

# Video2Depth

## Robust Depth Estimation for Digital Cinema



## Features

- DC camera mounted with two external satellite cameras
- On-the-fly depth generation with minimal impact on camera team
- Synchronized recording of video-plus-depth data during capturing
- Preview of depth data by dedicated 3D visualization tools
- Robust reliability measure using trifocal stereo constraint
- Gradual visualization of depth reliability

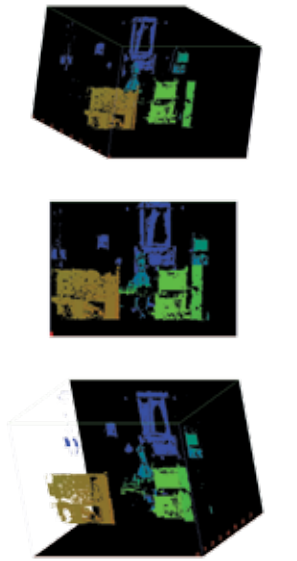
Depth Estimation is used as basis for the capturing of 3D-scenes. The trifocal setup selects only precise disparities. Mounting and calibration do not interfere with the established workflows. With two satellite cameras mounted to the left and the right of an electronic D-cinema camera a sophisticated trifocal stereo matching algorithm estimates the depth of the complete scene. Results are provided on a per-pixel basis along with a reliability measure.

Related visualisation tools allow a preview of the results at the set.

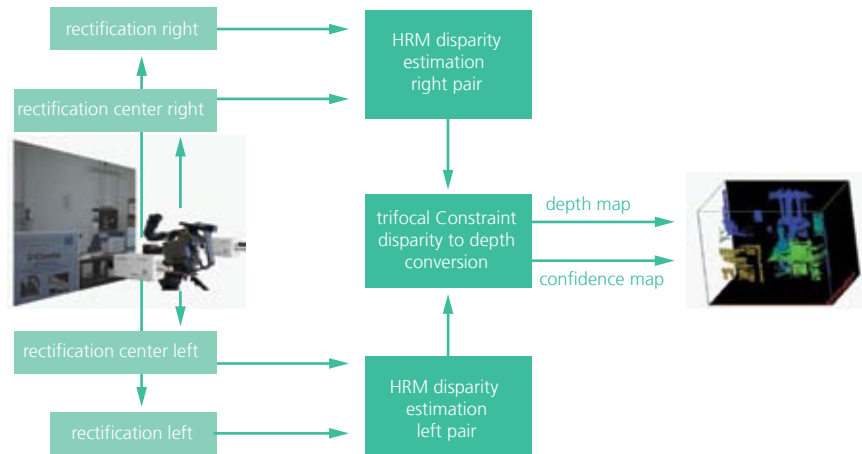
## System Concept

Visual effects editing during post-production requires specific features from the depth acquisition system. In contrast to other applications in 3D video processing, it is not of highest priority to provide dense per-pixel depth maps for each image. It is much more important to get reliable depth values in 3D world's metric and to have a certain and trustable measure on its accuracy. Thus, in post production depth maps are allowed to be sparse, but the calculated depth values must be correct within given preciseness limits.

To meet these requirements with minimal impact on production and camera team, two pre-calibrated satellite cameras are mounted to the right and the left of a central D-Cinema camera. The handling of the mounting procedure is easy and the final calibration of the whole rig is carried out automatically on the basis of the three captured views. Thus, mounting can be done on the fly and will not disturb the established workflows.

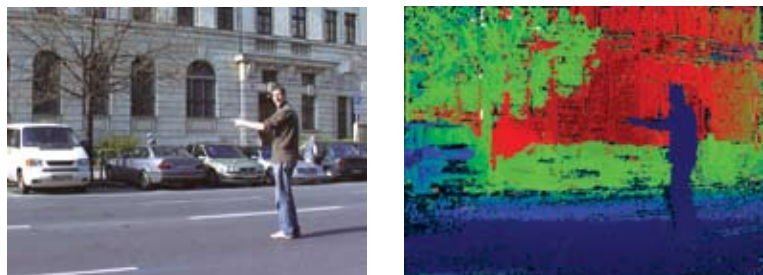


3D player for interactive visualization of depth estimates



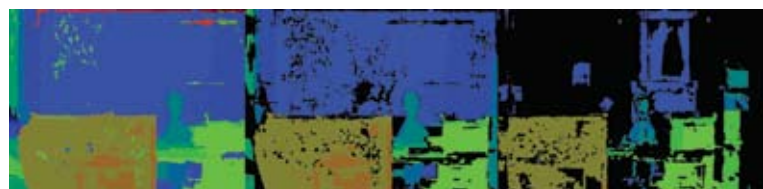
Concept of depth estimation system

Using this trifocal set-up, depth acquisition applies separate stereo matching processes to the two outer camera pairs. For this purpose the two pairs are first rectified to ease the subsequent processing. The two matching processes then result in two dense disparity maps for the mid view. The consistency of the two disparity maps can be checked against each other by using the trifocal constraint providing a measure of disparity accuracy counted in pixel. Based on this check and knowing the calibration data, a depth map and a reliability map are calculated for the mid view. These maps are then recorded along with the video signal of the central D-Cinema camera.



Example of high accuracy depth map visualized in false colour presentation

The recorded depth data can be previewed in the field by using a dedicated 3D player. During the preview the user can select different confidence levels for better visualisation. The highest confidence level shows depth values with perfect consistency only. In contrast, at the lowest confidence level, the player shows the estimated depth values for all pixels.



Visualization of depth accuracy vs. depth density

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