CV-HW4 Stereo Matching

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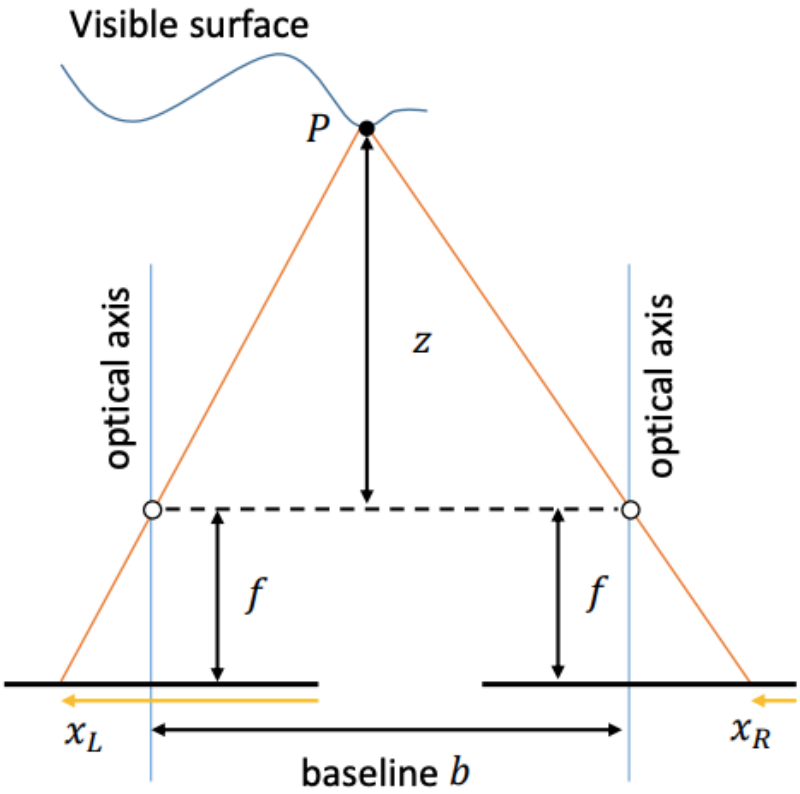
Part1

Let $d = X_L - X_R$, prove $d = \frac{f \cdot b}{z}$



Ans:

$$b : X_L + b - X_R = z : z + f$$

$$b : d + b = z : z + f$$

$$dz + bz = bz + bf$$

$$d = \frac{b \cdot f}{z}$$

Part2

Alogorithm

Cost Computation

Calculate the cost for each pixel with specific layer

$$C_{i,j} = (1-\alpha) \cdot min[\|I'_{i+l} - I_i\|, \tau_1] + \alpha \cdot min[|\nabla_x I'_{i+l} - \nabla_x I_i|, \tau_2]$$

Cost Aggregation

1. Produce the cost volume, each layer has parameter l, assigning the disparity from 1 to Maxdisp, and finsih it with above equation.
2. Apply an image guided filter on each layer of cost volume, using the input image as the reference of image.

Disp. Optimization

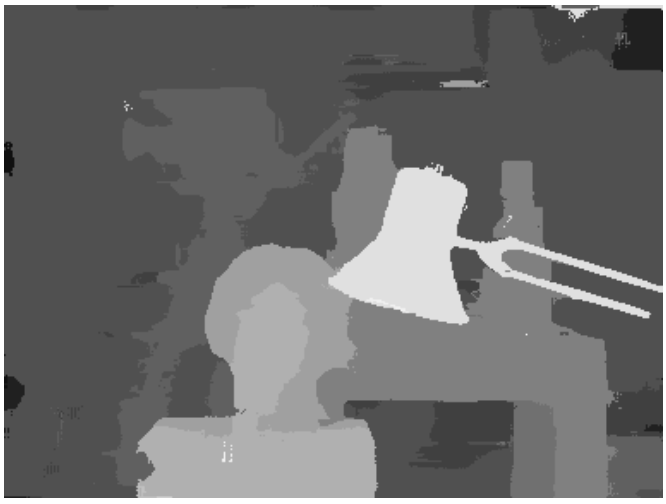
Winner take all from cost volume layers, and choose the minimum value.

Disp. Refinement

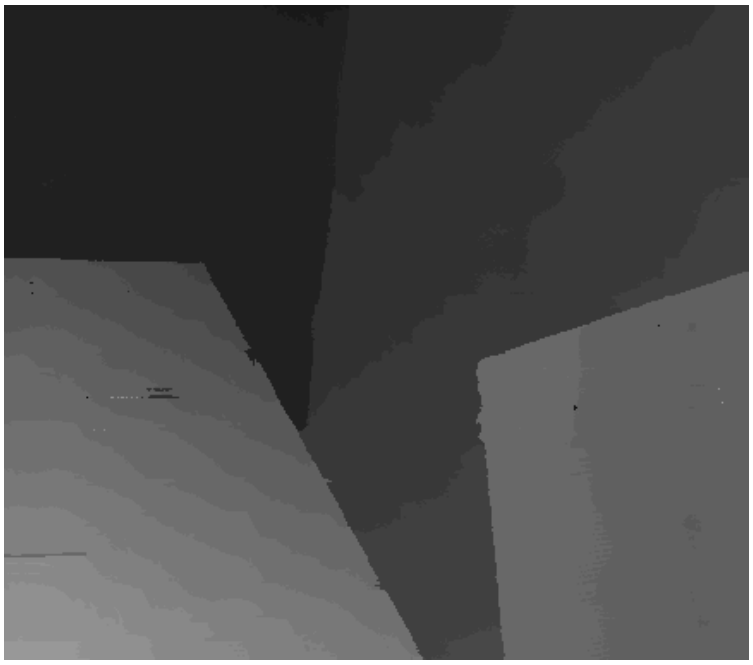
Apply a median weighted filter on the above labeled image.

Results

Tsukuba

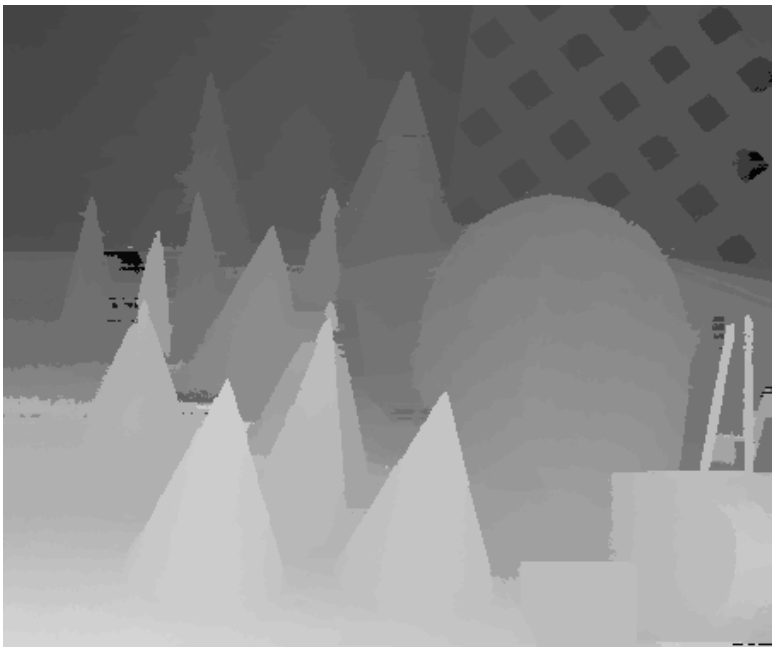


Venus



Teddy

Cones



Bad Pixel Ratio

Tsukuba: 2.23%

Venus: 0.41%

Teddy: 9.63%

Cones: 7.40%

Average: 4.92%

Reference

Fast Cost-Volume Filtering for Visual Correspondence and Beyond- Asmaa Hosni ; Christoph Rhemann ;