



Institute for Research in Fundamental Sciences

MemoCode 2013 Hardware/Software Co-design Contest : **Stereo Matching**

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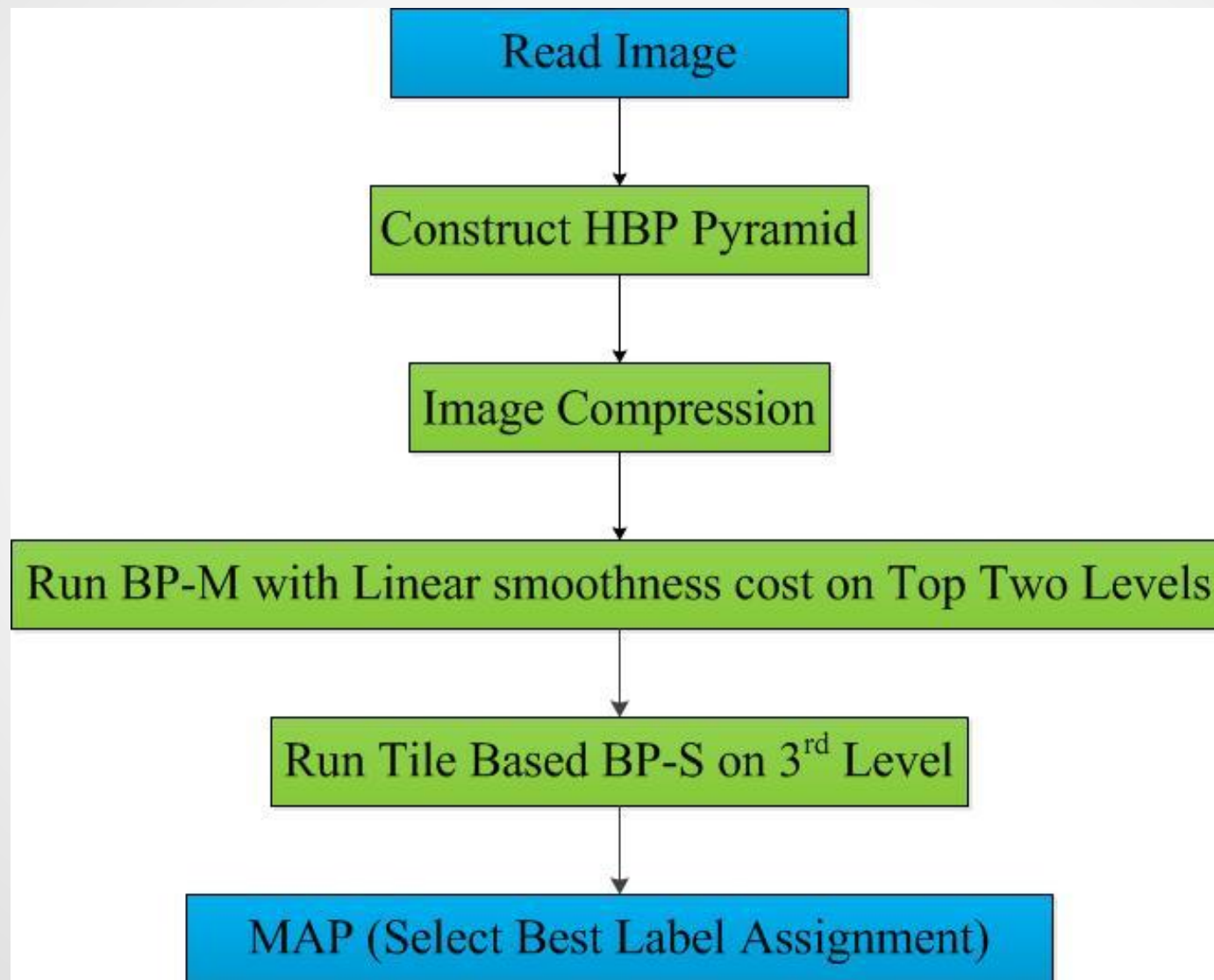
Introduction

- Solving early vision problems involves assigning labels to the pixels
- These labels can be assigned certain quantities such as disparity or motion vector.
- Several approximation methods such as Loopy Belief Propagation and Graph Cuts are proposed.
- The general energy minimization problem can be defined as:

$$E(f) = \sum_{p \in P} D_p(f_p) + \sum_{(p,q) \in N} W(f_p, f_q)$$

- This model can be justified in terms of maximum a posteriori estimation of a Markov Random Field (MRF)

Proposed Method



Proposed Method

1. Linear Smoothness Cost

This reduces time required to compute a single message update from $O(l^2)$ to $O(l)$

2. Multi scale Belief Propagation

This method eliminates the need of running several iterations on image

3. Image Compression

This method exploits locality available in image to reduce memory access and runtime

4. Tile based BP-S

This used to further speed up processing 3rd level of data pyramid

Experimental Results

Platform	Time	Cost Estimation (Proc + 256MB Mem)
Intel Core i7 920 @ 2.67GHz	1145 us	\$305.00 + \$10
Intel Core i5 M460 @ 2.53GHz	3451 us	\$54 + \$10
Intel Xeon 5650 @ 2.67GHz	840 us	\$1003.99 + \$10

Image Set	Teddy			Venus			Cones		
Methods									
Diff. Evaluations	nonocc	all	disc	Nonocc	all	Disc	nonocc	All	disc
Referenced	18.6	26.5	31.0	3.70	5.22	29.2	9.41	18.6	21.5
Our Method	18.0	26.1	35.3	4.89	6.38	31.4	14.5	22.9	26.8

References

- [1] Pedro F.Fenzelswalb , Daniel P.Huttenlocher , “Efficient Belief Propagation for Early Vision” , International Journal of Computer Vision 70(1), 41-54 , 2006
- [2] Middlebury MRF benchmark. Available online at:
<http://vision.middlebury.edu/MRF/code/>
- [3] Eriko Nurvitadhi, “MEMOCODE 2013 Hardware/Software Codesign Contest: Stereo Matching” International Conference on Formal Methods and Models for Codesign (MEMOCODE), 2013.