

# Stereo Camera Range Finder with a Slit-like Window for Visual Aid

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A stereo camera range finder for visual aid developed jointly with Kaneko Manufacturing Co., Ltd. under a support by Grant-in-Aid for Scientific Research C 23500658 in Japan, cf. Fig. 1, captures each frame of stereo image; estimates the depth image by applying a dynamic programming (DP) for real-time stereo matching; calculates a representative value such as the mean of depths in a rectangular window on the depth image; and converts the representative value into a frequency of oscillation on skin or ears.

For example, the minimum of depths in a wide window can detect the nearest obstacle, cf. the middle (M) in Fig. 2 (red: near; blue: far), while the maximum of depths can detect some hole. The median of depths in a narrow window can measure the pinpoint distance to any obstacle, cf. the right (R) in Fig. 2.

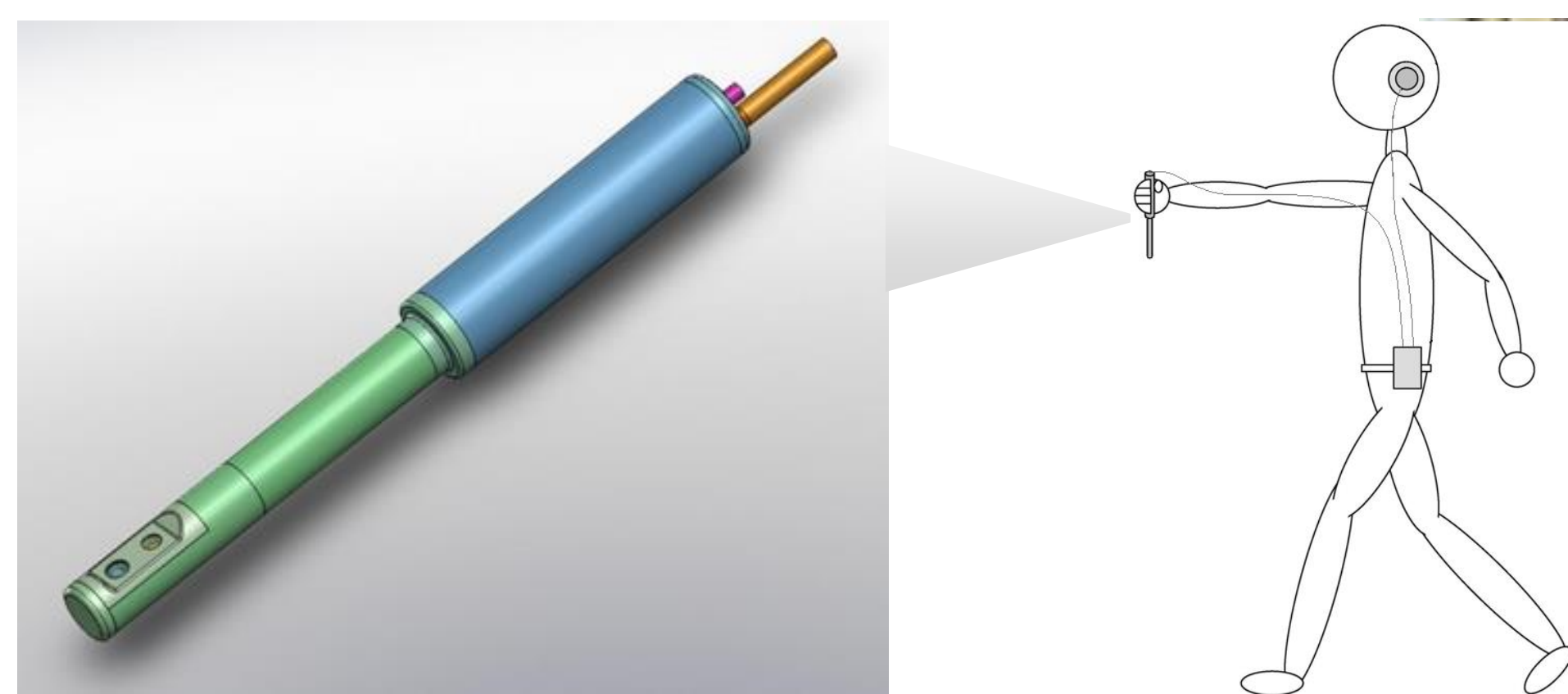


Fig. 1. The Stereo Camera Range Finder for Visual Aid.

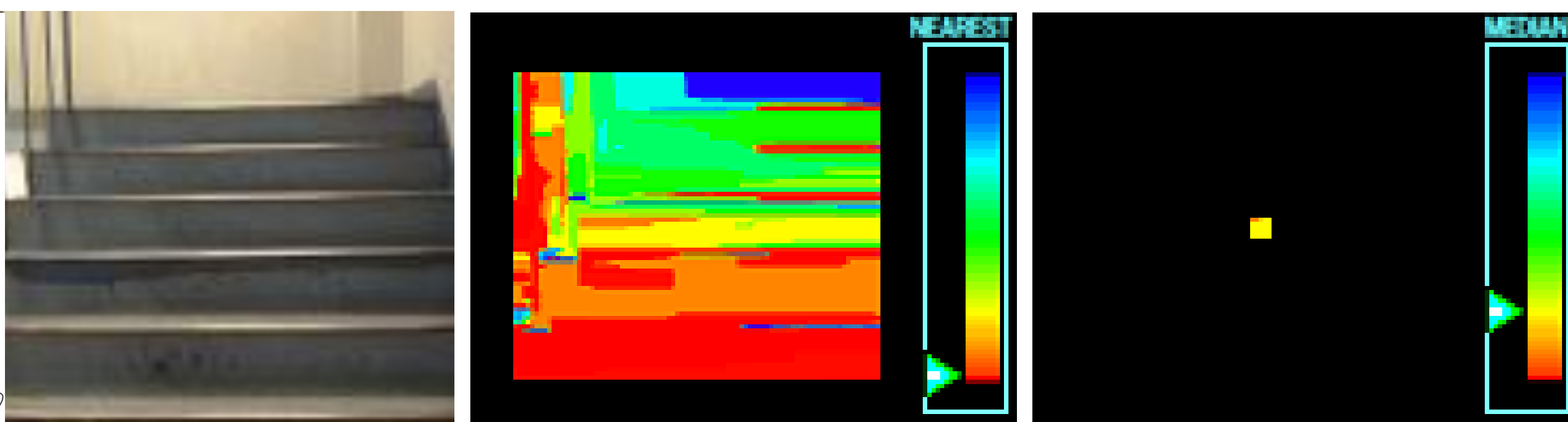


Fig. 2. L: Stairs; M: Detecting the *Nearest* Obstacle in a *Wide* Window; R: Measuring a Pinpoint Distance as the *Median* in a *Narrow* Window.

The mean of depths in a slit-like window tends to smooth any distribution of depths along the long axis of slit, and this property facilitates detecting edges of linear structures in civilized life, cf. Fig. 3 and Fig. 4.

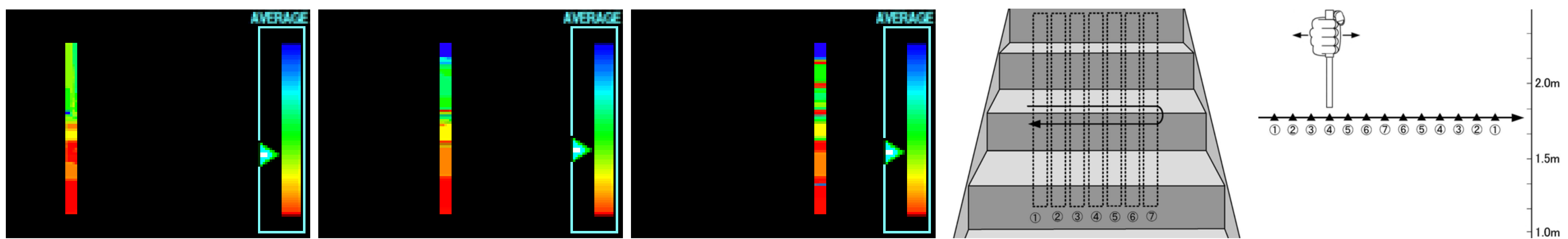


Fig. 3. *Horizontal* Scan of Stairs Makes the *Mean* in a *Vertical* Slit-like Window Fluctuate Slightly.

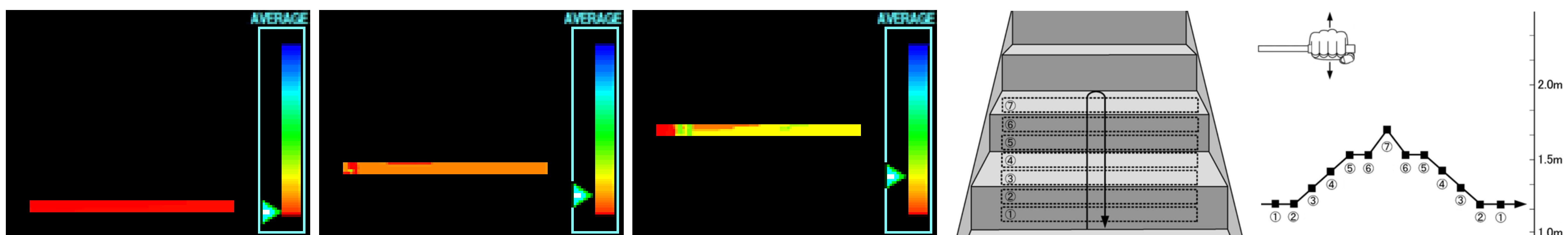


Fig. 4. *Vertical* Scan of Stairs Makes the *Mean* in a *Horizontal* Slit-like Window Fluctuate Significantly.

Performance of DP for stereo matching [1] includes the accuracy of depth estimation and the processing time. The authors' algorithm can process over 30 fps with Intel Core i7-2670QM (2.2GHz, 4GB), where a frame consists of 320x240-doubled stereo image. The rate of accurate matching achieves 94.4% in average for the typical images called Tsukuba, Venus, Cones, Teddy, Map, and Sawtooth in Middlebury Stereo Datasets.

## Reference

1. L. Wang, M. Liao, M. Gong, R. Yang, and D. Nister, "High-Quality Real-Time Stereo Using Adaptive Cost Aggregation and Dynamic Programming," *Proc. of the Third International Symposium on 3D Data Processing, Visualization, and Transmission*, pp. 798-805 (2006).

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