DDR-SGM report

Computer Vision Final Project

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Contents

- Intro: Stereo Vision & Disparity
- Costs
- Cost Aggregation
- L-R check
- DDR-SGM
- Other Ideas (a new cost, a new evaluation method)

Intro: Stereo Vision & Disparity

- Depth - Disparity

- Disparity - Stereo Vision

SGM

- Match corresponding points
- Computing disparity
- Smooth

Point Matching — Costs

Costs

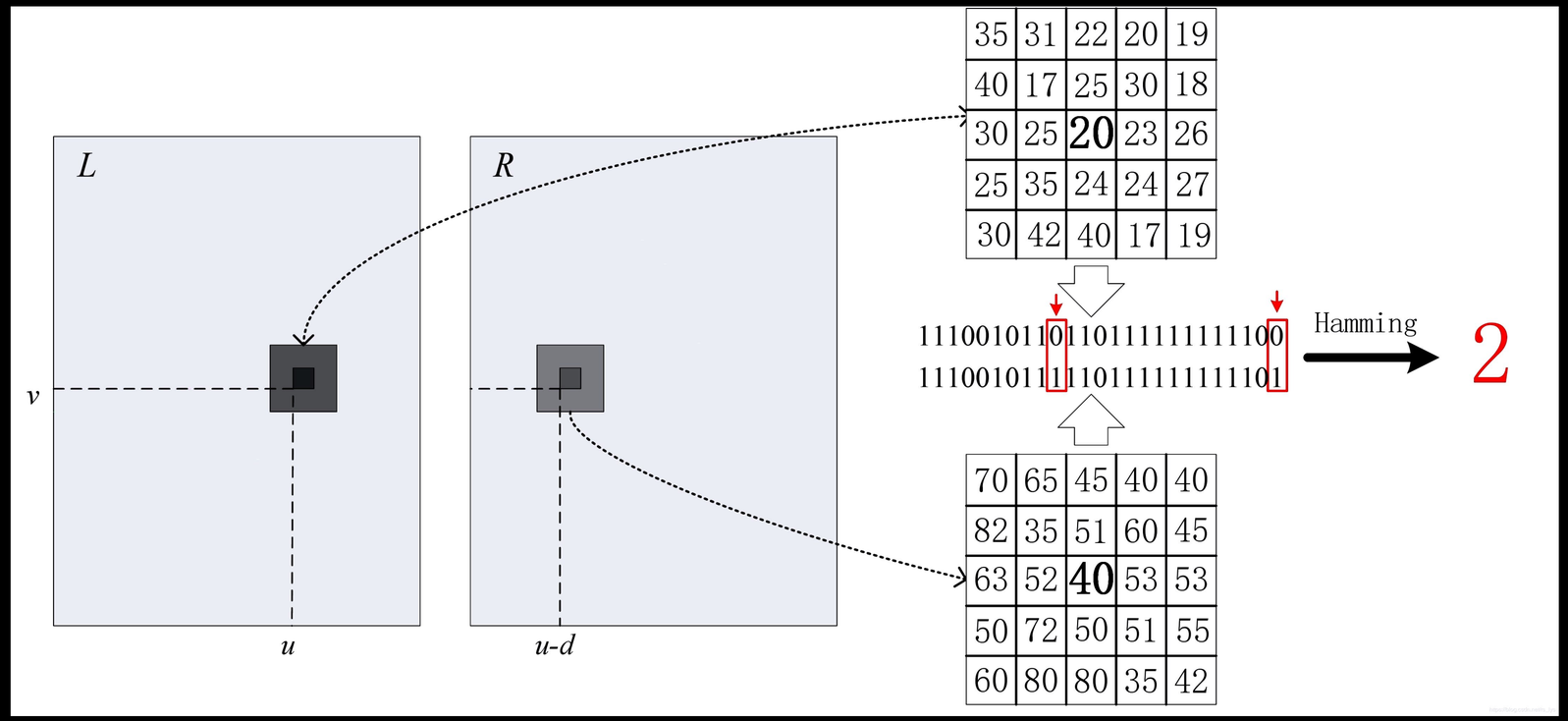
- BT

$$\bar{d}(x_i, y_i, I_L, I_R) = \max\{0, I_L(x_i) - I_{max}, I_{min} - I_L(x_i)\}.$$

Birchfield, Tomasi Depth Discontinuities by Pixel-to-Pixel Stereo 1998 IEEE

Costs

- Census



https://ethanli.blog.csdn.net/article/details/84305717

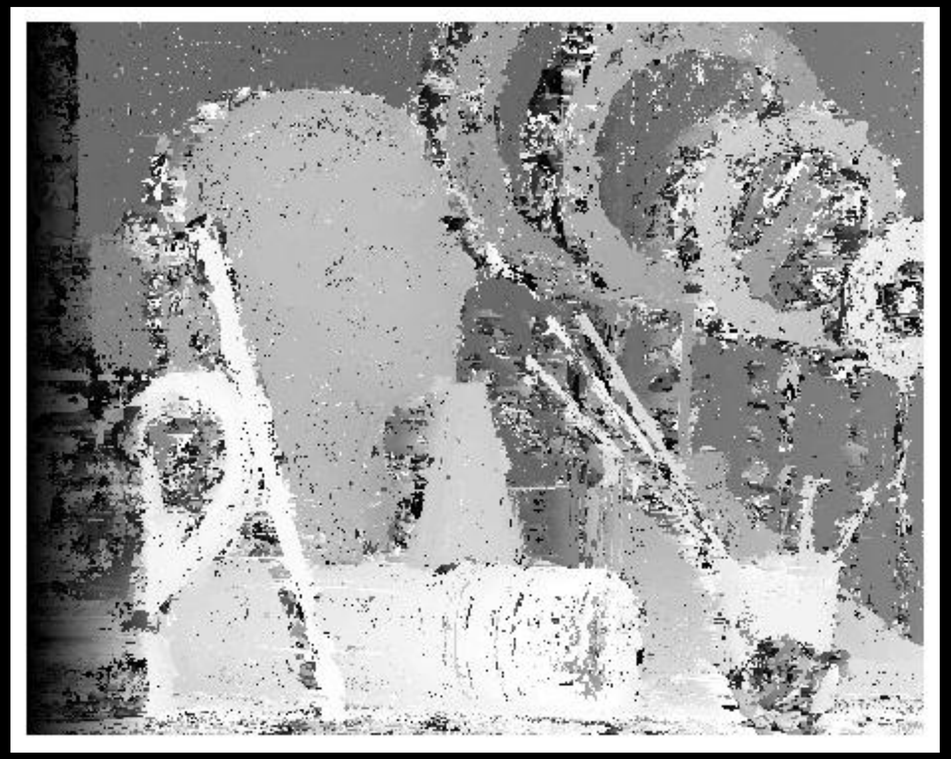
Costs Results

- Census

5x5 7x7 9x9

Costs Results

- Census



11x11

13x13

Costs Results

- Census

Window size	Runtime	Bad4	Bad2
5x5	36.3	0.213	0.219
7x7	46.3	0.205	0.210
9x9	49.4	0.200	0.202
11x11	56.3	0.190	0.194
13x13	61.6	0.185	0.189

Costs Results

- BT

3x3 5x5 7x7

Costs Results

- BT

9x9 11x11 13x13

Costs Results

- BT

Window size	Runtime	Bad4	Bad2
3x3	48.3	0.294	0.304
5x5	51.9	0.322	0.333
7x7	59.7	0.342	0.353
9x9	60.7	0.353	0.364
11x11	58.7	0.363	0.374
13x13	63.5	0.377	0.388

Smoothing — Cost Aggregation

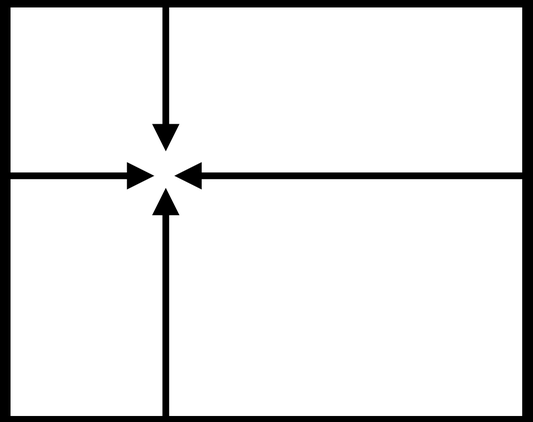
Cost Aggregation

$$E(\mathrm{D}) = \sum_{\mathrm{p}} \mathrm{C}(\mathrm{p}, \mathrm{D}_{\mathrm{p}}) + \sum_{\mathrm{q} \in N_{\mathrm{p}}} P_1 T[\left|\mathrm{D}_{\mathrm{p}} - \mathrm{D}_{\mathrm{q}}\right| = 1] + \sum_{\mathrm{q} \in N_{\mathrm{p}}} P_2 T[\left|\mathrm{D}_{\mathrm{p}} - \mathrm{D}_{\mathrm{q}}\right| > 1]]$$

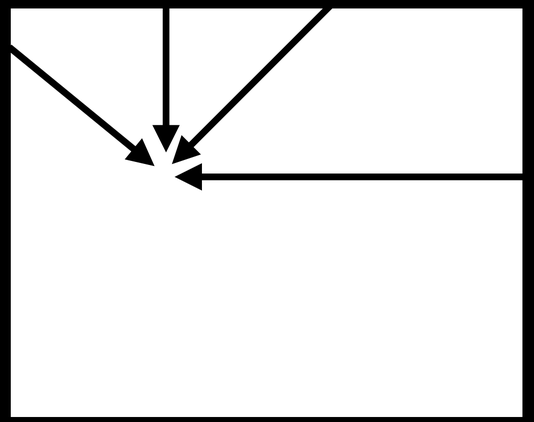
https://ethanli.blog.csdn.net/article/details/84305717

Cost Aggregation

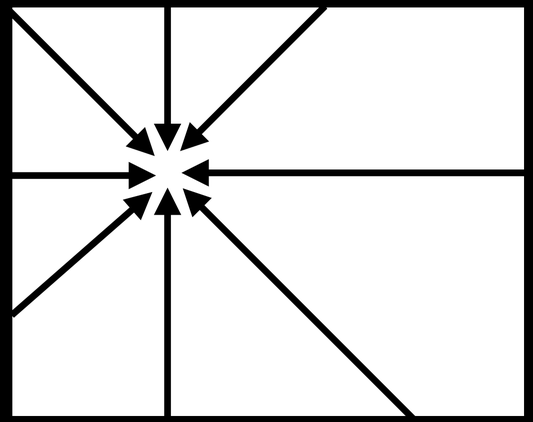
4 PATH A



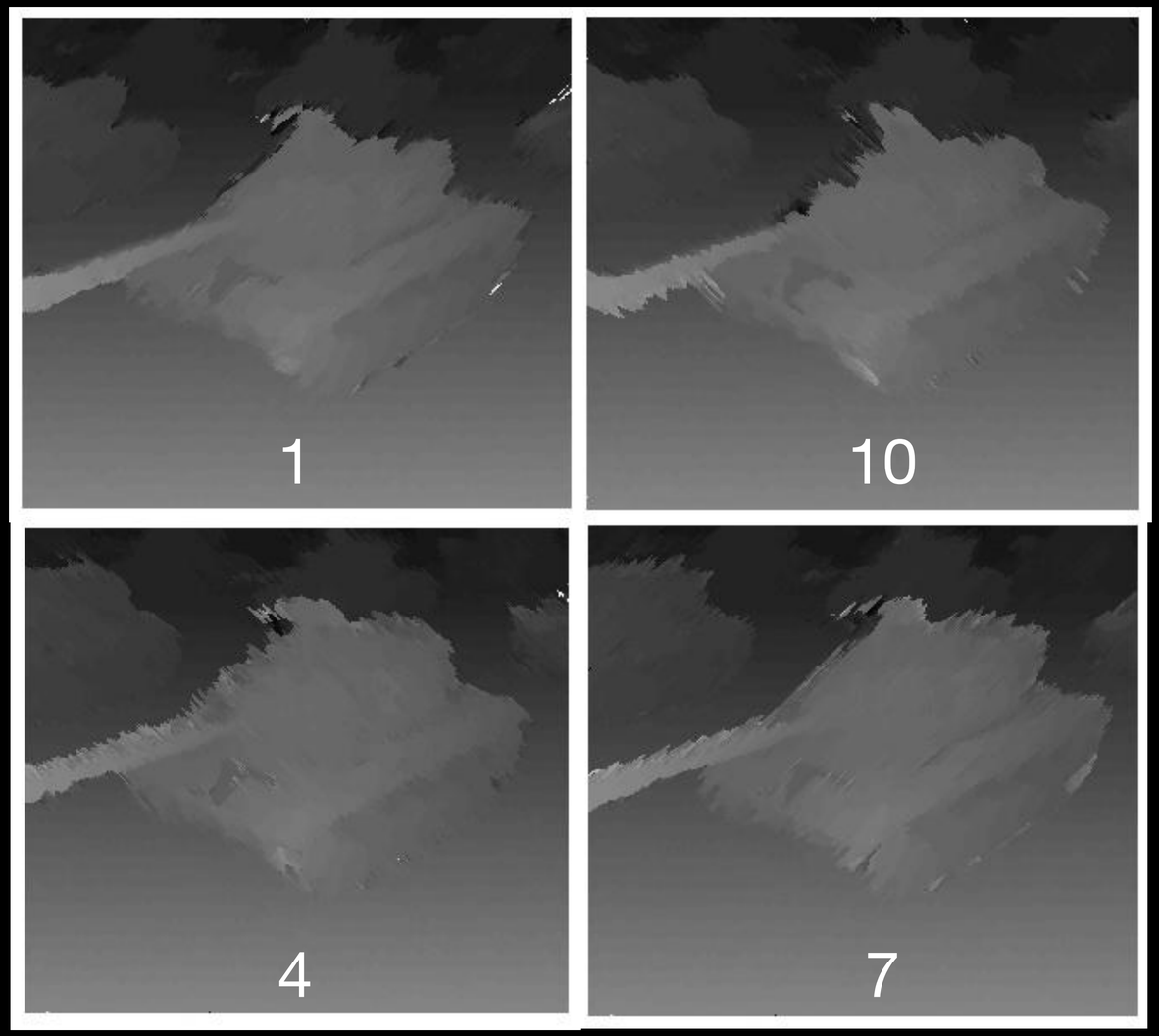
4 PATH B



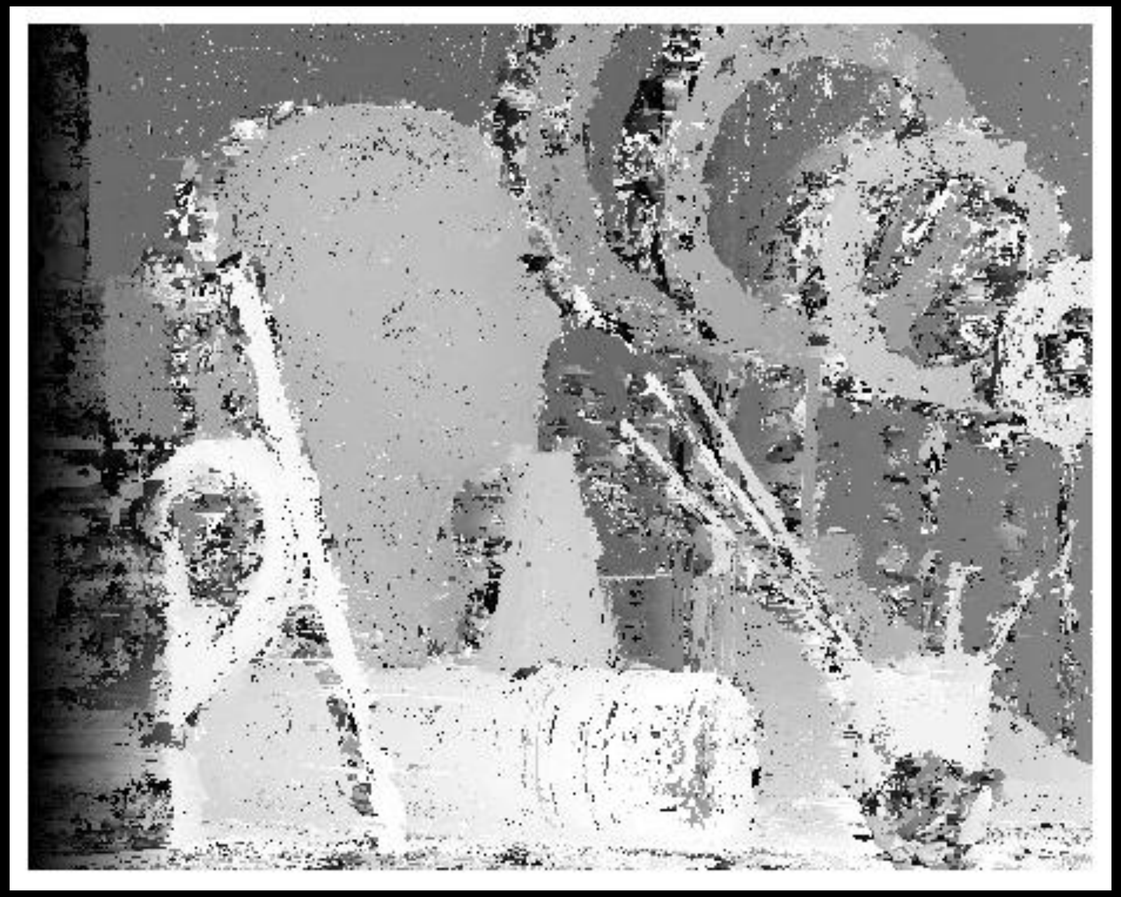
8 PATH



Cost Aggregation

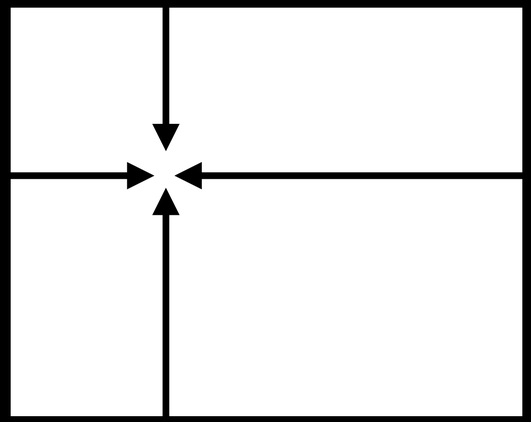


Cost Aggregation



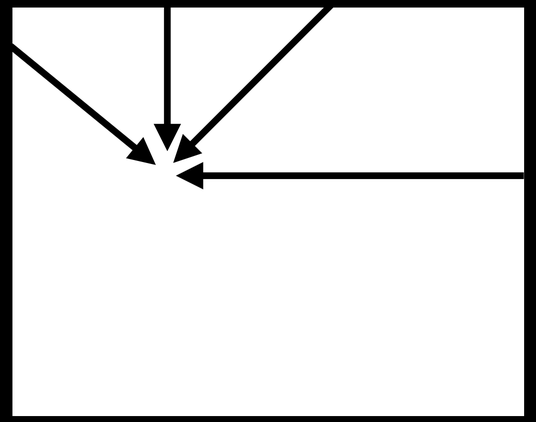
Cost Aggregation Results

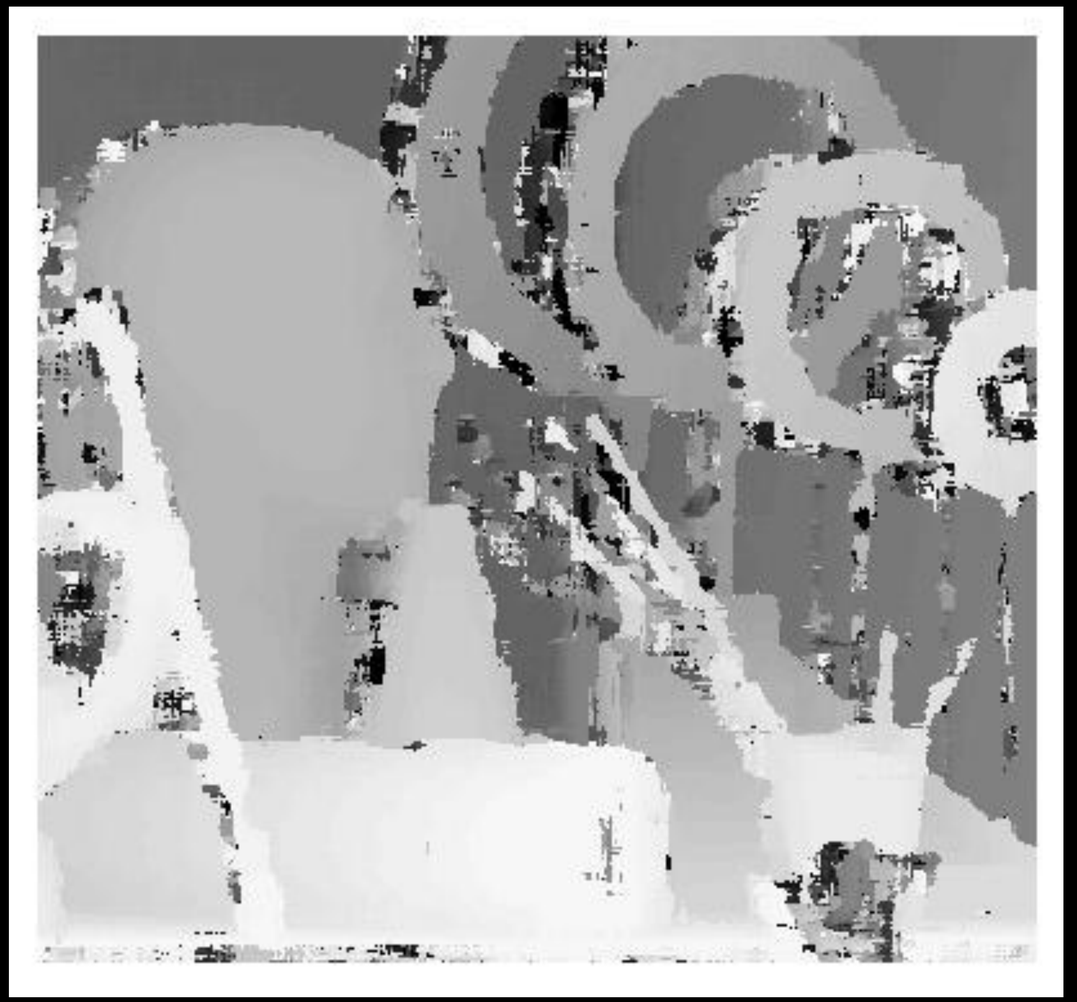
- 4 path A



Cost Aggregation Results

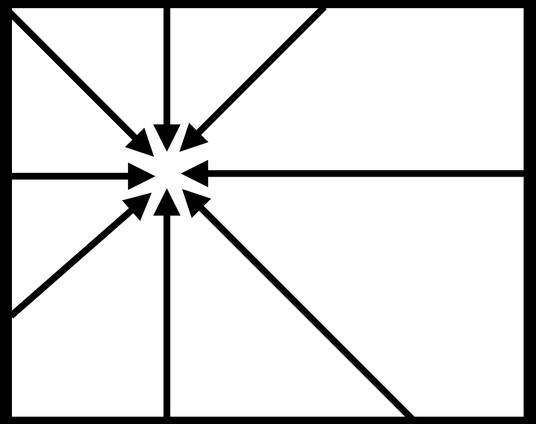
- 4 path B

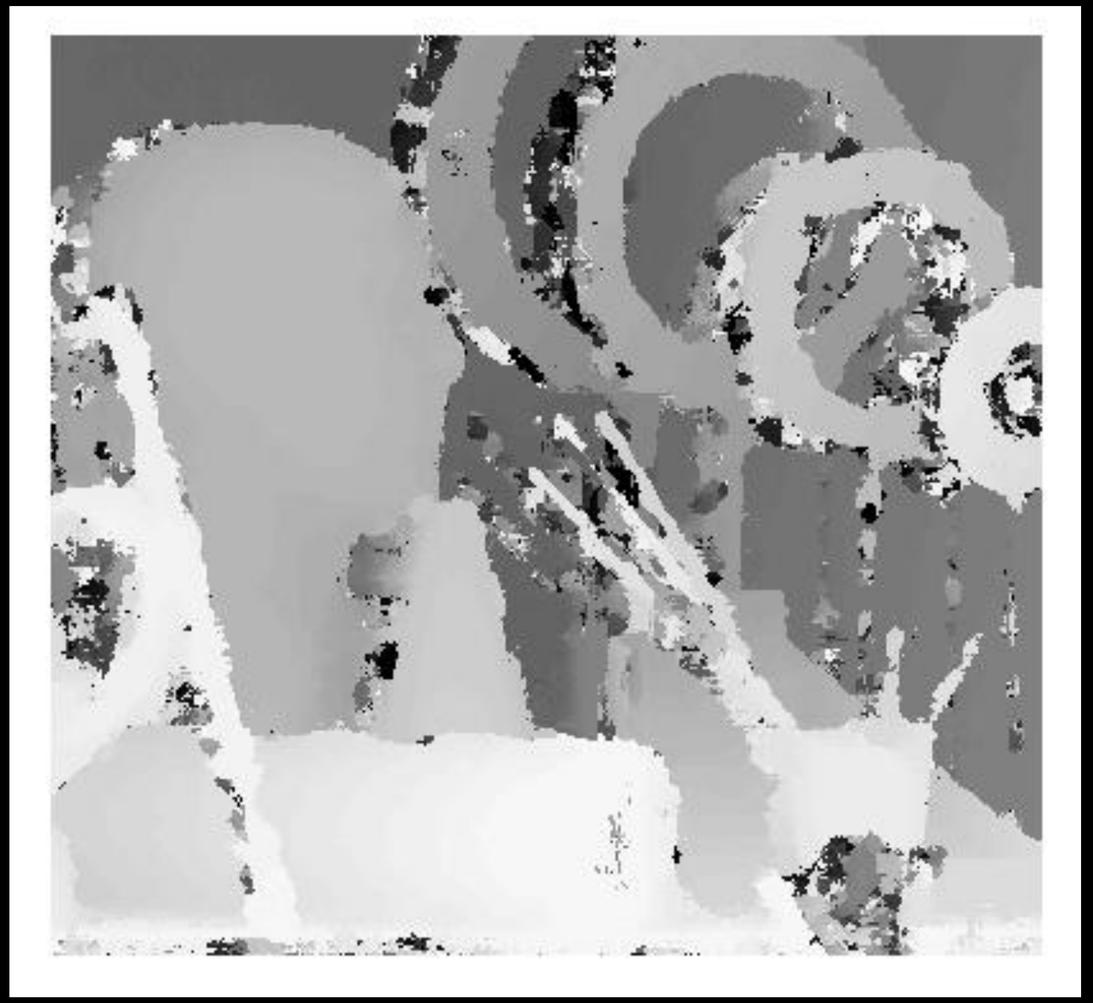




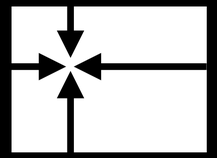
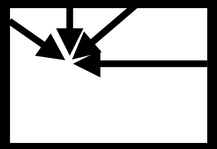
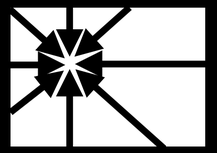
Cost Aggregation Results

- 8 path





Cost Aggregation Results

	PATH	Runtime	Bad4	Bad2
	NO CA	61.3	0.127	0.132
	4 PATH A	106.8	0.085	0.089
	4 PATH B	94.7	0.086	0.091
	8 PATH	126.9	0.080	0.084

L-R check

- SGM based on Left image + SGM based on Right image

- for i, j in Left image:
  - if | d_left_ij - d_right_ij |>1 , set d_left_ij = invalid

L-R check Result

no LR check

with LR check

DDR — For Sequences

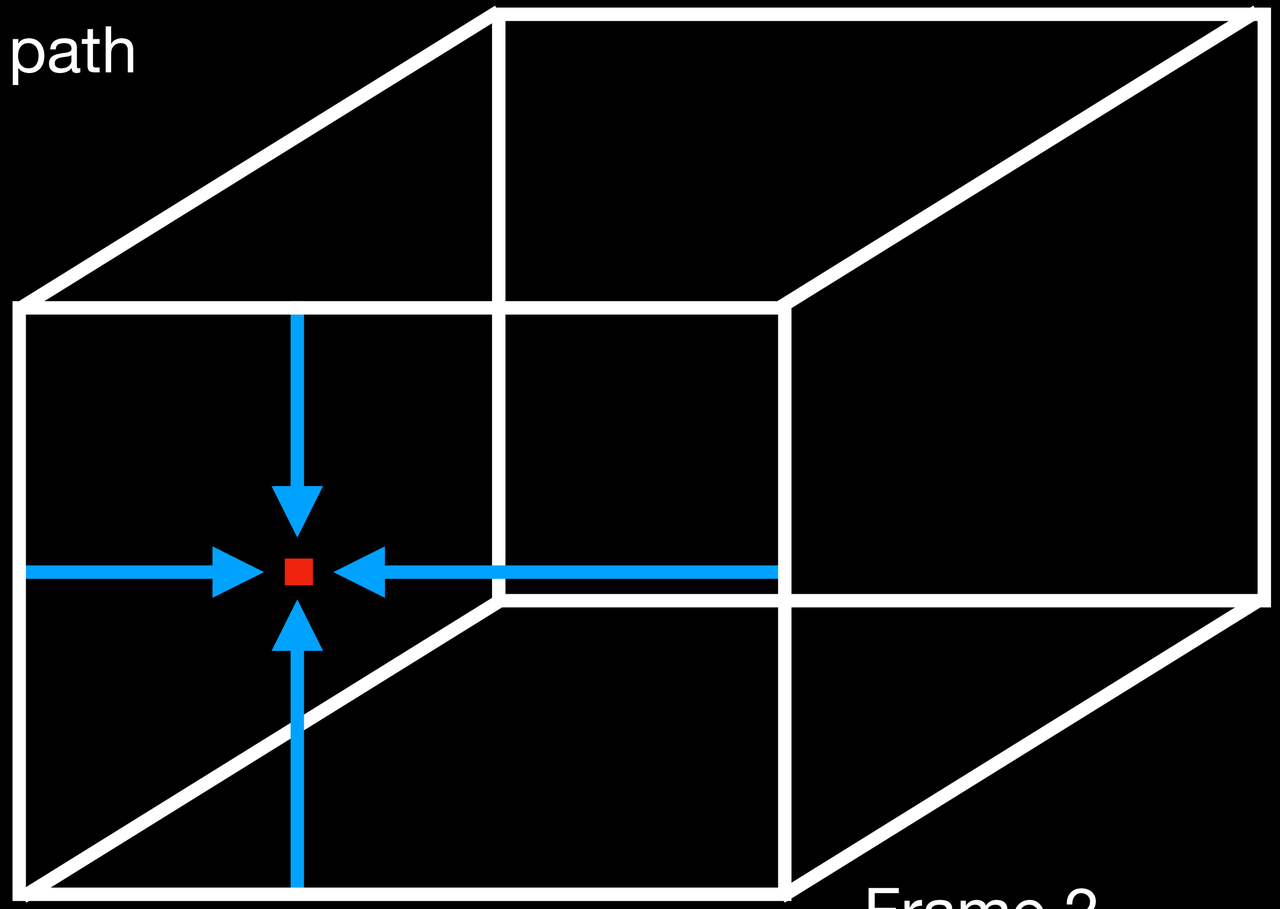
DDR-SGM

- image -> video
- temporal correlation between frames
- improve computational efficiency

- Search range_t_ij = [d_t-1_ij - R_range , d_t-1_ij + R_range]
- Recompute SGM at points where Lr exceeds threshold

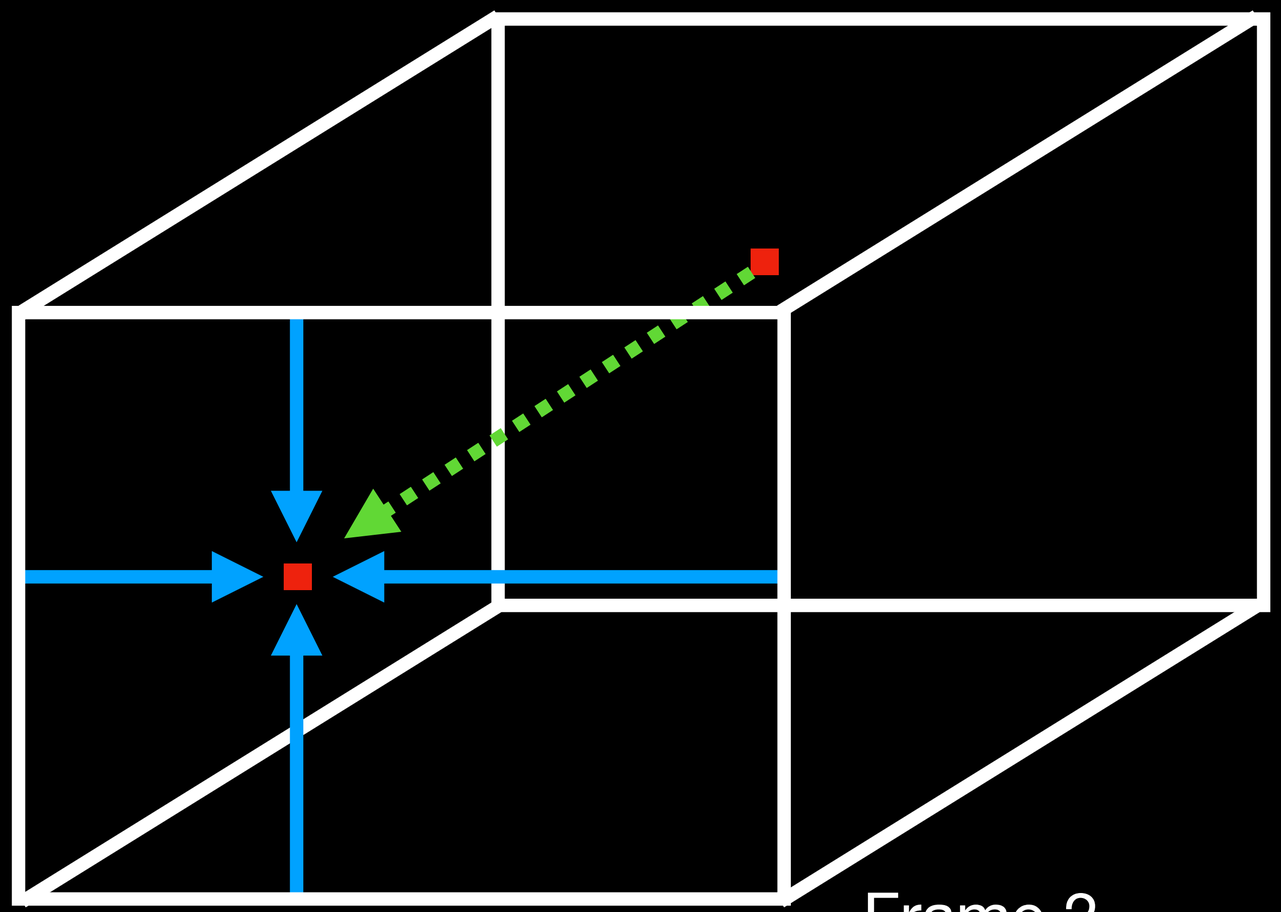
DDR-SGM

- Cost Aggregation：new path



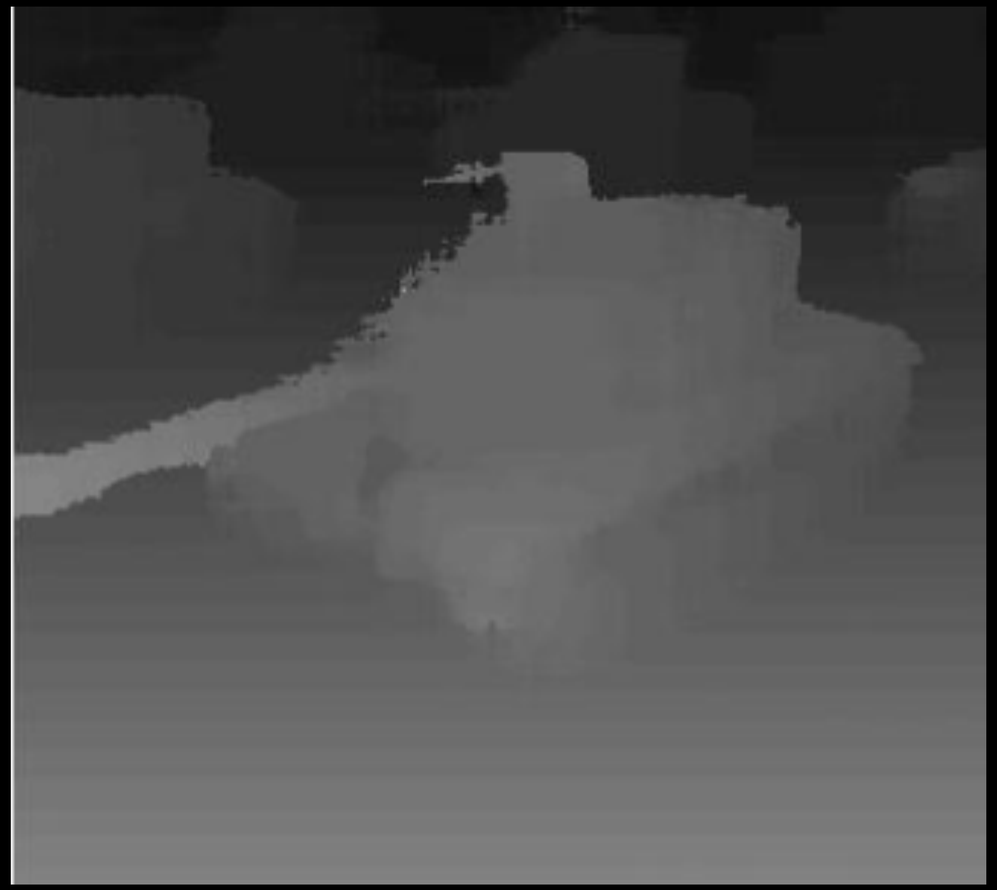
DDR-SGM

- Cost Aggregation： new path



DDR-SGM Results

- TH = 10
- R range = 20
- D range = 64
- Window size = 11
- p1 = 0.6
- p2 = 2.5
- # Frames = 70

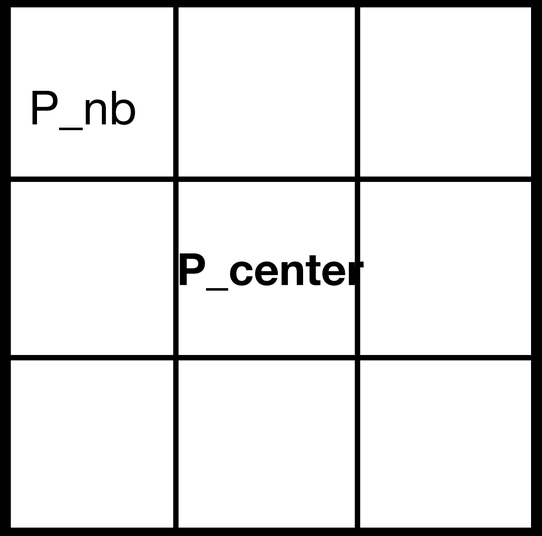


DDR-SGM Results

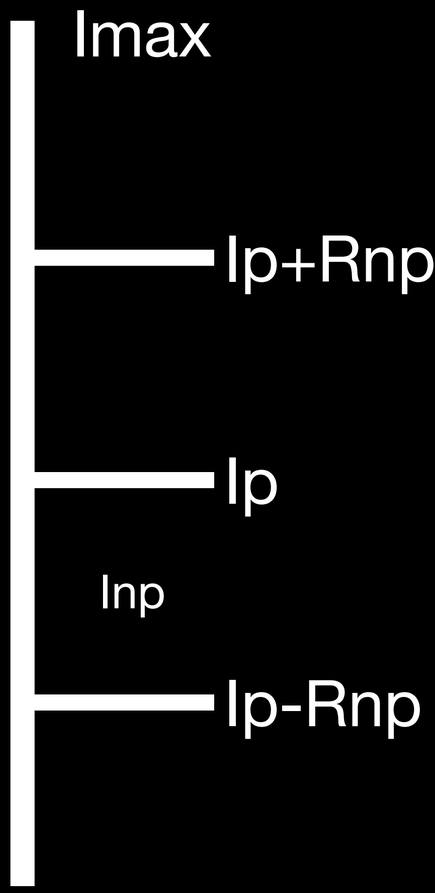
Method	Runtime/F	avrBad4	avrBad2
SGM	70.8	0.022	0.156
DDR-SGM	55.8	0.028	0.184

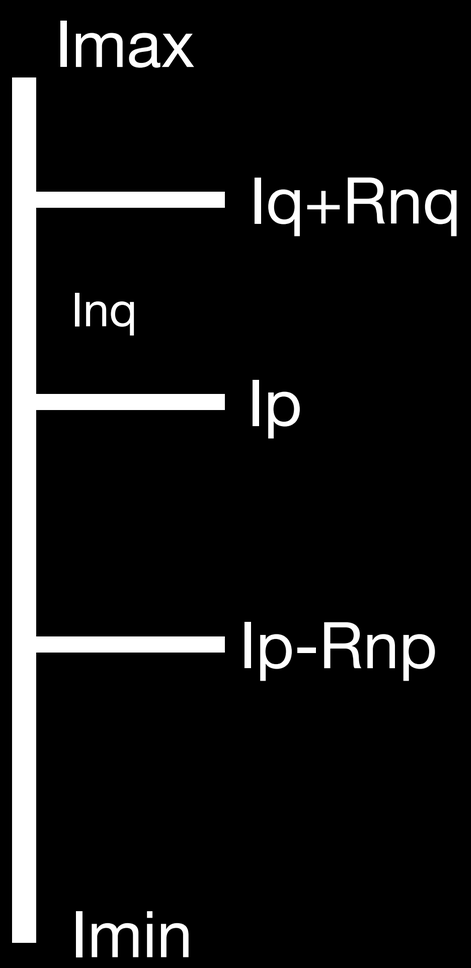
Other Ideas

Other Ideas I — “Neighbor Range” Cost

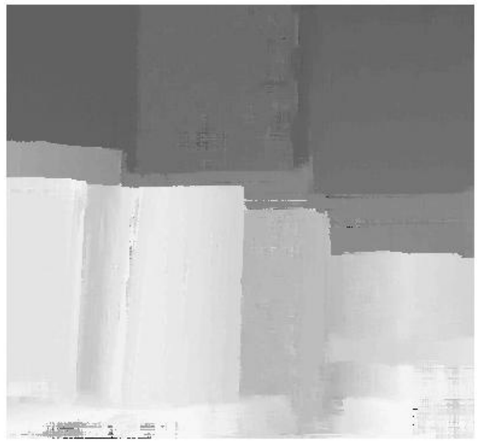


逻辑判断





Other Ideas I — “Neighbor Range” Cost



census

RT 60.1s

bad 4 : 0.127

bad 2 : 0.132

NR0.03

RT 88.1s

bad 4 : 0.106

bad 2 : 0.111

NR0.05

RT 79.9s

bad 4 : 0.179

bad 2 : 0.196

NR1.5

RT 88.1s

bad 4 : 0.106

bad 2 : 0.1

Other Ideas II — “Differential Weighed” Evaluation

关注细节：

For p_ij in dis_map

weight(i,j) = diff_mask (GT(p_ij))

cost _ij = weight(i,j) * (GT(p_ij) - dis_map(p_ij))

cost = sum(cost_ij)

Thank You