Balogh's presentation at China International 3D World Forum

A rare contribution from MUSCADE at MMSP 2010

Link: http://www.mmsp2010.org/

Banu Gunel of University of Surrey presented a paper entitled "Spatial Synchronization of Audiovisual Objects by 3D Audio Object Coding" during the 12th IEEE International Workshop on Multimedia Signal Processing (MMSP 2010), held in Saint-Malo, France on 4-6 October 2010. She introduced the challenges in providing the users with interactive 3D audio content in synchronous with free-viewpoint video and explained the solutions being developed under MUSCADE. The paper was well received by the audience as being one of the rare contributions in the field of multimedia processing addressing joint audio-video capturing, processing and rendering.

Submitted by: UNIS

Astrium and Technicolor represents MUSCADE at NEM Summit

The NEM Summit is an annual Conference and Exhibition organised by the NEM Initiative under the aegis of the European Commission (DG Information Society and Media). This year's NEM Summit took place in Barcelona, Spain on 13-15 October 2010. In addition to the conference, the 2010 NEM Summit also included – over a 1500 m2 exhibition area – showcases and demonstrations of research results from key players in the field of networked electronic media and ICT at large.

At this event, both Astrium and Technicolor represented MUSCADE. Guillaume Berenger of EADS Astrium presented a paper entitled "MUSCADE, Multimedia Scalable 3D for Europe" during the "3D Media" session of "NEM Track 3 - User Centric Content Technologies". In his presentation, he introduced the objectives of the MUSCADE project as well as the first technical choices made by the consortium.

In the same session, Didier Doyen of Technicolor also presented a paper entitled "3D intensity adjustment of a stereo content to improve Quality of Experience". He presented the context and different scenarios for the 3D intensity adjustment technology as well as its technical implementation. This study is a part of the work conducted within MUSCADE, and will be implemented in the first phase of the project.

"The 2010 NEM Summit included over a 1500 m² exhibition area of research results from key players in the field of networked electronic media and ICT"

Submitted by:
Astrium and Technicolor

MUSCADE partner gives the key note talk at CVMP 2010

Link: http://www.cvmp-conference.org/

MUSCADE researcher Aljoscha Smolic of Disney Research Zurich gave a keynote talk on "Next Generation 3D Video Representation, Processing and Coding" at the European Conference on Visual Media Production (CVMP 2010), which took place in London, UK on 17-18 November 2010. His talk described the state-of-the-art and remaining challenges in the area of 3D video during this event, which was the seventh in a series of events bringing together production and post-production specialists from the worlds of film, broadcast and games with imaging and graphics researchers. CVMP 2010 provided a European forum to discuss the latest research, advances and state-of-the-art industry practices.

Submitted by: Disney Research Zurich

MUSCADE at the biggest European ICT forum

The biennial ICT Event is the biggest European forum dealing with research and innovation in ICT. This year, the ICT Event was held at the Brussels Expo on 27-29 September 2010, with researchers from all around Europe and outside Europe to present their latest ICT innovations and research projects. The results from more than 200 projects were exhibited to over 5000 researchers, students and interested industrial partners. The exhibition is also shares floor with a conference discussing research trends and funding priorities, as well as networking sessions with both researchers and investors.

MUSCADE was represented by Holografika at the ICT 2010 Event held at Brussels Expo. Holografika demonstrated the first glasses-free light-field 3D cinema installation featuring a 3m x 1.5m holographic screen and distributed multi-projection technology publicly for the first time. The demonstration showcased dynamic multimedia content (3D video shots, 3D stills) as well as interactive 3D applications (multimedia 3D advertisement, 3D games, 3D applications). The large-scale, impressive 3D visualisation system was considered a must-see by all viewers, and thus attracted most visitors of the exhibition. Using the MUSCADE recorded 3D video shootings for demonstration, the idea behind and the work already conducted in the MUSCADE project were presented to interested parties (Fig. 5).

For further info on this demonstration, please visit:

http://ec.europa.eu/information_society/events/cf/ict2010/item-display.cfm?id=3610&displaypage=technical

http://www.holografika.com/Videos/3D-glasses-free-cinema-system-ICT-2010-277.html

Submitted by: Holografika

Figure 5. Visitors experiencing the glasses-free 3D cinema presented by Holografika

" Holografika demonstrated the first glasses-free light-field 3D cinema installation featuring a 3m x 1.5m holographic screen and distributed multi-projection technology publicly for the first time."

3DTV Workshop organized by the MUSCADE partners

On December 16, 2010, Technicolor hosted the first MUSCADE workshop in Rennes, France. 14 speakers from all over Europe including 1 keynote speaker presented their vision and the results of their work related to 3DTV. 7 demonstrators had been set up to show MUSCADE results. Despite the travelling difficulties due to weather conditions and the period of the year (just before Christmas Holidays), a hundred people attended the conference and the demonstrations. Feedback from attendees were very positive.

As a starting point, Thierry Borel (Technicolor) introduced the workshop to the attendees and Guillaume Berenger (Astrium) presented the objectives, the challenges and the partnership of the MUSCADE project.

The keynote speech was intended to set the scene of 3D today and was performed by Alexander Schaefer, Head of technical department of MMZ (Mitteldeutsches Multimediazentrum Halle). Mr Schaefer organized the Live 3D concert of the "Fantastische Vier" Fantastic 4, which is a german Hip-Hop band. Muscade partners KUK and HHI were involved as well. It was live broadcasted into 91 cinemas in 5 countries (via satellite). 5 Stereo cameras were used. Some components of the stereoscopic broadcast chain were similar to the MUSCADE chain. A 3D BluRay of this event has also been produced. During 45 mn, Mr Schaefer shared with the audience his experience of shooting live events in 3D through the description of the making of this film. At the end of the speech, a lot of questions have been asked to the speaker.

The first paper session in the morning was called “3D content creation beyond glasses” and was chaired by Stewart Worrall of University of Surrey. This was followed by presentations from Disney Research Zurich, Orange, HHI, University of Surrey and the University of Trier. The morning session concluded with a 30 mn round table,.

The second paper session in the afternoon was chaired by Thierry Borel of Technicolor. University of Nantes, Technicolor, Eutelsat and Holografika presented their work on 3D video in this session. Followed by a 30 mn round table as well.

To illustrate the technologies that have been presented during the day, the MUSCADE partners conducted a set of demonstrations to attendees during the lunch break and from 3:30 to 6:00 pm. These demonstrations have been very well appreciated by various people attending the workshop.

Submitted by: Technicolor

Figure 6. Some moments from the 3DTV Workshop

Publications Corner

3D video assessment with just noticeable difference in depth evaluation

Authors: D.V.S.X. De Silva, W.A.C. Fernando, G. Nur, E. Ekmekcioglu, and S.T. Worrall

Affiliation: UNIS

Publication: IEEE International Conference on Image Processing , Hong Kong, China, 26-29 September 2010

Link: http://www.icip2010.org/

Abstract:

The ability to provide a realistic perception of depth is the core added functionality of modern 3D video display systems. At present, there is no standard method to assess the perception of depth in 3D video. Existence of such methods would immensely enhance the progression of 3D video research. This paper focuses on the depth perception assessment in color plus depth representation of 3D video. In this paper, we subjectively evaluate the depth perceived by the users on an auto stereoscopic display, and analyze its variation with the impairments introduced during the compression of the depth images. The variation of the subjective perception of depth is explained based on another evaluation that is carried out to identify the Just Noticeable Difference in Depth (JNDD) perceived by the subjects. The JNDD corresponds to the sensitivity of the observers to the changes in depth in a 3D video scene. Even though only the effects of compression artifacts are considered in this paper, the proposed assessment technique, based on the JNDD values can be used in any future depth perception assessment work .

The stereoscopic analyzer - an image-based assistance tool for stereo shooting and 3D production

Authors: F. Zilly, M. Muller, P. Eisert, and P. Kauff

Affiliation: HHI

Publication: IEEE International Conference on Image Processing , Hong Kong, China, 26-29 September 2010

Link: http://www.icip2010.org/

Abstract:

The paper discusses an assistance system for stereo shooting and 3D production, called Stereoscopic Analyzer (STAN). A feature-based scene analysis estimates in real-time the relative pose of the two cameras in order to allow optimal camera alignment and lens settings directly at the set. It automatically eliminates undesired vertical disparities and geometrical distortions through image rectification. In addition, it detects the position of near- and far objects in the scene to derive the optimal inter-axial distance (stereo baseline), and gives a framing alert in case of stereoscopic window violation. Against this background the paper describes the system architecture, explains the theoretical background and discusses future developments

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Publications Corner continued..

Spatial synchronization of audiovisual objects by 3D audio object coding

Authors: B. Gunel, E. Ekmekcioglu, and A.M. Kondoz

Affiliation: UNIS

Publication: IEEE International Workshop on Multimedia Signal Processing (MMSP 2010), Saint-Malo, France, 4-6 October 2010

Link: http://www.mmsp2010.org

Abstract:

Free viewpoint video enables the visualisation of a scene from arbitrary viewpoints and directions. However, this flexibility in video rendering provides a challenge in 3D media for achieving spatial synchronicity between the audio and video objects. When the viewpoint is changed, its effect on the perceived audio scene should be considered to avoid mismatches in the perceived positions of audiovisual objects. Spatial audio coding with such flexibility requires decomposing the sound scene into audio objects initially, and then synthesizing the new scene according to the geometric relations between the A/V capturing setup, selected viewpoint and the rendering system. This paper proposes a free viewpoint audio coding framework for 3D media systems utilising multiview cameras and a microphone array. A real-time source separation technique is used for object decomposition followed by spatial audio coding. Binaural, multichannel sound systems and wave field synthesis systems are addressed. Subjective test results shows that the method achieves spatial synchronicity for various viewpoints consistently, which is not possible by conventional recording techniques.

MUSCADE, Multimedia Scalable 3D for Europe

Authors: G. Berenger and MUSCADE consortium

Affiliation: Astrium

Publication: NEM Summit 2010, Barcelona, Spain, 13-15 October 2010

Link: http://nem-summit.eu/

Abstract:

MUSCADE (Multimedia Scalable 3D for Europe) is a European project, funded under the European Commission ICT 7th Framework Programme. MUSCADE aims at generating major innovations in the fields of 3DTV production equipment and tools, data representation, compression, transmission and rendering on various kinds of 3D displays. This paper provides an overview of the MUSCADE system architecture and the first technical choices made by the consortium. The final objective of MUSCADE is to demonstrate a complete multiview 3DTV live chain over wireline, wireless and satellite networks.

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Publications Corner continued..

3D intensity adjustment of a stereo content to improve Quality of Experience

Authors: D. Doyen, T. Borel, S. Thiebaud, C. Thebault, P. Robert, and L. Blonde

Affiliation: Technicolor

Publication: NEM Summit 2010, Barcelona, Spain, 13-15 October 2010

Link: http://nem-summit.eu/

Abstract:

3D content to the home is becoming more and more a reality. Consequently new challenges have to be addressed to ensure a good Quality of Experience with these new contents. Since human vision system is not perfectly adapted to visualize 3D content on TV, special video processing must be applied to enhance the 3D rendering. Furthermore, variability of the human vision is so high that 3D intensity adjustment tools will be required for some people and/or for some specific contents. Several use cases are presented to illustrate this necessity. The view interpolation technology is described, using stereo content associated with dense disparity map. Depending on the application, the insertion of this processing in the complete workflow is discussed and some standardization challenges are presented.

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