Junhwan Lee
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Programming Assignment 2

In this assignment, we are given two stereo images, left and right, to create a disparity map. In order to do so, two stereo images are compared to find the disparity of each pixel.

Disparity is found using the sum of absolute difference(SAD) algorithm. The window size n is taken at each position of two images and are compared using SAD. The left image window is fixed and the right image window is shifted to the right by 1 pixel to calculate for the SAD. Two images are rectified meaning that the pixel displacement is only in the x-axis. Therefore, the disparity is the displacement in x-axis at minimum SAD. This entire process occurs in every pixel along the height of the image. The disparity map at the position of the left image is then the value of the displacement found using SAD.

The timing analysis of this algorithm for the two images with height(h), width(w), window size(n x n), and search numbers(s) is

$$O(h) * O(w) * O(s) * O(n)$$

where $O(n)$ is the timing analysis of SAD computation. The algorithm will take exponentially longer if any of these factors increase. Images with higher resolutions will slow down the process. However, there is a trade off between the accuracy and the run-time. The increase in search numbers will significantly improve the accuracy of the disparity map, but also increase the run-time. The final disparity map fails to show the clear distinction between the objects due to the lack of smoothing constraint calculated for the disparity. This can be improved by adding more constraints such as an algorithm to compare the neighboring disparity values and normalizing them.

The collection of the resulting disparity map images are located in the folder contained along the input left and right images.

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Citation

SAD Algorithm

Pardo-Beainy, Camilo & Gutierrez Caceres, Edgar & Jiménez L., Fabián & Quintero, Luis. (2013). Disparity map generation, from the use of rectified images. Symposium of Signals, Images and Artificial Vision - 2013, STSIVA 2013. 1-6. 10.1109/STSIVA.2013.6644908.

Data Sets

"Middlebury Stereo Datasets." *Vision.middlebury.edu/Stereo/Data*, https://vision.middlebury.edu/stereo/data/.