**1. LOW MEMORY COST BLOCK-BASED BELIEF PROPAGATION FOR STEREO CORRESPONDENCE**

The typical belief propagation has good accuracy for stereo correspondence but suffers from large run-time memory cost . In this paper,It is proposed that a block-based belief propagation algorithm for stereo correspondence that partitions an image into regular blocks for optimization. With independently partitioned blocks, the required memory size could be reduced significantly by 99% with slightly degraded performance.

Stereo correspondence is used in in computer vision to find the depth among the cameras and objects. This depth inference problem could be further transformed to a disparity inference problem by assuming that the cameras and objects are under epipolar geometry. The inferred disparity information could be widely applied to tracking, surveillance system, and multiview video coding .

The stereo matching algorithms can be roughly divided into two categories.local approaches and global approaches. Local approaches] select disparities of image pixels using the information in a window. Therefore local approaches are faster than global approaches. However, it results in poor accuracy since the local approaches could not deal with textureless regions and occluded regions well due to the insufficient information in window.

On the other hand, global approaches can handle the textureless and occluded regions well by formulating disparity inference as an energy minimization problem. The energy function usually has a smoothness constraint which represents a certain physical relationship between neighboring pixel pair. This smoothness constraint often enforces penalty on the energy function, if the labels (disparities or segments) of neighboring pixels are inconsistent. Among the global methods, 2-D optimization algorithms such as graph cut and belief propagation (BP) have been applied quite successfully to optimize energy function.

The BP algorithms construct 2-D graph structures with nodes representing all the pixels in the disparity images to find the disparity map with energy closer to the global minima. However, the vast number of nodes in the 2-D graph result in extremely high computation complexity, thereby rendering 2-D optimization is too difficult to be directly implemented for real-time application.

To address above problems, in this paper it is proposed that ,a block-based BP algorithm that directly partitions an image into separated independent blocks. Thus, can reduce the memory size significantly due to block based computation. In addition, the independent blocks also enable parallel computation by multiple computation units. Moreover earlier convergence for each block can also improve the long running time.

Conclusion of this paper,a new stereo matching algorithm partitions an image to block and optimizes with belief propagation technique.This method reduces memory stogarge size by 99% with good performance.

Future work is possible is to enhance the interaction between neighbouring blocks such that the independent block could extract useful information from neighbouring finished processing blocks.

**[2.]Efficient Belief Propagation for Early Vision**

Markov random field models provide a robust and unified framework for early vision problems such as stereo and image restoration. Inference algorithms based on graph cuts and belief propagation have been found to yield accurate results, but despite recent advances are often too slow for practical use. In this paper we present some algorithmic techniques that substantially improve the running time of the loopy belief propagation approach.

One of the techniques reduces the complexity of the inference algorithm to be linear rather than quadratic in the number of possible labels for each pixel, which is important for problems such as image restoration that have a large label set.

Another technique speeds up and reduces the memory requirements of belief propagation on grid graphs.

A third technique is a multi-grid method that makes it possible to obtain good results with a small fixed number of message passing iterations, independent of the size of the input images.

Taken together these techniques speed up the standard algorithm by several orders of magnitude. In practice we obtain results that are as accurate as those of other global methods (e.g., using the Middlebury stereo benchmark) while being nearly as fast as purely local methods.

In this research paper concluded that three algorithmic techniques for speeding up the belief propagation approach for solv- ing low level vision problems formulated in terms of Markov random fields. The main focus of the paper is on the max-product formulation of belief propagation, and the corresponding energy minimization problem in terms of costs that are proportional to negative log prob- abilities.

The first of the three techniques reduces the time necessary to compute a single message update from O (k2 ) to O (k), where k is the number of possible la- bels for each pixel. For the max-product formulation.

**[3] Hardware-Efficient Belief Propagation**

Loopy belief propagation (BP) is an effective so- lution for assigning labels to the nodes of a graphical model such as the Markov random field (MRF), but it requires high memory, bandwidth, and computational costs.

the loopy BP has been widely applied to stereo matching , image denoising , image inpainting , and super resolution. The success of BP is due to its regularity and simplicity. It uses a simple message update process to iteratively refine the beliefs of labels for each node. A message sent from one node to another is updated according to neighboring messages and local energy functions, using simple arithmetic operations.

However, BP algorithms generally require a great amount of memory for storing the messages, typically on the order of tens to hundreds times larger than the input data. Besides, since each message is processed hundreds of times, the sav- ing/loading of messages consumes considerable bandwidth. Therefore, although BP may work on high-end platforms such as desktops, it cannot be applied to most consumer electronic devices that have limited memory, computational power, and energy. sequential procedure, it is difficult to utilize hardware parallelism to accelerate BP.

In this paper, it is proposed that two techniques,

The first one is tile-based BP and fast message construction, to address these issues. Tile-based BP splits the Markov random field (MRF) into many tiles and only stores the messages across the neighboring tiles. The memory and bandwidth required by this technique is only a fraction of the ordinary BP algorithms. But the quality of the results, as tested by the publicly available Middlebury MRF benchmarks, is comparable to other efficient algorithms.

Second technique is that The fast message construction technique is based on the observation that many hypotheses used to construct the mesasages are repetitive. therefore, they only need to be computed once. This observation allows us to reduce the complexity of message construction from

O(L2 ) to O(L). Moreover, unlike previous sequential algorithms, the proposed algorithm can be easily parallelized.

The proposed techniques can be realized in both hardware and software. A software reference implementation compatible to the Middlebury MRF library is available online , while two hardware examples [the first one is a very large- scale integration (VLSI) circuit and the second one a graphic processing unit (GPU) program] are analyzed in this paper.

Conclusion

The techniques used ti develop a tile-based message passing and fast message construction algorithm greatly reduced the memory, bandwidth, and computational costs of BP and enabled the parallel processing. With these two techniques, BP becomes more suitable for low-cost and power- limited consumer electronics.

These techniques can be applied to other parallel platforms

**[4] Learning continuous time Bayesian network classiﬁers**

Streaming data are relevant to ﬁnance, computer science, and engineering while they are becoming increasingly important to medicine and biology. Continuous time Bayesian network classiﬁers are designed for analyzing multivariate streaming data when time duration of event matters. Structural and parametric learning for the class of continuous time Bayesian network classiﬁers are considered in the case where complete data is available.

Conditional log-likelihood scoring is developed for structural learning on continuous time Bayesian network classiﬁers. Performance of continuous time Bayesian network classiﬁers learned when combining conditional log-likelihood scoring and Bayesian parameter estimation are compared with that achieved by continuous time Bayesian network classiﬁers when learning is based on marginal log-likelihood scoring and to that achieved by dynamic Bayesian network classiﬁers. Classiﬁers are compared in terms of accuracy and computation time. Comparison is based on numerical experiments where synthetic and real data are used. Results show that conditional log-likelihood scoring combined with Bayesian parameter estimation outperforms marginal log-likelihood scoring. Conditional log-likelihood scoring becomes even more effective when the amount of available data is limited. Continuous time Bayesian network classiﬁers outperform in terms of computation time and accuracy dynamic Bayesian network on synthetic and real data sets.

5. Conclusions

Conditional log-likelihood scoring function has been developed to learn continuous time Bayesian network classiﬁers from multivariate streaming data. A new learning algorithm for continuous time Bayesian network classiﬁers is designed by combining conditional log-likelihood scoring for structural learning with marginal log-likelihood parameter estimation. Conditional log-likelihood scoring outperforms the marginal log-likelihood scoring in terms of the accuracy achieved by continuous time Bayesian network classiﬁers

Future work :

Continuous Time Bayesian Network Classiﬁers eﬃciently address the problem of classifying multivariate trajectories in the case where the class is static and the multivariate trajectories are completely observable. A possible future step is to study if it is possible to preserve the eﬃciency of the classiﬁcation algorithm, relaxing the necessity to work with completely observable trajectories. The quality of the classiﬁcation performances also suggests to extend the Continuous Time Bayesian Network Classiﬁers to the clustering problem.