Eigen Space Compression with Automatic Obstacle Removal
for Virtual City Rendering

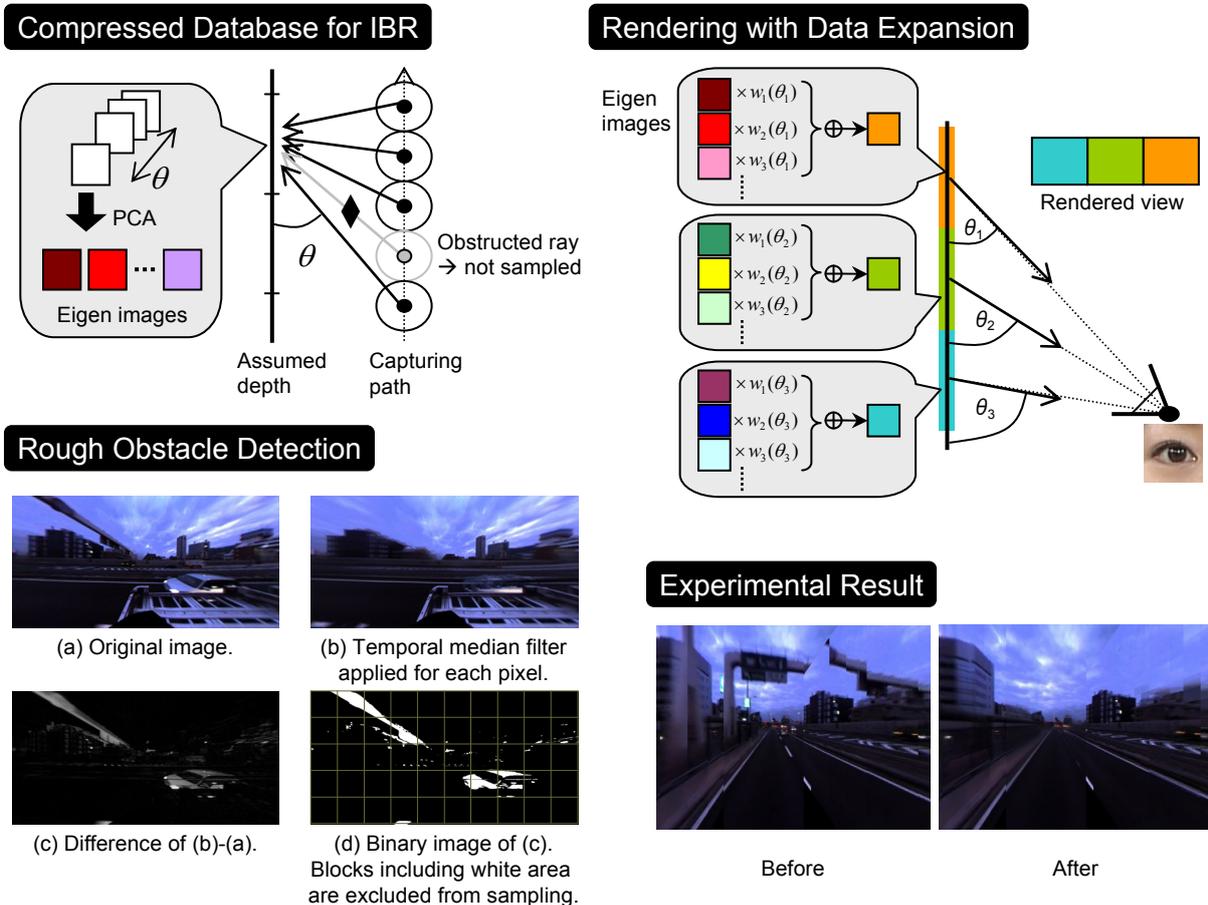Ryo Sato[*]   Shintaro Ono   Ryo Nagatsuka   Hiroshi Kawasaki[*]   Katsushi Ikeuchi

We propose free-point view rendering technique for urban traffic scenes without particular obstacles such as elevated bridges, telegraph poles, peripheral vehicles, etc. The novel point is that it is completely combined with image compression based on eigen images.

We have already developed the IBR method using omnidirectional videos captured by a sensing vehicle. As shown in the figure, rays in captured images are sampled into block images, and compressed by PCA. Free-point views can be restored by weighed sum of eigen images in real time, using GPU. Meanwhile, objects in front of the assumed depth in IBR often become obstacles. Especially, since we are applying this rendering system as a view for a driving simulator, signboards and peripheral vehicles are preferred to be removed – such objects are required to be arranged arbitrarily, subject to the simulating conditions.

This time we succeeded to automatically remove these objects, taking advantage of our compression and expansion technique. Obstacles can be roughly detected by temporal median filtering for each pixel. By excluding the image blocks corresponding to the detected areas from the sampling process, images without the obstacles can be restored based on regression. Additionally, since image blocks become more similar after the exclusion, the compression ratio can be more better.

Publications

[1]   R. Sato, S. Ono, H. Kawasaki, K. Ikeuchi, "Photo-Realistic Driving Simulator using Eigen Texture and Real-Time Restoration Techniques by GPU," Int'l Journal of ITS Research, Vol. 6, No. 2, Dec. 2008.

[2]   R. Sato, S. Ono, H. Kawasaki, K. Ikeuchi, "Real-Time Image-Based Rendering System for Virtual City Based on Image Compression Technique and Eigen Texture Method," 19th Int'l Conf. on Pattern Recognition (ICPR), Dec. 2008.

[3]   R. Sato, S. Ono, H. Kawasaki, K. Ikeuchi, "GPU Implementation of Real-time Image Based Rendering Technique for Virtual City Modeling" (in Japanese), Proc. Meeting of Image Recognition and Understanding (MIRU), pp. 479, Aug. 2008.

Compressed Database for IBR

Rendering with Data Expansion

Rendered view

Rough Obstacle Detection

(a) Original image.

(b) Temporal median filter applied for each pixel.

(c) Difference of (b)-(a).

(d) Binary image of (c). Blocks including white area are excluded from sampling.

Experimental Result

Before

After

* Saitama University