International Journal of Engineering Research in Electronic and Communication Engineering (IJERECE) Vol 3, Issue 3, March 2016

A Review on a Novel Approach for Image Segmentation Using Fast Gradient and Nontrivial Transformation

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Abstract: **A comparative analysis to fast multi label color image segmentation using Convex optimization techniques were studied. The presented model is in some ways related to the well-known Mumford–Shah model, but deviates in certain important aspects. The optimization problem has been designed with two goals in mind. It represent fundamental concepts of image segmentation, such as incorporation of weighted curve length and variation of intensity in the segmented regions, while allowing transformation into a convex concave saddle point problem that is computationally inexpensive. The nontrivial transformation of this model into a convex–concave saddle point problem, and the numerical treatment of the problem were studied. By applying an algorithm to various images it shows that the results are competitive in terms of quality at unprecedentedly low computation times. This algorithm allows high-quality segmentation of megapixel images in a few seconds and achieves interactive performance for low resolution images.**

***Index Terms*—Unsupervised image segmentation, convex optimization.**

I. INTRODUCTION

Image segmentation is the most important part in image processing, and also main building blocks in many different computer vision applications. Image segmentation is used to reduce the information for easy analysis. In general segmentation is the partition of an image into a set of meaningful atomic regions. Segmentation also depends on various features contained in the image. It may be either color or texture. Depending on the subsequent application, one mainly distinguishes two different scenarios for segments: (a) super pixel segmentation, where one aims at partitioning the image into a large number of regions (typically hundreds), which should not straddle object boundaries, and (b) segmentations into larger perceptually meaningful regions that are frequently used for subsequent recognition tasks and in this scope are referred to as object proposals. To be able to handle the diverging requirements of the two scenarios, the state-of-the-art in image segmentation provides results in terms of a hierarchy, where the lower levels provide accurate super pixel segments, which are merged into larger hopefully semantically meaningful segments at higher levels. Especially the remarkable Ultra Contour Map (UCM) [3] has led to improved performance in several diverse computer vision applications that are based on a segment hierarchy. For example, the UCM was used for distinguishing between internal and occlusion boundaries in video streams based on an optical flow analysis.

The approach significantly outperformed the state-of-the art in this field. In the UCM was exploited to learn the parameters of a Conditional Random Field (CRF), which is frequently used for image labeling. Authors showed how to learn 105 parameters in a global optimal manner, allowing to derive previously unclear key findings for the area of parameter learning. In the problem of segmenting and recognizing objects was addressed by combining bottom-up segmentation cues from the UCM with top-down sliding window part models. Evaluation showed that the proposed semantic segmentation method especially outperforms state-of-the-art approaches on articulated objects. In a random field image labeling problem was formulated over a UCM hierarchy and it is demonstrated that optimal solutions for the defined graph, which is denoted as pylon model, can still be found by standard graph cut algorithms.

Existing convex approaches typically suffer from high computational costs, especially when separating into incorporating all the basic aspects of the gradient-based Mumford-Shah approach while maintaining an easy and efficiently-to-handle convex saddle point structure to enable fast computation. This is inspired by the previous work on the Mumford-Shah functional by Alberti *et al.* [6] and the works of Pock *et al.* and Strekalovskiy *et al.*, which build upon Alberta's investigations. In Section II introducing a model by considering the binary segmentation case. Which derive its unique saddle point representation and present non-trivial extensions that allow for multi-region segmentation and proper color information treatment.

II.RELATED WORK

In [7] proposed Discrete-continuous gradient orientation estimation for faster image segmentation. The state-of-the-art in image segmentation builds hierarchical segmentation structures based on analyzing local features in spectral settings. Because of their performance, such segmentation approaches become building blocks in the computer vision applications. It is based on a discrete-continuous optimization of oriented gradient signals. To provide segmentation performance competitive to state-of-the-art on BSDS 500 and decreasing the computation time by a factor of 30 and memory demands by a factor of 10.

In [8], proposed a new model and simple algorithms for Mumford-shah problems that is the problem of jointly estimating a partitioning of the domain of the image. It is difficult to find the smooth approximations and to solve the minimization in practice. Some algorithms are formulated by using the statistical model from the Mumford-shah functional is derived. This can demonstrate on joint multilabel and denoising, and joint multi-label motion segmentation and flow estimation.

In [9], proposed a convex approach for minimal partitions. In this we describe a problem of minimal perimeter partitions. It is based on image analysis applications like image segmentation. Several approaches were proposed in solving this problem. In this method 'potts model' algorithm is used. This minimizes the dimensional measures of the total interface of an image.

In [10], proposed convex relaxation techniques for segmentation stereo and multi view reconstruction from multiple images. In this we can retain the original stereo weighted surface area. An efficient parallel implementation of this convex optimization problem on a graphics card. Based on the photo consistency map and set of image silhouettes. Therefore we can compute highly accurate and silhouette-consistent reconstructions for challenging real world data sets in less than one minute.

In[11], proposed quick shift image segmentation GPU. It is based on the quick shift image segmentation algorithm that is similar in the concept of mean shift or mediod shift most related work involving GPUs for segmentation is in the medical imaging domain. An implementation of quick shift over ten times faster on similar hardware.

In [12], proposed preconditioning techniques for image segmentation. The convex optimization problems are solved by using first order primal dual algorithms. The minimal partitioning problems and the saddle point problems can also completed by primal-dual algorithm. This becomes a standard algorithm in computer vision since it can be applied to a large class of convex optimization problems arising in computer vision.

In [13], proposed a morphological gradient based active contour model. Because of slow computation, inaccuracy and loss of information a novel segmentation algorithm based on active contour models to overcome this weakness by applying a morphological gradient based edge detector to color images, it helps in avoiding losing color characteristics. This algorithm evolves the contour faster and segments the boundary of objects more precisely in color images and also for accuracy and computational time.

In [14], propose a first tractable formulation of the vectorial Mumford-shah functional it allows to compute high quality that is piecewise smooth approximations of color images independent of the initialization. A well known Ambrosio-Tortorelli approximation and with the classical total variation confirm the advantages of the proposed relaxation for contrast preserving and edge enhancing regularization

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III.EXISTING SYSTEM

BSDS 500	Cover		PRI		VoI	
	ODS	OIS	ODS	OIS	ODS	OIS
Human[6]	0.72	0.72	0.88	0.88	1.17	1.17
ucm [7]	0.59	0.63	0.81	0.85	1.70	1.52
red-spectral [8]	0.56	0.62	0.81	0.85	1.78	1.56
agg-merge [9]	0.56	0.60	0.81	0.84	1.78	1.66
mean-shift [10]	0.54	0.58	0.79	0.81	1.85	1.64
graph-seg [11]	0.52	0.57	0.80	0.82	2.21	1.87
norm-cut [12]	0.45	0.53	0.78	0.80	2.23	1.89
canny-ucm [13]	0.49	0.55	0.79	0.83	2.19	1.89
DC-Seg[14]	0.58	0.63	0.82	0.85	1.75	1.59
DCSegappr[15]	0.59	0.64	0.82	0.85	1.69	1.52

DC-Seg-full[16]	0.59	0.64	0.82	0.85	1.68	1.54

Table 1: Evaluation of image segmentation methods on the Berkeley segmentation dataset BSDS 500. Scores if selecting the optimal dataset scale (ODS) or the optimal image scale (OIS) are shown. To measure the quality of the obtained segmentation results, the coverage (Cover), the Probabilistic Rand Index (PRI) and the Variation of Information (VoI) is used.

Figure: Original and LAB Converted Image

Figure2: L Channel and FCM Segmentation

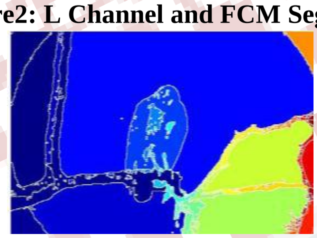

Figure3: Final Segmentation by Watershed Algorithm

MSE	PSNR
MSE(:,:,1) =4.1543e+03	PSNR(:,:,1) =11.9458
MSE(:,:,2) =5.5099e+03	PSNR(:,:,2) =10.7194
MSE(:,:,3) =1.8128e+03	PSNR(:,:,3) =15.5474

Table 2: MSE & PSNR values for Proposed Approach

MSE	PSNR
MSE(:,:,1) =6.7683e+03	PSNR(:,:,1) =9.8260
MSE(:,:,2) =6.7624e+03	PSNR(:,:,2) =9.8298
MSE(:,:,3) =3.1579e+03	PSNR(:,:,3) =13.1369

Table 3: MSE & PSNR values for Watershed Approach

IV.CONCLUSION

In these existed comparisons a very fast method for unsupervised, gradient based image segmentation. An evaluated approach on different test cases, and achieve high-quality results at a fraction of the usually required computation time functional), which would further improve quality. These ideas can be applied to a more general class of optimization problems that tries to minimize gradient norms specifically excluding boundaries. While the presented approach works autonomously, additional user input can be incorporated to increase the visual quality of the segmentation. For example, it would be an interesting and Useful extension to let the user influence the weights for each energy term in the objective functions locally at each pixel. Because of the short computation times it would also be interesting to see real time interaction of the user with the algorithm via some sort of GUI.

V. REFERENCES

[1] M. Wertheimer, Laws of Organization in Perceptual Forms. Orlando, FL, USA: Harcourt Brace Jovanovich, 1938.

[2] K. W. Tobin, Jr., et al., “Automated feature generation in large-scale geospatial libraries for content-based indexing,” Photogrammetric Eng. Remote Sens., vol. 72, no. 5, pp. 531–540, May 2006.

[3] S. M. Aqil Burney, Humera Tariq, “ K-Means Cluster Analysis for Image Segmentation”, International Journal of Computer Applications (0975 – 8887) Volume 96– No.4, June 2014, pp. 1-8.

[4] Amanpreet Kaur Bhogal, Neeru Singla,Maninder Kaur, “Color image segmentation using k-means clustering algorithm”, International Journal on Emerging Technologies 1(2), 2010,pp. 18-20.

[5] D.J. Bora, A.K. Gupta, “Clustering Approach Towards Image Segmentation: An Analytical Study”, IJRCAR,Vol2,Issue 7,July 2014, pp. 115-124

[6] D.J. Bora, A.K. Gupta, F.A. Khan, “ Comparing the Performance of L*A*B* and HSV Color Spaces with Respect to Color Image Segmentation”, International Journal of Emerging Technology and Advanced

Engineering, Volume 5, Issue 2, February 2015, pp. 192-203.

[7] C Mythili, V.kavitha, "Color Image Segmentation using ERKFCM", International Journal of Computer Applications 41(20), March 2012, pp.21-28.

[8] Juraj Horvath, "Image Segmentation using Fuzzy C-means", SAMI 2006.

[9] B.-W. Hong, Z.Lu, and G. Sundaramoorthi, " A new model and simple algorithms for multilabel mumford- shah problems," in Proc. IEEE Conf. Comput> Vis. Pattern Recognition (CVPR), June 2013, pp.1219-1226

[10] A.Chambolle, D.Cremers, and T.Pock, "A convex approach to minimal partitions," SIAM J.Imag.Sic., vol. 5, no. 4, pp. 1133-1158, 2012.

[11] D.Cremers, T.Pock, K. Kolev, and A.Chambolle "Convex relaxation techniques for segmentation, stereo and multiview reconstruction," in Markov Random Fields For vision and Image Processing. Carabridge, MA,USA, MIT Press, 2011

[12] B.Fulkerson and S.Soatto, "Really quick shift : Image segmentation on a GPU,"in Proc. 11th Eur.conf. Trends Topics Xomput.Vis.(ECCV),Heraklion, Greece, Sep. 2010

[13] Rahman, M.H., Islam, M.R., "Segmentation of color image using adaptive thresholding and masking with watershed algorithm," Informatics, Electronics & Vision (ICIEV), 2013 International Conference on , vol., no., pp.1,6, 17-18 May 2013

[14] Amit Chaudhary , Tarun Gulati, "Segmenting Digital Images Using Edge Detection", International Journal of Application or Innovation in Engineering & Management, Volume 2, Issue 5, May 2013, pp. 319-323.

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