Fraunhofer
Heinrich Hertz Institute

Real-Time Stereo-to-Multiview Conversion

Live Generation of content for playback on autostereoscopic displays from 3D Blu-ray

Watching 3D without glasses will be the future of 3D home entertainment. However, current stereoscopic 3D content is not suited to drive autostereoscopic displays which means that a 3D format conversion is required. Developed at the Fraunhofer Heinrich Hertz Institute, the real-time stereo-to-multiview conversion engine allows playback of 3D Blu-ray content or any other stereoscopic 3D video content on most existing autostereoscopic displays. Costly offline conversion is no longer needed and personal 3D viewing preferences can be adjusted by users on–the-fly.

Challenges

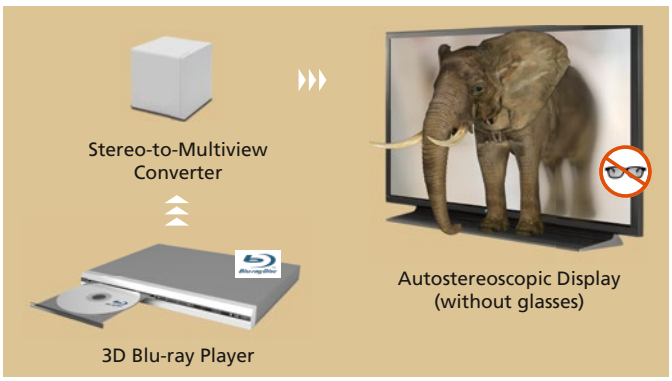
The future of 3D digital signage and home entertainment will be based on 3D display technologies without glasses. Current stereoscopic 3D, however, is not equipped for this field of application since multiple views are required to drive most autostereoscopic 3D displays.

Up to now multiview content had to be produced in a costly off-line post production process from stereo – at least if high-end applications were addressed. Such an offline process is suitable for some applications like 3D digital signage but fails in others like 3D entertainment. As most stereo 3D content is now available only on Blu-ray, an automatic real-time conversion is needed to drive autostereoscopic 3D displays in home entertainment environments.

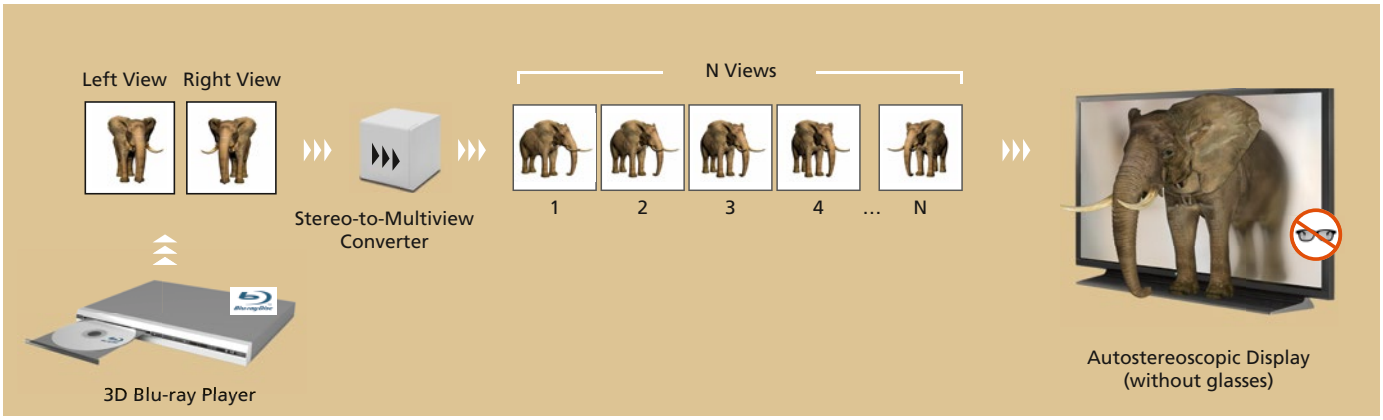
The Fraunhofer Heinrich Hertz Institute provides a solution that creates high-quality autostereoscopic 3D in real-time suitable for most existing and future autostereoscopic 3D displays. The stereo-to-multiview conversion engine can be seen as a black box with stereoscopic 3D input such as 3D Blu-ray or any other stereo input and an output suitable to drive any autostereoscopic 3D display. The engine also is capable of adjusting various parameters to modify the depth impression in line with personal 3D viewing preferences.

Benefits

- Watching 3D without glasses from out-of-the-box 3D Blu-ray or any other 3D video content
- Real-time conversion of any stereoscopic 3D video content to multiview video representation needed for autostereoscopic 3D displays
- Support of existing and future 3D video formats for any autostereoscopic display
- On-the-fly adjustment of the depth impression according to users' 3D viewing preferences



Stereoscopic 3D to Multiview Conversion Pipeline



Conversion of generic Stereoscopic 3D Video to Multiview by generating virtual camera images

Technical Background

Generation of additional views from stereoscopic 3D is based on disparity maps estimated from the two input views. The disparity maps represent pixel-by-pixel information about the depth of the scene. Sophisticated confidence measures and consistency checks coupled with detection of mismatches and tricky post-filtering of disparity maps provide robust depth information. With this information, additional virtual views are generated by applying depth image-based rendering techniques (DIBR). Thus it is possible to generate an arbitrary number of views and adapt the number and position of these virtual views to the specific properties of existing and future autostereoscopic 3D displays. During this 3D format conversion, the depth impression can also be adapted to users' 3D viewing preferences. Hence, the level of perceived depth as well as the position of scene objects in relation to the screen plane can be adjusted during conversion.

Specifications

- Highly real-time optimized core algorithms like L-HRM, SKB, STAN
- All core algorithms are designed for a maximum of parallelization
- Real-time implementation on 2 Intel Hexa-Core CPUs and Nvidia Geforce GTX 590 GPU
- Support for all commercially available autostereoscopic 3D displays like Alioscopy, Tridelity, Magnetic 3D, Zero Creative, etc.

Future Objectives

- Provision of a SystemC or VHDL implementation suitable for realization in hardware
- FPGA / ASIC implementation for set-top box or related solutions
- Further optimization of algorithms to improve image quality

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