ISMAR 2006 Demo proposal:

An All-In-One Solution to Geometric and Photometric Calibration

Julien Pilet, Andreas Geiger, Pascal Lagger,
Vincent Lepetit and Pascal Fua

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Abstract

We demonstrate a simple-to-use camera calibration system that can handle multiple cameras whose fields of view do not necessarily overlap. It estimates the geometry of the cameras, their photometric responses, and an environmental lighting map. The only manual intervention required involves waving an arbitrarily textured planar pattern in front of the cameras. In other words, in one single operation, our system yields all the information required by sophisticated Augmented Reality applications to draw virtual 3–D objects at the right locations and then light them convincingly.

The user moves a calibration pattern in front of the cameras connected to a simple laptop running our software. We use a powerful computer vision technique to detect it in the images both robustly and in real-time. This provides homographies between the pattern and the images, which are then used to compute the intrinsic camera parameters. We also use them to compute the poses of the cameras with respect to each other. Finally, we rely on the intensity variations within the pattern and across the images to achieve photometric calibration.

The video streams are augmented in real-time and the light map is updated to reflect changes in the lighting environment.

Figure 1: A possible setup for our demonstration.

Contact Author

Julien Pilet
EPFL IC CVLAB
BC 306
Station 14
CH-1015 Lausanne
Switzerland
E-mail: julien.pilet@epfl.ch Tel: +41216937518 Fax: +41216937520

Demonstration Description

We developed an open source calibration and AR software that we present at ISMAR 2006 in a long paper. The goal is to demonstrate it live. Participants will have a chance to modify the camera setup, calibrate it and then play with a real-time augmented planar object. The demonstration shows very well how the light map is built and updated, with instantaneous effect on the augmented scene. The demonstration is made with a few cameras connected to a laptop. A textured box serves as calibration pattern. Demonstrating all the different phases of the calibration process takes 5 to 10 minutes:

Phase A How to turn any planar object into a calibration pattern.

Phase B The geometric and photometric calibration process.

Phase C Real-time augmentation and light map update.

Practical details

Equipment we will bring: 1 laptop, a few cams with tripods.
Space required: A standard desk.
Lighting: It would be nice to have a spot light that we could move around to show changes in lighting environment. However, it is not practical to bring one from Europe due to plane travel and voltage problems. Can the organizers provide a spot light for us ?