Appendix A

Variational Optimization

The variational optimization function has been used as:

A.1 Energy function

The MRF has been used as a energy minimization problem. The energy is denoted as:

$$\underset{X}{argmin}(E(x,y)) = \underset{X}{argmin}(y-x) + \lambda \sum_{x_i,x_j \varepsilon N} (x_i x_j + (1-x_i)(1-x_j) \tag{A.1}$$

$x_i, x_j \varepsilon N$ represents that x_i, x_j are adjacent. In continuous image functions, the term $\sum_{x_i,x_j \varepsilon N} (x_i x_j + (1-x_i)(1-x_j)$ has used to penalize the optimization problem given Y is observation and (Y-X) is regularization factor. For a binary problem, the equation can be converted to Bernoulli equation as:

$$P(x|y) = \prod_i (p(y|x=a)^{1-x_i} p(y|x=b)^{x_i} exp(\lambda(1-x_i)(1-x_j)) \tag{A.2}$$

The terms $exp(\lambda(1-x_i)(1-x_j))$ can be used as prior or x. The equation becomes as:

$$P(x|y) \propto \phi(y_i)x_i + (\lambda(1-x_i)(1-x_j)) \tag{A.3}$$

where

$$\phi(y_i) = \frac{ln(P(y_i|x_i = a))}{ln(P(y_i|x_i = b))}$$

. The term $\phi(y_i)x_i$ is an error correction cost and ln P(x—y) has been maximised. The EPS and two phase label energy minimization are two main schemes that use these equations for minimisation.

A.2 Variations by Minimizing Least Square Regression

We can minimize the variational optimization by converting it to a least square regression and minimizing the error. Let X,β ,ε, and y is datacost, slope, and smoothness cost. The function is defined as:

$$Y = X\beta + \varepsilon \tag{A.4}$$

If $X\beta$ is Y1 then the error is:

$$e = Y - Y1 \tag{A.5}$$

Square error(SE) is:

$$SE = \sum_{i=1}^{n} (e_i)^2 \tag{A.6}$$

It can be written in matrix form as:

$$SE = e^T e \tag{A.7}$$

We can put the

$$SE = e^T e \tag{A.8}$$

Put the value of error as

$$SE = (Y - Y1)^T (Y - Y1) \tag{A.9}$$

$$SE = (Y - X\beta)^T (Y - X\beta) \tag{A.10}$$

We can apply the transpose property as

$$SE = (Y^T - \beta^T X^T)(Y - X\beta) \tag{A.11}$$

BY multiplying the equation can be transformed as

$$SE = Y^T Y - Y^T X\beta - \beta^T X^T Y + \beta^T X^T X\beta \tag{A.12}$$

To minimize this equation we have used following properties.

- X is $(m \times 1)$ and A is $(n \times m)$ matrix. $A \perp X$
- Y=A $\rightarrow \frac{\partial}{\partial X}$(Y) = 0
- Y=AX $\rightarrow \frac{\partial}{\partial X}$(Y) = A
- Y=XA $\rightarrow \frac{\partial}{\partial X}$(Y) = A^T
- Y=$X^T AX$ $\rightarrow \frac{\partial}{\partial X}$(Y) = $2X^T$A

We can put $\frac{\partial}{\partial \beta}(SE) = 0$ for minimization.

$$\frac{\partial}{\partial \beta}(SE) = 0 - Y^T X - (X^T Y)^T + 2\beta^T X^T X \tag{A.13}$$

$$\beta^T X^T X = Y^T X \tag{A.14}$$

$$\beta^T = Y^T X (X^T X)^{-1} \tag{A.15}$$

$$\beta = (X^T X)^{-1} X^T Y \tag{A.16}$$

Least square method has used in some future works to minimize the variational optimization equation after transforming the variational equation to a linear equation.

Appendix B

List of Publications

- Vishal Srivastava, Bhaskar Biswas. "Deep CNN feature fusion with manifold learning and regression for pixel classification in HSI images", **Journal of Experimental & Theoretical Artificial Intelligence**, Taylor & Francis, vol. 32, pp. 339-358, 2019. (**SCI**, I.F-2.039).

- Vishal Srivastava, Bhaskar Biswas. "An efficient feature fusion in HSI image classification". **Multidimensional Systems & Signal Processing**, Springer,vol. 31, pp. 221–247, 2020. (**SCI**, I.F-2.338)

- Vishal Srivastava, Bhaskar Biswas. "A subspace regression and two phase label optimization for High Dimensional Image classification".**Multimedia Tools & Applications**, Springer, vol. 79, pp. 5897–5918, 2020. (**SCI**, I.F-2.313)

- Vishal Srivastava, Bhaskar Biswas "CNN-based salient features in HSI image semantic target prediction", **Connection Science**, Taylor & Francis,vol. 32, pp. 113-131, 2020. (**SCI**, I.F-1.042)

- Vishal Srivastava, Bhaskar Biswas "An efficient approach for dimension selection and classification in HSI images", **Remote Sensing Letters**, Taylor & Francis, 10:9, 844-853, 2019. (**SCI**, I.F-2.298)

- Vishal Srivastava, Bhaskar Biswas. "Manifold Preservation and CNN Learning for Image Parsing in High Dimensional Feature spaces". **Neural Processing Letters**, Springer, 2021. (**SCI**, I.F-2.891)

- Vishal Srivastava, Bhaskar Biswas. ”CNN-EFF: CNN based Edge Feature Fusion in Semantic image Labelling and Parsing”. **Neural Processing Letters**, Springer, 2021. (**SCI**, I.F-2.891)

- Vishal Srivastava, Bhaskar Biswas. ”LM-MFP: Large scale Morphology and Multi-criteria based Feature Pooling for Image Parsing”. **Soft Computing**, Springer, (Under Review) 2021. (**SCI**, I.F-3.05)

- Vishal Srivastava, Bhaskar Biswas. ”Mining on the Basis of Similarity in Graph and Image Data”. in Second International Conference on **Advanced Informatics for Computing Research** (ICAICR 2018), Shimla, India, July 14–15, 2018, Springer. (**Scopus**)

Bibliography

[1] Shabab Bazrafkan, Shejin Thavalengal, and Peter Corcoran. An end to end deep neural network for iris segmentation in unconstrained scenarios. *Neural Networks*, 106:79 – 95, 2018.

[2] Thierry Bouwmans, Sajid Javed, Maryam Sultana, and Soon Ki Jung. Deep neural network concepts for background subtraction:a systematic review and comparative evaluation. *Neural Networks*, 117:8 – 66, 2019.

[3] Wongun Choi, Yu-Wei Chao, Caroline Pantofaru, and Silvio Savarese. Indoor scene understanding with geometric and semantic contexts. *International Journal of Computer Vision*, 112(2):204–220, Apr 2015.

[4] Ying Fu, Antony Lam, Imari Sato, and Yoichi Sato. Adaptive spatial-spectral dictionary learning for hyperspectral image restoration. *International Journal of Computer Vision*, 122(2):228–245, Apr 2017.

[5] Ruiqi Guo and Derek Hoiem. Labeling complete surfaces in scene understanding. *International Journal of Computer Vision*, 112(2):172–187, Apr 2015.

[6] Siyuan Huang, Siyuan Qi, Yixin Zhu, Yinxue Xiao, Yuanlu Xu, and Song-Chun Zhu. Holistic 3d scene parsing and reconstruction from a single RGB image. *CoRR*, abs/1808.02201, 2018.

[7] Nabil Ibtehaz and M. Sohel Rahman. Multiresunet : Rethinking the u-net architecture for multimodal biomedical image segmentation. *Neural Networks*, 121:74 – 87, 2020.

[8] Ryo Ito, Ken Nakae, Junichi Hata, Hideyuki Okano, and Shin Ishii. Semi-supervised deep learning of brain tissue segmentation. *Neural Networks*, 116:25 – 34, 2019.

[9] Bo Jiang, Jin Tang, and Bin Luo. Efficient feature matching via nonnegative orthogonal relaxation. *International Journal of Computer Vision*, 127(9):1345–1360, Sep 2019.

[10] Chenfanfu Jiang, Siyuan Qi, Yixin Zhu, Siyuan Huang, Jenny Lin, Lap-Fai Yu, Demetri Terzopoulos, and Song-Chun Zhu. Configurable 3d scene synthesis and 2d image rendering with per-pixel ground truth using stochastic grammars. *International Journal of Computer Vision*, 126(9):920–941, Sep 2018.

[11] Jörg H. Kappes, Bjoern Andres, Fred A. Hamprecht, Christoph Schnörr, Sebastian Nowozin, Dhruv Batra, Sungwoong Kim, Bernhard X. Kausler, Thorben Kröger, Jan Lellmann, Nikos Komodakis, Bogdan Savchynskyy, and Carsten Rother. A comparative study of modern inference techniques for structured discrete energy minimization problems. *International Journal of Computer Vision*, 115(2):155–184, Nov 2015.

[12] Alexander Kirillov, Kaiming He, Ross B. Girshick, Carsten Rother, and Piotr Dollár. Panoptic segmentation. *CoRR*, abs/1801.00868, 2018.

[13] Heesung Kwon and Nasser M. Nasrabadi. Kernel spectral matched filter for hyperspectral imagery. *International Journal of Computer Vision*, 71(2):127–141, Feb 2007.

[14] Xiaolong Liu, Zhidong Deng, and Yuhan Yang. Recent progress in semantic image segmentation. *Artificial Intelligence Review*, 52(2):1089–1106, Aug 2019.

[15] Allan Aasbjerg Nielsen. Spectral mixture analysis: Linear and semi-parametric full and iterated partial unmixing in multi- and hyperspectral image data. *Journal of Mathematical Imaging and Vision*, 15(1):17–37, Jul 2001.

[16] Claudia Nieuwenhuis, Eno Töppe, and Daniel Cremers. A survey and comparison of discrete and continuous multi-label optimization approaches for the potts model. *International Journal of Computer Vision*, 104(3):223–240, Sep 2013.

[17] Gemma Piella. Image fusion for enhanced visualization: A variational approach. *International Journal of Computer Vision*, 83(1):1–11, Jun 2009.

[18] Jake Porway, Qiongchen Wang, and Song Chun Zhu. A hierarchical and contextual model for aerial image parsing. *International Journal of Computer Vision*, 88(2):254–283, Jun 2010.

[19] Ying Shan and Zhengyou Zhang. New measurements and corner-guidance for curve matching with probabilistic relaxation. *International Journal of Computer Vision*, 46(2):157–171, Feb 2002.

[20] V. Sowmya, D. Govind, and K. P. Soman. Significance of processing chrominance information for scene classification: a review. *Artificial Intelligence Review*, Jan 2019.

[21] Meng Tang, Dmitrii Marin, Ismail Ben Ayed, and Yuri Boykov. Kernel cuts: Kernel and spectral clustering meet regularization. *International Journal of Computer Vision*, 127(5):477–511, May 2019.

[22] Joseph Tighe and Svetlana Lazebnik. Superparsing. *International Journal of Computer Vision*, 101(2):329–349, Jan 2013.

[23] Joseph Tighe, Marc Niethammer, and Svetlana Lazebnik. Scene parsing with object instance inference using regions and per-exemplar detectors. *International Journal of Computer Vision*, 112(2):150–171, Apr 2015.

[24] Elena Tretyak, Olga Barinova, Pushmeet Kohli, and Victor Lempitsky. Geometric image parsing in man-made environments. *International Journal of Computer Vision*, 97(3):305–321, May 2012.

[25] Zhuowen Tu, Xiangrong Chen, Alan L. Yuille, and Song-Chun Zhu. Image parsing: Unifying segmentation, detection, and recognition. *International Journal of Computer Vision*, 63(2):113–140, Jul 2005.

[26] Frederick Tung and James J. Little. Scene parsing by nonparametric label transfer of content-adaptive windows. *Computer Vision and Image Understanding*, 143:191 – 200, 2016. Inference and Learning of Graphical Models Theory and Applications in Computer Vision and Image Analysis.

[27] Viktor Varkarakis, Shabab Bazrafkan, and Peter Corcoran. Deep neural network and data augmentation methodology for off-axis iris segmentation in wearable headsets. *Neural Networks*, 121:101 – 121, 2020.

[28] Xue Wei, Son Lam Phung, and Abdesselam Bouzerdoum. Visual descriptors for scene categorization: experimental evaluation. *Artificial Intelligence Review*, 45(3):333–368, Mar 2016.

[29] Weiying Xie, Jie Lei, Baozhu Liu, Yunsong Li, and Xiuping Jia. Spectral constraint adversarial autoencoders approach to feature representation in hyperspectral anomaly detection. *Neural Networks*, 119:222 – 234, 2019.

[30] Tianshu Yu and Ruisheng Wang. Scene parsing using graph matching on street-view data. *Computer Vision and Image Understanding*, 145:70 – 80, 2016. Light Field for Computer Vision.

[31] Hengshuang Zhao, Jianping Shi, Xiaojuan Qi, Xiaogang Wang, and Jiaya Jia. Pyramid scene parsing network. *CoRR*, abs/1612.01105, 2016.

[32] Hongyuan Zhu, Fanman Meng, Jianfei Cai, and Shijian Lu. Beyond pixels: A comprehensive survey from bottom-up to semantic image segmentation and cosegmentation. *Journal of Visual Communication and Image Representation*, 34:12 – 27, 2016.

[33] Benediktsson, J. A., and P. H. Swain. 1992. "Consensus theoretic classification methods." *IEEE Transactions on Systems, Man, and Cybernetics* 22 (4): 688–704.

[34] Chatfield, K., K. Simonyan, A. Vedaldi, and A. Zisserman. 2014. "Return of the Devil in the Details: Delving Deep into Convolutional Nets." In *British Machine Vision Conference*, .

[35] Chatfield, Ken, Karen Simonyan, Andrea Vedaldi, and Andrew Zisserman. 2014. "Return of the Devil in the Details: Delving Deep into Convolutional Nets." *CoRR* abs/1405.3531. `http://arxiv.org/abs/1405.3531`.

[36] Das, D., and C. S. George Lee. 2018. "Unsupervised Domain Adaptation Using Regularized Hyper-Graph Matching." In *2018 25th IEEE International Conference on Image Processing (ICIP)*, Oct, 3758–3762.

[37] Das, D., and C. S. George Lee. 2018. "Graph Matching and Pseudo-Label Guided Deep Unsupervised Domain Adaptation." In *2018 27th International Conference on Artificial Neural Networks Rhodes, Greece* Oct, 342–352.

[38] Das, Debasmit, and C.S. George Lee. 2018. "Sample-to-sample correspondence for unsupervised domain adaptation." *Engineering Applications of Artificial Intelligence* 73: 80 – 91. http://www.sciencedirect.com/science/article/pii/S0952197618301088.

[39] Cahil, Chew, and Wenger. 2015. "Spatial-spectral dimensionality reduction of hyperspectral imagery with partial knowledge of class labels." *Proc. SPIE 9472, Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery* 9742 (): 4905–4922. 10.1117/12.2177139.

[40] Hu, W., Y. Huang, L. Wei, F. Zhang, , and H. Li. 2015. "Deep Convolutional Neural Networks for Hyperspectral Image Classification." *Journal of Sensors* 2015 (258619): 12.

[41] Krishnapuram, B., L. Carin, M. A. T. Figueiredo, and A. J. Hartemink. 2005. "Sparse multinomial logistic regression: fast algorithms and generalization bounds." *IEEE Transactions on Pattern Analysis and Machine Intelligence* 27 (6): 957–968.

[42] Krizhevsky, Alex, Ilya Sutskever, and Geoffrey E. Hinton. 2012. "ImageNet Classification with Deep Convolutional Neural Networks." *Neural Information Processing Systems* 25.

[43] Bioucas-Dias, and Nascimento,. 2014. "Hyperspectral Subspace Identification." *IEEE Transactions on Geoscience and Remote Sensing* 46 (8): 2435–2445. 10.1109/TGRS.2008.918089.

[44] Khodadadzadeh, Li, Plaza, Ghassemian,Bioucas-Dias. 2014. "Spectral–Spatial Classification of Hyperspectral Data Using Local and Global Probabilities for Mixed Pixel Characterization." *IEEE Transactions on Geoscience and Remote Sensing* 52 (10): 6298–6314. 10.1109/TGRS.2013.2296031.

[45] Landgrebe, David A. 2005. *Signal Theory Methods in Multispectral Remote Sensing*. Newark, NJ: Wiley. https://cds.cern.ch/record/995182.

[46] Cai, Qing, Huiying Liu, Yiming Qian, Sanping Zhou, Xiaojun Duan, and Yee-Hong Yang. 2019. "Saliency-guided level set model for automatic object segmentation." *Pattern Recognition* 93: 147 – 163. http://www.sciencedirect.com/science/article/pii/S0031320319301657.

[47] Chatfield, K., K. Simonyan, A. Vedaldi, and A. Zisserman. 2014. "Return of the Devil in the Details: Delving Deep into Convolutional Nets." In *British Machine Vision Conference*, .

[48] Cheng, G., J. Han, and X. Lu. 2017. "Remote Sensing Image Scene Classification: Benchmark and State of the Art." *Proceedings of the IEEE* 105 (10): 1865–1883.

[49] Cheng, G., Z. Li, J. Han, X. Yao, and L. Guo. 2018. "Exploring Hierarchical Convolutional Features for Hyperspectral Image Classification." *IEEE Transactions on Geoscience and Remote Sensing* 56 (11): 6712–6722.

[50] Flores, Carola Figueroa, Abel Gonzalez-Garcia, Joost van de Weijer, and Bogdan Raducanu. 2019. "Saliency for fine-grained object recognition in domains with scarce training data." *Pattern Recognition* 94: 62 – 73. http://www.sciencedirect.com/science/article/pii/S0031320319301773.

[51] Han, J., R. Quan, D. Zhang, and F. Nie. 2018. "Robust Object Co-Segmentation Using Background Prior." *IEEE Transactions on Image Processing* 27 (4): 1639–1651.

[52] Han, J., D. Zhang, X. Hu, L. Guo, J. Ren, and F. Wu. 2015. "Background Prior-Based Salient Object Detection via Deep Reconstruction Residual." *IEEE Transactions on Circuits and Systems for Video Technology* 25 (8): 1309–1321.

[53] Hu, W., Y. Huang, L. Wei, F. Zhang, , and H. Li. 2015. "Deep Convolutional Neural Networks for Hyperspectral Image Classification." *Journal of Sensors* 2015 (258619): 12.

[54] Kadir, T., and M. Brady. 2003. "Scale Saliency: a novel approach to salient feature and scale selection." In *2003 International Conference on Visual Information Engineering VIE 2003*, July, 25–28.

[55] Kadir, Timor, and Michael Brady. 2001. "Saliency, Scale and Image Description." *International Journal of Computer Vision* 45 (2): 83–105. https://doi.org/10.1023/A:1012460413855.

[56] Kagawade, Vishwanath C., and Shanmukhappa A. Angadi. 2019. "Multi-directional local gradient descriptor: A new feature descriptor for face recognition." *Image and Vision Computing* 83-84: 39 – 50. http://www.sciencedirect.com/science/article/pii/S0262885619300095.

[57] Krizhevsky, Alex, Ilya Sutskever, and Geoffrey E. Hinton. 2017. "ImageNet Classification with Deep Convolutional Neural Networks." *Commun. ACM* 60 (6): 84–90. http://doi.acm.org/10.1145/3065386.

[58] Li, W., C. Chen, H. Su, and Q. Du. 2015. "Local Binary Patterns and Extreme Learning Machine for Hyperspectral Imagery Classification." *IEEE Transactions on Geoscience and Remote Sensing* 53 (7): 3681–3693.

[59] Li, W., G. Wu, F. Zhang, and Q. Du. 2017. "Hyperspectral Image Classification Using Deep Pixel-Pair Features." *IEEE Transactions on Geoscience and Remote Sensing* 55 (2): 844–853.

[60] Li, Yanshan, XIANCHEN WANG, Qinghua Huang, Xiaohui Hu, and Xie xin. 2018. "A robust multi-view representation for spatial-spectral domain in application of hyperspectral image classification." *IET Computer Vision* .

[61] Lindeberg, Tony. 1994. "Scale-Space Theory in Computer Vision." 01.

[62] Mustafa, Hafiz Tayyab, Jie Yang, and Masoumeh Zareapoor. 2019. "Multi-scale convolutional neural network for multi-focus image fusion." *Image and Vision Computing* 85: 26 – 35. http://www.sciencedirect.com/science/article/pii/S026288561930023X.

[63] Su, P., D. Liu, X. Li, and Z. Liu. 2018. "A Saliency-Based Band Selection Approach for Hyperspectral Imagery Inspired by Scale Selection." *IEEE Geoscience and Remote Sensing Letters* 15 (4): 572–576.

[64] Szegedy, C., Wei Liu, Yangqing Jia, P. Sermanet, S. Reed, D. Anguelov, D. Erhan, V. Vanhoucke, and A. Rabinovich. 2015. "Going deeper with convolutions." In *2015 IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, June, 1–9.

[65] Waske, B., S. van der Linden, J. A. Benediktsson, A. Rabe, and P. Hostert. 2010. "Sensitivity of Support Vector Machines to Random Feature Selection in Classification of Hyperspectral Data." *IEEE Transactions on Geoscience and Remote Sensing* 48 (7): 2880–2889.

[66] Xie, J., G. Dai, F. Zhu, E. K. Wong, and Y. Fang. 2017. "DeepShape: Deep-Learned Shape Descriptor for 3D Shape Retrieval." *IEEE Transactions on Pattern Analysis and Machine Intelligence* 39 (7): 1335–1345.

[67] Yao, X., J. Han, D. Zhang, and F. Nie. 2017. "Revisiting Co-Saliency Detection: A Novel Approach Based on Two-Stage Multi-View Spectral Rotation Co-clustering." *IEEE Transactions on Image Processing* 26 (7): 3196–3209.

[68] Zhang, D., D. Meng, and J. Han. 2017. "Co-Saliency Detection via a Self-Paced Multiple-Instance Learning Framework." *IEEE Transactions on Pattern Analysis and Machine Intelligence* 39 (5): 865–878.

[69] Zhang, Dingwen, Junwei Han, Chao Li, Jingdong Wang, and Xuelong Li. 2016. "Detection of Co-salient Objects by Looking Deep and Wide." *International Journal of Computer Vision* 120 (2): 215–232. https://doi.org/10.1007/s11263-016-0907-4.

[70] Zhang, Pingping, Wei Liu, Yinjie Lei, and Huchuan Lu. 2019. "Hyperfusion-Net: Hyper-densely reflective feature fusion for salient object detection." *Pattern Recognition* 93: 521 – 533. http://www.sciencedirect.com/science/article/pii/S0031320319301876.

[71] Lowe, David G. 2004. "Distinctive Image Features from Scale-Invariant Keypoints." *International Journal of Computer Vision* 60 (2): 91–110. https://doi.org/10.1023/B:VISI.0000029664.99615.94.

[72] Rashwan, S., and N. Dobigeon. 2017. "A Split-and-Merge Approach for Hyperspectral Band Selection." *IEEE Geoscience and Remote Sensing Letters* 14 (8): 1378–1382.

[73] Zhong, Yanfei, Ailong Ma, Yew soon Ong, Zexuan Zhu, and Liangpei Zhang. 2018. "Computational intelligence in optical remote sensing image processing." *Applied Soft Computing* 64: 75 – 93. http://www.sciencedirect.com/science/article/pii/S1568494617307081.

[74] Arrieta C, Uribe S, Sing-Long C, Hurtado D, Andia M, Irarrazaval P, Tejos C (2017) Simultaneous left and right ventricle segmentation using topology preserving level sets. Biomedical Signal Processing and Control 33:88 – 95, doi:https://doi.org/10.1016/j.bspc.2016.11.002, http://www.sciencedirect.com/science/article/pii/S174680941630180X

[75] Ayed IB, Mitiche A, Belhadj Z (2006) Polarimetric image segmentation via maximum-likelihood approximation and efficient multiphase level-sets. IEEE

Transactions on Pattern Analysis and Machine Intelligence 28(9):1493–1500, doi:10.1109/TPAMI.2006.191

[76] Bejinariu S, Luca R, Costin H (2016) Nature-inspired algorithms based multispectral image fusion. In: 2016 International Conference and Exposition on Electrical and Power Engineering (EPE), pp 010–015, doi:10.1109/ICEPE.2016.7781293

[77] Böhning D (1992) Multinomial logistic regression algorithm 44:197–200

[78] Bioucas-Dias JM, Nascimento JMP (2008) Hyperspectral subspace identification. IEEE Transactions on Geoscience and Remote Sensing 46(8):2435–2445, doi:10.1109/TGRS.2008.918089

[79] Boykov Y, Funka-Lea G (2006) Graph cuts and efficient n-d image segmentation. International Journal of Computer Vision 70(2):109–131, doi:10.1007/s11263-006-7934-5, https://doi.org/10.1007/s11263-006-7934-5

[80] Boykov Y, Kolmogorov V (2004) An experimental comparison of min-cut/max- flow algorithms for energy minimization in vision. IEEE Transactions on Pattern Analysis and Machine Intelligence 26(9):1124–1137, doi:10.1109/TPAMI.2004.60

[81] Boykov Y, Veksler O, Zabih R (2001) Fast approximate energy minimization via graph cuts. IEEE Transactions on Pattern Analysis and Machine Intelligence 23(11):1222–1239, doi:10.1109/34.969114

[82] Chan TF, Vese LA (2001) Active contours without edges. IEEE Transactions on Image Processing 10(2):266–277, doi:10.1109/83.902291

[83] Chang H, Yang Q, Auer M, Parvin B (2007) Modeling of front evolution with graph cut optimization. In: 2007 IEEE International Conference on Image Processing, vol 1, pp I – 241–I – 244, doi:10.1109/ICIP.2007.4378936

[84] Cremers D, Rousson M, Deriche R (2007) A review of statistical approaches to level set segmentation: Integrating color, texture, motion and shape. International Journal of Computer Vision 72(2):195–215, doi:10.1007/s11263-006-8711-1, https://doi.org/10.1007/s11263-006-8711-1

[85] Dai S, Lu K, Dong J, Zhang Y, Chen Y (2015) A novel approach of lung segmentation on chest ct images using graph cuts. Neurocomputing 168:799 – 807, doi:https://doi.org/10.1016/j.neucom.2015.05.044, http://www.sciencedirect.com/science/article/pii/S0925231215007201

[86] Delong A, Osokin A, Isack HN, Boykov Y (2012) Fast approximate energy minimization with label costs. International Journal of Computer Vision 96(1):1–27, doi:10.1007/s11263-011-0437-z, https://doi.org/10.1007/s11263-011-0437-z

[87] Dhillon IS, Guan Y, Kulis B (2007) Weighted graph cuts without eigenvectors a multilevel approach. IEEE Transactions on Pattern Analysis and Machine Intelligence 29(11):1944–1957, doi:10.1109/TPAMI.2007.1115

[88] Du Q, Younan NH (2008) On the performance improvement for linear discriminant analysis-based hyperspectral image classification. In: 2008 IAPR Workshop on Pattern Recognition in Remote Sensing (PRRS 2008), pp 1–4, doi:10.1109/PRRS.2008.4783168

[89] El Zehiry N, Xu S, Sahoo P, Elmaghraby A (2007) Graph cut optimization for the mumford-shah model. In: The Seventh IASTED International Conference on Visualization, Imaging and Image Processing, ACTA Press, Anaheim, CA, USA, VIIP '07, pp 182–187, http://dl.acm.org/citation.cfm?id=1659167.1659203

[90] Farhi L, Yusuf A, Raza RH (2017) Adaptive stochastic segmentation via energy-convergence for brain tumor in mr images. Journal of Visual Communication and Image Representation 46:303 – 311, doi:https://doi.org/10.1016/j.jvcir.2017.04.013, http://www.sciencedirect.com/science/article/pii/S1047320317301001

[91] Fukui, Kazuhiro (2014) Subspace methods

[92] Galambos J, Simonelli I (1997) Bonferroni-type inequalities with applications 92

[93] Keshava N, Mustard JF (2002) Spectral unmixing. IEEE Signal Processing Magazine 19(1):44–57, doi:10.1109/79.974727

[94] Li J, Bioucas-Dias JM, Plaza A (2010) Semisupervised hyperspectral image segmentation using multinomial logistic regression with active learning.

IEEE Transactions on Geoscience and Remote Sensing 48(11):4085–4098, doi:10.1109/TGRS.2010.2060550

[95] Li J, Bioucas-Dias JM, Plaza A (2012) Spectral–spatial hyperspectral image segmentation using subspace multinomial logistic regression and markov random fields. IEEE Transactions on Geoscience and Remote Sensing 50(3):809–823, doi:10.1109/TGRS.2011.2162649

[96] Liu C, Liu W, Xing W (2017) An improved edge-based level set method combining local regional fitting information for noisy image segmentation. Signal Processing 130:12 – 21, doi:https://doi.org/10.1016/j.sigpro.2016.06.013, http://www.sciencedirect.com/science/article/pii/S0165168416301256

[97] Muller K, Mika S, Ratsch G, Tsuda K, Scholkopf B (2001) An introduction to kernel-based learning algorithms. IEEE Transactions on Neural Networks 12(2):181–201, doi:10.1109/72.914517

[98] Mumford D, Shah J (1989) Optimal approximation by piecewise smooth function and associated variational problems 42

[99] Niu S, Chen Q, de Sisternes L, Ji Z, Zhou Z, Rubin DL (2017) Robust noise region-based active contour model via local similarity factor for image segmentation. Pattern Recognition 61:104 – 119, doi:https://doi.org/10.1016/j.patcog.2016.07.022, http://www.sciencedirect.com/science/article/pii/S0031320316301728

[100] O Duda R, E Hart P, GStork D (2001) Pattern classification

[101] Oja, Erkki (1983)

[102] Poulsen J, French A (2004) Discriminant function analysis

[103] Pratondo A, Chui CK, Ong SH (2017) Integrating machine learning with region-based active contour models in medical image segmentation. Journal of Visual Communication and Image Representation 43:1 – 9, doi:https://doi.org/10.1016/j.jvcir.2016.11.019, http://www.sciencedirect.com/science/article/pii/S1047320316302486

[104] Rother C, Kolmogorov V, Blake A (2004) Grabcut: Interactive foreground extraction using iterated graph cuts 23:309–314

[105] Salah MB, Mitiche A, Ayed IB (2011) Multiregion image segmentation by parametric kernel graph cuts. IEEE Transactions on Image Processing 20(2):545–557, doi:10.1109/TIP.2010.2066982

[106] Schoenemann T, Cremers D (2006) Near real-time motion segmentation using graph cuts. In: Franke K, Müller KR, Nickolay B, Schäfer R (eds) Pattern Recognition, Springer Berlin Heidelberg, Berlin, Heidelberg, pp 455–464

[107] Stefano CD, Cioppa AD, Marcelli A (2002) An adaptive weighted majority vote rule for combining multiple classifiers. In: Object recognition supported by user interaction for service robots, vol 2, pp 192–195 vol.2, doi:10.1109/ICPR.2002.1048270

[108] Thrun S (2002) Exploring artificial intelligence in the new millennium, chapter robotic mapping: A survey pp 1–35

[109] Veksler O (1999) Efficient graph-based energy minimization methods in computer vision. PhD thesis, Ithaca, NY, USA, aAI9939932

[110] Vu N, Manjunath BS (2008) Shape prior segmentation of multiple objects with graph cuts. In: 2008 IEEE Conference on Computer Vision and Pattern Recognition, pp 1–8, doi:10.1109/CVPR.2008.4587450

[111] Watanabe S, Pakvasa N (1973) Subspace method to pattern recognition

[112] Zeng X, Chen W, Peng Q (2006) Efficiently solving the piecewise constant mumford-shah model using graph cuts

[113] Zheng Q, Li H, Fan B, Wu S, Xu J (2018) Integrating support vector machine and graph cuts for medical image segmentation. Journal of Visual Communication and Image Representation 55:157 – 165, doi:https://doi.org/10.1016/j.jvcir.2018.06.005, http://www.sciencedirect.com/science/article/pii/S1047320318301305

[114] Zhong Y, Ma A, soon Ong Y, Zhu Z, Zhang L (2018) Computational intelligence in optical remote sensing image processing. Applied Soft Computing 64:75 – 93, doi:https://doi.org/10.1016/j.asoc.2017.11.045, http://www.sciencedirect.com/science/article/pii/S1568494617307081

[115] Zhou S, Wang J, Zhang S, Liang Y, Gong Y (2016) Active contour model based on local and global intensity information for medical image segmentation. Neurocomputing 186:107 – 118, doi:https://doi.org/10.1016/j.neucom.2015.12.073, http://www.sciencedirect.com/science/article/pii/S0925231215020469

[116] Zhu SC, Lee TS, Yuille AL (1995) Region competition: unifying snakes, region growing, energy/bayes/mdl for multi-band image segmentation. In: Proceedings of IEEE International Conference on Computer Vision, pp 416–423, doi:10.1109/ICCV.1995.466909

[117] A J q(John Alan) Richards (1999) Remote sensing digital image analysis : an introduction

[118] Aviris-NASA(JPL) HD (Accessed: 2019-01-20) Indian pines and Salinas Valley datasets. https://aviris.jpl.nasa.gov/

[119] Cao X, Zhou F, Xu L, Meng D, Xu Z, Paisley J (2018) Hyperspectral image classification with markov random fields and a convolutional neural network. IEEE Transactions on Image Processing 27(5):2354–2367, doi:10.1109/TIP.2018.2799324

[120] Chambolle A (2004) An algorithm for total variation minimization and applications. J Math Imaging Vis 20(1-2):89–97, doi:10.1023/B:JMIV.0000011325.36760.1e, http://dx.doi.org/10.1023/B:JMIV.0000011325.36760.1e

[121] Chang CI (2005) Orthogonal subspace projection (osp) revisited: a comprehensive study and analysis. IEEE Transactions on Geoscience and Remote Sensing 43(3):502–518, doi:10.1109/TGRS.2004.839543

[122] Devika S, Chaitanya SMK (2016) Signal estimation of hyperspectral data using hysime algorithm. In: 2016 International Conference on Research Advances in Integrated Navigation Systems (RAINS), pp 1–3, doi:10.1109/RAINS.2016.7764372

[123] Du Q, Younan NH (2008) On the performance improvement for linear discriminant analysis-based hyperspectral image classification. In: 2008 IAPR Workshop on Pattern Recognition in Remote Sensing (PRRS 2008), pp 1–4, doi:10.1109/PRRS.2008.4783168

[124] Dubes RC, Jain AK, Nadabar SG, Chen CC (1990) Mrf model-based algorithms for image segmentation. In: [1990] Proceedings. 10th International Conference on Pattern Recognition, vol i, pp 808–814 vol.1, doi:10.1109/ICPR.1990.118221

[125] Gamba PP (Accessed: 2019-01-20) Pavai university Rosis dataset. http://www.ehu.eus/ccwintco/index.php/Hyperspectral_Remote_Sensing_Scenes

[126] Gonzalez C, Lopez S, Mozos D, Sarmiento R (2015) Fpga implementation of the hysime algorithm for the determination of the number of endmembers in hyperspectral data. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing 8(6):2870–2883, doi:10.1109/JSTARS.2015.2425731

[127] Hahn J, Wu C, Tai XC (2012) Augmented lagrangian method for generalized tv-stokes model. Journal of Scientific Computing 50(2):235–264, doi:10.1007/s10915-011-9482-6, https://doi.org/10.1007/s10915-011-9482-6

[128] Krishnapuram B, Carin L, Figueiredo MAT, Hartemink AJ (2005) Sparse multinomial logistic regression: fast algorithms and generalization bounds. IEEE Transactions on Pattern Analysis and Machine Intelligence 27(6):957–968, doi:10.1109/TPAMI.2005.127

[129] Li J, Khodadadzadeh C, Plaza A, Jia X (2016) A Discontinuity Preserving Relaxation Scheme for Spectral–Spatial Hyperspectral Image Classification. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing 9(2):625–681, doi:10.1109/JSTARS.2015.2470129

[130] Li S (2001) Markov Random Field Modeling in Image Analysis. doi:10.1007/978-1-84800-279-1

[131] Liu J, Wu Z, Xiao Z, Yang J (2017) Region-based relaxed multiple kernel collaborative representation for hyperspectral image classification. IEEE Access 5:20921–20933, doi:10.1109/ACCESS.2017.2758168

[132] Lloyd S (1983) An optimization approach to relaxation labelling algorithms. Image and Vision Computing 1(2):85 – 91, doi:https://doi.org/10.1016/0262-8856(83)90046-X, http://www.sciencedirect.com/science/article/pii/026288568390046X

[133] Moser G, Serpico SB (2013) Combining support vector machines and markov random fields in an integrated framework for contextual image classification. IEEE Transactions on Geoscience and Remote Sensing 51(5):2734–2752, doi:10.1109/TGRS.2012.2211882

[134] Pelkowitz L (1990) A continuous relaxation labeling algorithm for markov random fields. IEEE Transactions on Systems, Man, and Cybernetics 20(3):709–715, doi:10.1109/21.57279

[135] Perona P, Malik J (1990) Scale-space and edge detection using anisotropic diffusion. IEEE Transactions on Pattern Analysis and Machine Intelligence 12(7):629–639, doi:10.1109/34.56205

[136] Richards JA, Landgrebe DA, Swain PH (1981) Pixel labeling by supervised probabilistic relaxation. IEEE Transactions on Pattern Analysis and Machine Intelligence PAMI-3(2):188–191, doi:10.1109/TPAMI.1981.4767077

[137] Sun L, Wu Z, Liu J, Wei Z (2013) Supervised hyperspectral image classification using sparse logistic regression and spatial-tv regularization. In: 2013 IEEE International Geoscience and Remote Sensing Symposium - IGARSS, pp 1019–1022, doi:10.1109/IGARSS.2013.6721336

[138] Tian Y, Guo P, Lyu M (2005) Comparative studies on feature extraction methods for multispectral remote sensing image classification. doi:10.1109/ICSMC.2005.1571322

[139] Wang Y, Niu R, Yu X (2010) Anisotropic diffusion for hyperspectral imagery enhancement. IEEE Sensors Journal 10(3):469–477, doi:10.1109/JSEN.2009.2037800

[140] Waske B, van der Linden S, Benediktsson JA, Rabe A, Hostert P (2010ch5) Sensitivity of support vector machines to random feature selection in classification of hyperspectral data. IEEE Transactions on Geoscience and Remote Sensing 48(7):2880–2889, doi:10.1109/TGRS.2010.2041784

[141] Yan Q, Ding Y, Zhang JJ, Xun LN, Zheng CH (2018) Approximate sparse spectral clustering based on local information maintenance for hyperspectral image classification. PLOS ONE 13(8):1–15, doi:10.1371/journal.pone.0202161, `https://doi.org/10.1371/journal.pone.0202161`

[142] Yıldırım I, Ersoy OK, Yazgan B (2005) Improvement of classification accuracy in remote sensing using morphological filter. Advances in Space Research 36(5):1003 – 1006, doi:https://doi.org/10.1016/j.asr.2005.05.043, http://www.sciencedirect.com/science/article/pii/S0273117705005764, atmospheric Remote Sensing: Earth's Surface, Troposphere, Stratosphere and Mesosphere- I

[143] Zhang X, Pan Z, Lu X, Hu B, Zheng X (2018) Hyperspectral image classification based on joint spectrum of spatial space and spectral space. Multimedia Tools and Applications 77(22):29759–29777, doi:10.1007/s11042-017-5552-6, https://doi.org/10.1007/s11042-017-5552-6

[144] Song W, Li S, Kang X, Huang K (2016) Hyperspectral image classification based on knn sparse representation. In: 2016 IEEE International Geoscience and Remote Sensing Symposium (IGARSS), pp 2411–2414, doi:10.1109/IGARSS.2016.7729622

[145] Zhu J, Li K, Hao B (2018) Image restoration by a mixed high-order total variation and regularization model,. Hindawi Mathematical Problems in Engineering p 13

[146] Basaeed E, Bhaskar H, Al-Mualla M (2016) Supervised remote sensing image segmentation using boosted convolutional neural networks. Knowledge-Based Systems 99:19 – 27, doi:https://doi.org/10.1016/j.knosys.2016.01.028, http://www.sciencedirect.com/science/article/pii/S0950705116000484

[147] Bian X, Zhang T, Zhang X, Yan L, Li B (2013) Clustering-based extraction of near border data samples for remote sensing image classification. Cognitive Computation 5(1):19–31, doi:10.1007/s12559-012-9147-2, https://doi.org/10.1007/s12559-012-9147-2

[148] Cai Z, Shao L (2018) Rgb-d scene classification via multi-modal feature learning. Cognitive Computation doi:10.1007/s12559-018-9580-y, https://doi.org/10.1007/s12559-018-9580-y

[149] Chaudhuri U, Banerjee B, Bhattacharya A (2019) Siamese graph convolutional network for content based remote sensing image retrieval. Computer Vision and Image Understanding 184:22 – 30, doi:https://doi.org/10.1016/j.cviu.2019.04.004, http://www.sciencedirect.com/science/article/pii/S1077314219300578

[150] Fang X, Xu Y, Li X, Lai Z, Wong WK, Fang B (2018) Regularized label relaxation linear regression. IEEE Transactions on Neural Networks and Learning Systems 29(4):1006–1018, doi:10.1109/TNNLS.2017.2648880

[151] Farabet C, Couprie C, Najman L, LeCun Y (2013) Learning hierarchical features for scene labeling. IEEE Transactions on Pattern Analysis and Machine Intelligence 35(8):1915–1929, doi:10.1109/TPAMI.2012.231

[152] Garcia-Garcia A, Orts-Escolano S, Oprea S, Villena-Martinez V, Martinez-Gonzalez P, Garcia-Rodriguez J (2018) A survey on deep learning techniques for image and video semantic segmentation. Applied Soft Computing 70:41 – 65, doi:https://doi.org/10.1016/j.asoc.2018.05.018, http://www.sciencedirect.com/science/article/pii/S1568494618302813

[153] Halstead MA, Denman S, Sridharan S, Tian Y, Fookes C (2019) Multimodal clothing recognition for semantic search in unconstrained surveillance imagery. Journal of Visual Communication and Image Representation 58:439 – 452, doi:https://doi.org/10.1016/j.jvcir.2018.12.001, http://www.sciencedirect.com/science/article/pii/S1047320318303274

[154] Hu T, Wu W, Liu L (2014) Combination of hard and soft classification method based on adaptive threshold. In: 2014 IEEE Geoscience and Remote Sensing Symposium, pp 4180–4183, doi:10.1109/IGARSS.2014.6947409

[155] Hu W, Hu H (2019) Discriminant deep feature learning based on joint supervision loss and multi-layer feature fusion for heterogeneous face recognition. Computer Vision and Image Understanding 184:9 – 21, doi:https://doi.org/10.1016/j.cviu.2019.04.003, http://www.sciencedirect.com/science/article/pii/S1077314219300566

[156] Jiang H, Guo Y (2019) Multi-class multimodal semantic segmentation with an improved 3d fully convolutional networks. Neurocomputing doi:https://doi.org/10.1016/j.neucom.2018.11.103, http://www.sciencedirect.com/science/article/pii/S0925231219304187

[157] Kittler J, Illingworth J (1985) Relaxation labelling algorithms — a review. Image and Vision Computing 3(4):206 – 216, doi:https://doi.org/10.1016/0262-8856(85)90009-5, http://www.sciencedirect.

com/science/article/pii/0262885685900095, papers from the 1985 Alvey Computer Vision and Image Interpretation Meeting

[158] Kosov S, Shirahama K, Li C, Grzegorzek M (2018) Environmental microorganism classification using conditional random fields and deep convolutional neural networks. Pattern Recognition 77:248 – 261, doi:https://doi.org/10.1016/j.patcog.2017.12.021, http://www.sciencedirect.com/science/article/pii/S0031320317305174

[159] Lateef F, Ruichek Y (2019) Survey on semantic segmentation using deep learning techniques. Neurocomputing 338:321 – 348, doi:https://doi.org/10.1016/j.neucom.2019.02.003, http://www.sciencedirect.com/science/article/pii/S092523121930181X

[160] Le TN, Nguyen TV, Nie Z, Tran MT, Sugimoto A (2019) Anabranch network for camouflaged object segmentation. Computer Vision and Image Understanding 184:45 – 56, doi:https://doi.org/10.1016/j.cviu.2019.04.006, http://www.sciencedirect.com/science/article/pii/S1077314219300608

[161] Lekic V, Babic Z (2019) Automotive radar and camera fusion using generative adversarial networks. Computer Vision and Image Understanding 184:1 – 8, doi:https://doi.org/10.1016/j.cviu.2019.04.002, http://www.sciencedirect.com/science/article/pii/S1077314219300530

[162] Li R, Gu D, Liu Q, Long Z, Hu H (2018) Semantic scene mapping with spatio-temporal deep neural network for robotic applications. Cognitive Computation 10(2):260–271, doi:10.1007/s12559-017-9526-9, https://doi.org/10.1007/s12559-017-9526-9

[163] Li R, Wang S, Gu D (2018) Ongoing evolution of visual slam from geometry to deep learning: Challenges and opportunities. Cognitive Computation 10(6):875–889, doi:10.1007/s12559-018-9591-8, https://doi.org/10.1007/s12559-018-9591-8

[164] Li T, Leng J, Kong L, Guo S, Bai G, Wang K (2019) Dcnr: deep cube cnn with random forest for hyperspectral image classification. Multimedia Tools and Applications 78(3):3411–3433, doi:10.1007/s11042-018-5986-5, https://doi.org/10.1007/s11042-018-5986-5

[165] Li X, Lin S, Yan S, Xu D (2008) Discriminant locally linear embedding with high-order tensor data. IEEE Transactions on Systems, Man, and Cybernetics, Part B (Cybernetics) 38(2):342–352, doi:10.1109/TSMCB.2007.911536

[166] Li Y, Sohel F, Bennamoun M, Lei H (2015) Outdoor scene labelling with learned features and region consistency activation. In: 2015 IEEE International Conference on Image Processing (ICIP), pp 1374–1378, doi:10.1109/ICIP.2015.7351025

[167] Li Y, Qi H, Dai J, Ji X, Wei Y (2017) Fully convolutional instance-aware semantic segmentation. In: 2017 IEEE Conference on Computer Vision and Pattern Recognition (CVPR), pp 4438–4446, doi:10.1109/CVPR.2017.472

[168] Litjens G, Kooi T, Bejnordi BE, Setio AAA, Ciompi F, Ghafoorian M, van der Laak JA, van Ginneken B, Sánchez CI (2017) A survey on deep learning in medical image analysis. Medical Image Analysis 42:60 – 88, doi:https://doi.org/10.1016/j.media.2017.07.005, http://www.sciencedirect.com/science/article/pii/S1361841517301135

[169] Liu X, Deng Z (2018) Segmentation of drivable road using deep fully convolutional residual network with pyramid pooling. Cognitive Computation 10(2):272–281, doi:10.1007/s12559-017-9524-y, https://doi.org/10.1007/s12559-017-9524-y

[170] Liu X, Deng Z, Yang Y (2018) Recent progress in semantic image segmentation. Artificial Intelligence Review doi:10.1007/s10462-018-9641-3, https://doi.org/10.1007/s10462-018-9641-3

[171] Liu Y, Chen X, Zhang C, Sprague A (2009) Semantic clustering for region-based image retrieval. Journal of Visual Communication and Image Representation 20(2):157 – 166, doi:https://doi.org/10.1016/j.jvcir.2008.11.006, http://www.sciencedirect.com/science/article/pii/S1047320308001132, special issue on Emerging Techniques for Multimedia Content Sharing, Search and Understanding

[172] Luo L, Wang X, Hu S, Hu X, Chen L (2017) Interactive image segmentation based on samples reconstruction and flda. Journal of Visual Communication and Image Representation 43:138 – 151, doi:https://doi.org/10.1016/j.jvcir.2016.12.012, http://www.sciencedirect.com/science/article/pii/S1047320316302656

[173] Ma X, Liu W, Tao D, Zhou Y (2019) Ensemble p-laplacian regularization for scene image recognition. Cognitive Computation doi:10.1007/s12559-019-09637-z, https://doi.org/10.1007/s12559-019-09637-z

[174] Marinoni A, Gamba P (2017) Unsupervised data driven feature extraction by means of mutual information maximization. IEEE Transactions on Computational Imaging 3(2):243–253, doi:10.1109/TCI.2017.2669731

[175] Marquina A, Osher SJ (2008) Image super-resolution by tv-regularization and bregman iteration. Journal of Scientific Computing 37(3):367–382, doi:10.1007/s10915-008-9214-8, https://doi.org/10.1007/s10915-008-9214-8

[176] Ning Q, Zhu J, Chen C (2018) Very fast semantic image segmentation using hierarchical dilation and feature refining. Cognitive Computation 10(1):62–72, doi:10.1007/s12559-017-9530-0, https://doi.org/10.1007/s12559-017-9530-0

[177] Niu X, Yan B, Tan W, Wang J (2019) Effective image restoration for semantic segmentation. Neurocomputing doi:https://doi.org/10.1016/j.neucom.2019.09.063, http://www.sciencedirect.com/science/article/pii/S0925231219313311

[178] Rodriguez P (2013) Total variation regularization algorithms for images corrupted with different noise models: A review. Journal of Electrical and Computer Engineering 2013, doi:10.1155/2013/217021

[179] Wang LL, Yung NH (2015) Hybrid graphical model for semantic image segmentation. Journal of Visual Communication and Image Representation 28:83 – 96, doi:https://doi.org/10.1016/j.jvcir.2015.01.014, http://www.sciencedirect.com/science/article/pii/S1047320315000218

[180] Wang W, He C, Xia XG (2018) A constrained total variation model for single image dehazing. Pattern Recognition 80:196 – 209, doi:https://doi.org/10.1016/j.patcog.2018.03.009, http://www.sciencedirect.com/science/article/pii/S0031320318300864

[181] Wu Z, Gao Y, Li L, Xue J, Li Y (2019) Semantic segmentation of high-resolution remote sensing images using fully convolutional network with adaptive threshold. Connection Science 31(2):169–184, doi:10.1080/09540091.2018.1510902, https://doi.org/10.1080/09540091.2018.1510902, doi:https://doi.org/10.1080/09540091.2018.1510902

[182] Xiaofei He, Deng Cai, Shuicheng Yan, Hong-Jiang Zhang (2005) Neighborhood preserving embedding. In: Tenth IEEE International Conference on Computer Vision (ICCV'05) Volume 1, vol 2, pp 1208–1213 Vol. 2, doi:10.1109/ICCV.2005.167

[183] Xie J, Yu L, Zhu L, Chen X (2017) Semantic image segmentation method with multiple adjacency trees and multiscale features. Cognitive Computation 9(2):168–179, doi:10.1007/s12559-016-9441-5, https://doi.org/10.1007/s12559-016-9441-5

[184] Yao Y, Guo P, Xin X, Jiang Z (2014) Image fusion by hierarchical joint sparse representation. Cognitive Computation 6(3):281–292, doi:10.1007/s12559-013-9235-y, https://doi.org/10.1007/s12559-013-9235-y

[185] Zhang A, Liu S, Sun G, Huang H, Ma P, Rong J, Ma H, Lin C, Wang Z (2018) Clustering of remote sensing imagery using a social recognition-based multi-objective gravitational search algorithm. Cognitive Computation doi:10.1007/s12559-018-9582-9, https://doi.org/10.1007/s12559-018-9582-9

[186] Zhang L, Barnden J (2012) Affect sensing using linguistic, semantic and cognitive cues in multi-threaded improvisational dialogue. Cognitive Computation 4(4):436–459, doi:10.1007/s12559-012-9170-3, https://doi.org/10.1007/s12559-012-9170-3

[187] shan Zhu S, Yung NH (2014) Sub-scene segmentation using constraints based on gestalt principles. Journal of Visual Communication and Image Representation 25(5):994 – 1005, doi:https://doi.org/10.1016/j.jvcir.2014.02.017, http://www.sciencedirect.com/science/article/pii/S1047320314000558

[188] Zhu X, Zhang X, Zhang XY, Xue Z, Wang L (2019) A novel framework for semantic segmentation with generative adversarial network. Journal

of Visual Communication and Image Representation 58:532 – 543, doi:https://doi.org/10.1016/j.jvcir.2018.11.020, http://www.sciencedirect.com/science/article/pii/S1047320318302931

[189] Altameem T, Zanaty E, Tolba A (2015) A new fuzzy c-means method for magnetic resonance image brain segmentation. Connection Science 27(4):305–321, doi:10.1080/09540091.2014.970126, https://doi.org/10.1080/09540091.2014.970126, doi:https://doi.org/10.1080/09540091.2014.970126

[190] Bhuvaneswari KS, Geetha P (2017) Segmentation and classification of brain images using firefly and hybrid kernel-based support vector machine. Journal of Experimental & Theoretical Artificial Intelligence 29(3):663–678, doi:10.1080/0952813X.2016.1212106, https://doi.org/10.1080/0952813X.2016.1212106, doi:https://doi.org/10.1080/0952813X.2016.1212106

[191] Bian X, Zhang T, Zhang X, Yan L, Li B (2013) Clustering-based extraction of near border data samples for remote sensing image classification. Cognitive Computation 5(1):19–31, doi:10.1007/s12559-012-9147-2, https://doi.org/10.1007/s12559-012-9147-2

[192] Cai Z, Shao L (2018) Rgb-d scene classification via multi-modal feature learning. Cognitive Computation doi:10.1007/s12559-018-9580-y, https://doi.org/10.1007/s12559-018-9580-y

[193] Cavallaro G, Mura MD, Benediktsson JA, Plaza A (2016) Remote sensing image classification using attribute filters defined over the tree of shapes. IEEE Transactions on Geoscience and Remote Sensing 54(7):3899–3911, doi:10.1109/TGRS.2016.2530690

[194] Cavallaro G, Falco N, Dalla Mura M, Benediktsson JA (2017) Automatic attribute profiles. IEEE Transactions on Image Processing 26(4):1859–1872, doi:10.1109/TIP.2017.2664667

[195] Chen SY, Lin WC, Chen CT (1991) Split-and-merge image segmentation based on localized feature analysis and statistical tests. CVGIP: Graphical Models and Image Processing 53(5):457 – 475, doi:https://doi.org/10.1016/1049-9652(91)90030-N, http://www.sciencedirect.com/science/article/pii/104996529190030N

[196] Dalla Mura M, Benediktsson JA, Waske B, Bruzzone L (2010) Morphological attribute profiles for the analysis of very high resolution images. IEEE Transactions on Geoscience and Remote Sensing 48(10):3747–3762, doi:10.1109/TGRS.2010.2048116

[197] Garcia-Garcia A, Orts-Escolano S, Oprea S, Villena-Martinez V, Martinez-Gonzalez P, Garcia-Rodriguez J (2018) A survey on deep learning techniques for image and video semantic segmentation. Applied Soft Computing 70:41 – 65, doi:https://doi.org/10.1016/j.asoc.2018.05.018, http://www.sciencedirect.com/science/article/pii/S1568494618302813

[198] Hancer E (2019) Fuzzy kernel feature selection with multi-objective differential evolution algorithm. Connection Science 0(0):1–19, doi:10.1080/09540091.2019.1639624, https://doi.org/10.1080/09540091.2019.1639624, doi:https://doi.org/10.1080/09540091.2019.1639624

[199] He J, Yao X, Chen Y (2007) A novel and practicable on-chip adaptive lossless image compression scheme using intrinsic evolvable hardware. Connection Science 19(4):281–295, doi:10.1080/09540090701725508, https://doi.org/10.1080/09540090701725508, doi:https://doi.org/10.1080/09540090701725508

[200] Holliday A, Barekatain M, Laurmaa J, Kandaswamy C, Prendinger H (2017) Speedup of deep learning ensembles for semantic segmentation using a model compression technique. Computer Vision and Image Understanding 164:16 – 26, doi:https://doi.org/10.1016/j.cviu.2017.05.004, http://www.sciencedirect.com/science/article/pii/S1077314217300826, deep Learning for Computer Vision

[201] Jiji GW (2018) Identifying stage of alzheimer disease using multiclass particle swarm optimisation technique. Journal of Experimental & Theoretical Artificial Intelligence 30(6):911–925, doi:10.1080/0952813X.2018.1509380, https://doi.org/10.1080/0952813X.2018.1509380, doi:https://doi.org/10.1080/0952813X.2018.1509380

[202] Kholerdi HA, TaheriNejad N, Ghaderi R, Baleghi Y (2016) Driver's drowsiness detection using an enhanced image processing technique inspired by the human visual system. Connection Science 28(1):27–46,

doi:10.1080/09540091.2015.1130019, https://doi.org/10.1080/09540091.2015.1130019, doi:https://doi.org/10.1080/09540091.2015.1130019

[203] Lopez-Garcia P, Masegosa AD, Osaba E, Onieva E, Perallos A (2019) Ensemble classification for imbalanced data based on feature space partitioning and hybrid metaheuristics. Applied Intelligence 49(8):2807–2822, doi:10.1007/s10489-019-01423-6, https://doi.org/10.1007/s10489-019-01423-6

[204] LORENZO-NAVARRO J, HERNÁNDEZ-TEJERA M (1994) Image segmentation using a modified split and merge technique. Cybernetics and Systems 25(1):137–162, doi:10.1080/01969729408902319, https://doi.org/10.1080/01969729408902319, doi:https://doi.org/10.1080/01969729408902319

[205] Ma X, Liu W, Tao D, Zhou Y (2019) Ensemble p-laplacian regularization for scene image recognition. Cognitive Computation doi:10.1007/s12559-019-09637-z, https://doi.org/10.1007/s12559-019-09637-z

[206] Marinoni A, Gamba P (2017) Unsupervised data driven feature extraction by means of mutual information maximization. IEEE Transactions on Computational Imaging 3(2):243–253, doi:10.1109/TCI.2017.2669731

[207] Ouzounis GK, Pesaresi M, Soille P (2012) Differential area profiles: Decomposition properties and efficient computation. IEEE Trans Pattern Anal Mach Intell 34(8):1533–1548, doi:10.1109/TPAMI.2011.245, http://dx.doi.org/10.1109/TPAMI.2011.245

[208] Salembier P, Oliveras A, Garrido L (1998) Antiextensive connected operators for image and sequence processing. IEEE Transactions on Image Processing 7(4):555–570, doi:10.1109/83.663500

[209] Wadawadagi RS, Pagi VB (2019) A multi-layer approach to opinion polarity classification using augmented semantic tree kernels. Journal of Experimental & Theoretical Artificial Intelligence 31(3):349–367, doi:10.1080/0952813X.2018.1549108, https://doi.org/10.1080/0952813X.2018.1549108, doi:https://doi.org/10.1080/0952813X.2018.1549108

[210] Wei H, Dai ZL, Zuo QS (2016) A ganglion-cell-based primary image representation method and its contribution to object recognition. Connection Science 28(4):311–331, doi:10.1080/09540091.2016.1212813, https://doi.org/10.1080/09540091.2016.1212813, doi:https://doi.org/10.1080/09540091.2016.1212813

[211] Wu Z, Gao Y, Li L, Xue J, Li Y (2019) Semantic segmentation of high-resolution remote sensing images using fully convolutional network with adaptive threshold. Connection Science 31(2):169–184, doi:10.1080/09540091.2018.1510902, https://doi.org/10.1080/09540091.2018.1510902, doi:https://doi.org/10.1080/09540091.2018.1510902

[212] Yao Y, Guo P, Xin X, Jiang Z (2014) Image fusion by hierarchical joint sparse representation. Cognitive Computation 6(3):281–292, doi:10.1007/s12559-013-9235-y, https://doi.org/10.1007/s12559-013-9235-y

[213] Zanaty E, Asaad A (2013) Probabilistic region growing method for improving magnetic resonance image segmentation. Connection Science 25(4):179–196, doi:10.1080/09540091.2013.854736, https://doi.org/10.1080/09540091.2013.854736, doi:https://doi.org/10.1080/09540091.2013.854736

[214] Zhang L, Barnden J (2012) Affect sensing using linguistic, semantic and cognitive cues in multi-threaded improvisational dialogue. Cognitive Computation 4(4):436–459, doi:10.1007/s12559-012-9170-3, https://doi.org/10.1007/s12559-012-9170-3