

Vision-Based System for Occupancy and Posture Analysis

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Over the past few years advances in computer vision have given promise of robust systems for safety applications in cars. In particular, we seek to develop a way to deploy a passenger-side airbag that is aware of the occupant in the passenger seat. There is hope to avoid extensive injury due to airbag deployment in multiple passenger classes; children, babies, adults.

Our approach is to use a combination of two computer vision methods: invisible structured lighting and correlation-based stereo matching. The environment of an automobile poses challenges to these methods. Computer vision relies heavily on intensity values to function properly, and the interior environment of a car has a large amount of different lighting conditions. To get around this caveat the monochrome cameras cut light below 850nm. This reduces our consideration of illumination values to near infrared and produces a monochrome image of the target.

Structured lighting improves textured-ness and gives further constraint on the depth of the target [1]. Projecting a sine-wave grating onto the scene that has a known structure with each stripe having a random width. This is to ensure accuracy when using correlation-based window matching using brightness values in each image. When stripes are of the same width there is a “phase ambiguity” about what pixel belong to which stripe. It is important to ensure that each adjacent stripe is of a different width to ensure good matching. The method just described eliminates this problem during stereo matching.

Stereo matching uses a correlation window that is applied to the “reference” image and scans the other image in the stereo pair for a matching brightness [3]. The correlation window achieves its best results when it is larger than the largest stripe in the image. This avoids the problem of areas in the disparity map where we can lose depth information due to a window that is too small. For a good treatment of a correlation window based matching see [3].

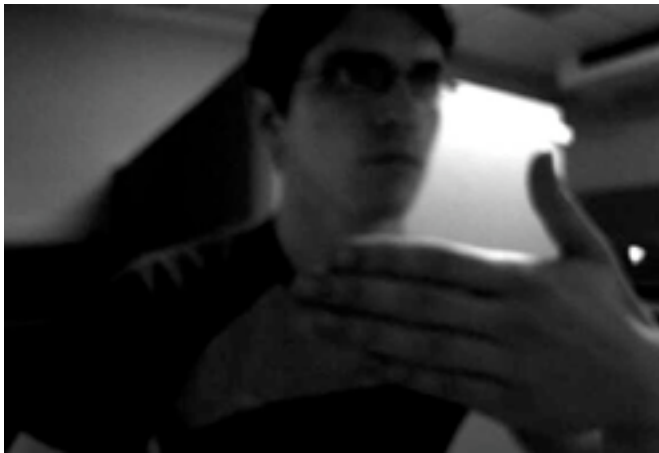


Figure 1: Example of a source target used to obtain depth maps, as in Figure 2. Image taken with near infrared sensitivity and no visible light cuts.

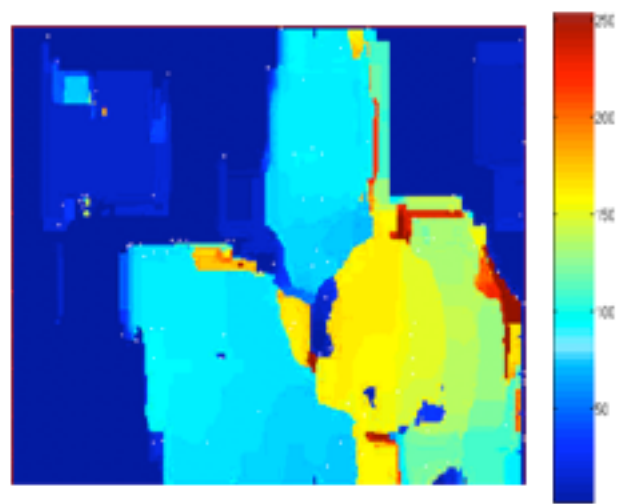


Figure 2: Example of disparity map obtain from two-frame stereo matching under structured lighting. The correlation window size is 32x32 pixels with max disparity of 60 pixels. Brighter colors imply a short distance to the camera and darker the opposite. Values are in pixels and indicate disparity.

REFERENCES

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