REAL-TIME LIGHT FIELD DEPTH ESTIMATION VIA GPU-ACCELERATED MULTI-VIEW SEMI-GLOBAL MATCHING

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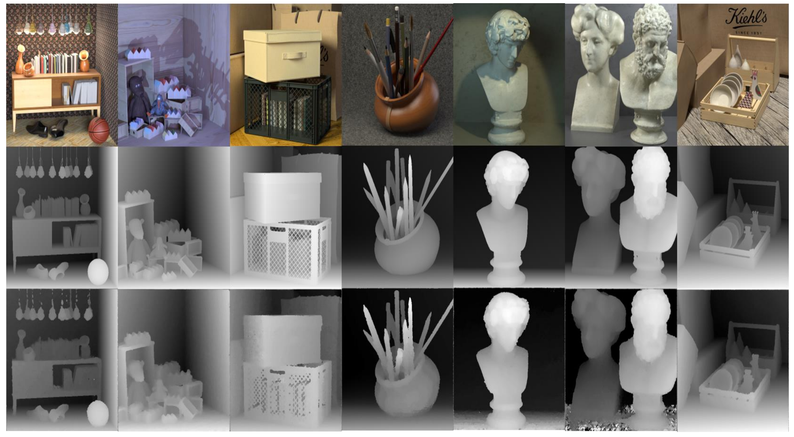
Introduction

The structured and redundant imagery of light field cameras can provide more robust depth estimation results while on the other hand demands a huge computation power, which limits its real-time applications, such as online industrial monitoring, 3D endoscopic surgery etc. This paper extends the classical SGM(Semi-global matching) algorithm to a light filed multi-view stereo framework.

Information about our algorithm

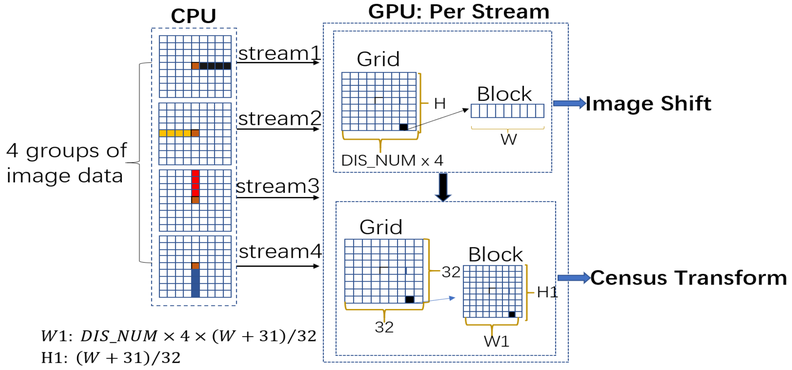
- Algorithm description
- In a light field, we choose central cross of horizontal and vertical views as the input of our algorithm. As Fig.1 shown,
- our method will output the disparity map of the center sub-view.



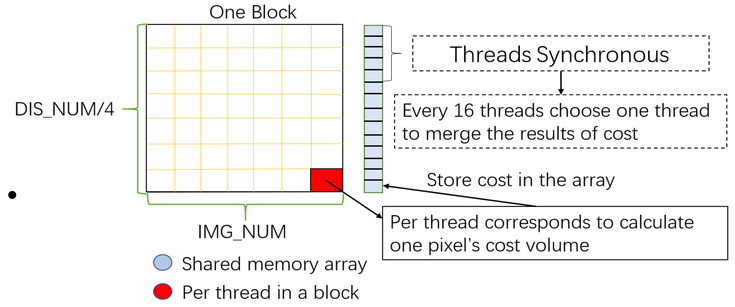
(a) (b) (c) (d) (e) (f) (g)

- Fig.1 Disparity map tested on 4D Light Field Dataset, second row is the ground truth, the third row is the results of our method.

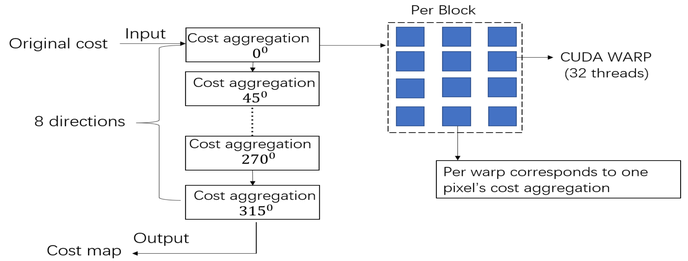
- Parallelization optimization
- (1).Image array preprocessing



- Fig.2 Preprocessing step using multi-streams consisting of sub-pixel interpolation and census transform.
- (2).Census Cost initialization

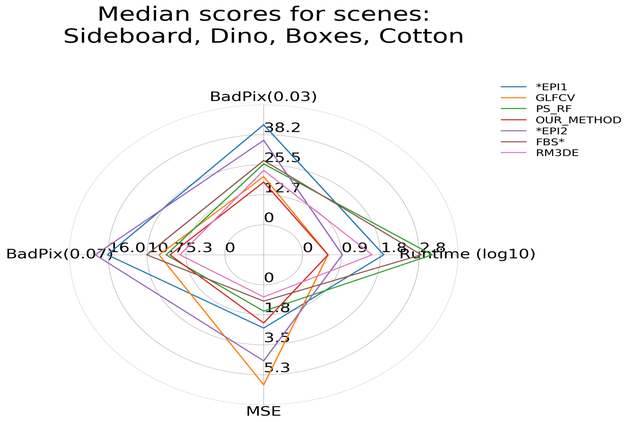


- Fig.3 Every M threads form a threads' group and a shared memory array is used to store intermediate label.
- (3).Semi-global cost aggregation



- Fig.4 Conducting path cost aggregation from 8 directions.

Experiment's Result



- Fig.5 Metrics: MSE, Badpix0.03, Badpix0.07, Running Time
- We proposed a GPU accelerated real-time light-field depth estimation method taking advantage of the disparity constraint among the sub-aperture images. Our method achieves real-time performance of more than 20fps which promises its application to many running time stringent circumstances.