Bibliography

[1] Adão, T., Hruška, J., Pádua, L., Bessa, J., Peres, E., Morais, R., and Sousa, J. Hyperspectral imaging: A review on UAV-based sensors, data processing and applications for agriculture and forestry. *Remote Sensing*, 9(11):1110, 2017.

[2] Ahmad, M., Khan, A., Khan, A. M., Mazzara, M., Distefano, S., Sohaib, A., and Nibouche, O. Spatial prior fuzziness pool-based interactive classification of hyperspectral images. *Remote Sensing*, 11(9):1136, 2019.

[3] AlSuwaidi, A., Veys, C., Hussey, M., Grieve, B., and Yin, H. Hyperspectral selection based algorithm for plant classification. In *International Conference on Imaging Systems and Techniques (IST'16)*, pages 395–400. IEEE, 2016.

[4] Andrejchenko, V., Liao, W., Philips, W., and Scheunders, P. Decision fusion framework for hyperspectral image classification based on markov and conditional random fields. *Remote Sensing*, 11(6):624, 2019.

[5] Archibald, R. and Fann, G. Feature selection and classification of hyperspectral images with support vector machines. *IEEE Geoscience and Remote Sensing letters*, 4(4):674–677, 2007.

[6] Ardouin, J.-P., Lévesque, J., and Rea, T. A. A demonstration of hyperspectral image exploitation for military applications. In *International Conference on Information Fusion (ICIF'07)*, pages 1–8. IEEE, 2007.

[7] Aspinall, R. J., Marcus, W. A., and Boardman, J. W. Considerations in collecting, processing, and analysing high spatial resolution hyperspectral data for environmental investigations. *Journal of Geographical Systems*, 4 (1):15–29, 2002.

[8] Bannari, A., Pacheco, A., Staenz, K., McNairn, H., and Omari, K. Estimating and mapping crop residues cover on agricultural lands using hyper-

spectral and ikonos data. *Remote Sensing of Environment*, 104(4):447–459, 2006.

[9] Barman, B. and Patra, S. A novel technique to detect a suboptimal threshold of neighborhood rough sets for hyperspectral band selection. *Soft Computing*, pages 1–11, 2019. doi: https://doi.org/10.1007/s00500-019-03909-4.

[10] Bazi, Y. and Melgani, F. Toward an optimal SVM classification system for hyperspectral remote sensing images. *IEEE Transactions on Geoscience and Remote Sensing*, 44(11):3374–3385, 2006.

[11] Bellens, R., Gautama, S., Martinez-Fonte, L., Philips, W., Chan, J. C.-W., and Canters, F. Improved classification of VHR images of urban areas using directional morphological profiles. *IEEE Transactions on Geoscience and Remote Sensing*, 46(10):2803–2813, 2008.

[12] Bellman, R., Bellman, R. E., Bellman, R. E., and Bellman, R. E. *Adaptive control processes: a guided tour*. Princeton university press, Princeton, 1961.

[13] Benediktsson, J. A., Pesaresi, M., and Amason, K. Classification and feature extraction for remote sensing images from urban areas based on morphological transformations. *IEEE Transactions on Geoscience and Remote Sensing*, 41(9):1940–1949, 2003.

[14] Benediktsson, J. A., Palmason, J. A., and Sveinsson, J. R. Classification of hyperspectral data from urban areas based on extended morphological profiles. *IEEE Transactions on Geoscience and Remote Sensing*, 43(3):480–491, 2005.

[15] Bhardwaj, K. and Patra, S. An unsupervised technique for optimal feature selection in attribute profiles for spectral-spatial classification of hyperspectral images. *ISPRS Journal of Photogrammetry and Remote Sensing*, 138: 139–150, 2018.

[16] Bhardwaj, K., Patra, S., and Bruzzone, L. Threshold-free attribute profile for classification of hyperspectral images. *IEEE Transactions on Geoscience and Remote Sensing*, 57(10):7731–7742, 2019.

[17] Bingxiang, T. Application of hyperspectral remote sensing in forestry. *World Forestry Research*, 16(2):33–37, 2003.

[18] Bioucas-Dias, J. M., Plaza, A., Dobigeon, N., Parente, M., Du, Q., Gader, P., and Chanussot, J. Hyperspectral unmixing overview: Geometrical, statistical, and sparse regression-based approaches. *IEEE Journal of Selected*

Topics in Applied Earth Observations and Remote Sensing, 5(2):354–379, 2012.

[19] Bioucas-Dias, J. M., Plaza, A., Camps-Valls, G., Scheunders, P., Nasrabadi, N., and Chanussot, J. Hyperspectral remote sensing data analysis and future challenges. *IEEE Geoscience and Remote Sensing Magazine*, 1(2):6–36, 2013.

[20] Borengasser, M., Hungate, W. S., and Watkins, R. *Hyperspectral remote sensing: principles and applications*. CRC press,Taylor & Francis Group, Boca Raton, 2007.

[21] Breen, E. J. and Jones, R. Attribute openings, thinnings, and granulometries. *Computer Vision and Image Understanding*, 64(3):377–389, 1996.

[22] Breiman, L. Bagging predictors. *Machine Learning*, 24(2):123–140, 1996.

[23] Brinker, K. Incorporating diversity in active learning with support vector machines. In *International Conference on Machine Learning (ICML'03)*, pages 59–66, 2003.

[24] Briottet, X., Boucher, Y., Dimmeler, A., Malaplate, A., Cini, A., Diani, M., Bekman, H., Schwering, P., Skauli, T., Kasen, I., et al. Military applications of hyperspectral imagery. In *Targets and backgrounds XII: Characterization and representation*, page 62390B. International Society for Optics and Photonics, 2006.

[25] Bruzzone, L. and Demir, B. A review of modern approaches to classification of remote sensing data. In *Land Use and Land Cover Mapping in Europe*, pages 127–143. Springer, 2014.

[26] Bruzzone, L. and Persello, C. Active learning for classification of remote sensing images. In *IEEE International Geoscience and Remote Sensing Symposium (IGARSS'09)*, volume 3, pages III–693–III–696. IEEE, 2009.

[27] Bruzzone, L. and Persello, C. A novel approach to the selection of spatially invariant features for the classification of hyperspectral images with improved generalization capability. *IEEE Transactions on Geoscience and Remote Sensing*, 47(9):3180–3191, 2009.

[28] Bruzzone, L., Chi, M., and Marconcini, M. A novel transductive SVM for semisupervised classification of remote-sensing images. *IEEE Transactions on Geoscience and Remote Sensing*, 44(11):3363–3373, 2006.

[29] Bruzzone, L., Liu, S., Bovolo, F., and Du, P. Change detection in multitemporal hyperspectral images. In *Multitemporal Remote Sensing*, pages 63–88. Springer, 2016.

[30] Burges, C. J. A tutorial on support vector machines for pattern recognition. *Data Mining and Knowledge Discovery*, 2(2):121–167, 1998.

[31] Campbell, C., Cristianini, N., Smola, A., et al. Query learning with large margin classifiers. In *International Conference on Machine Learning (ICML'00)*, pages 111–118, 2000.

[32] Camps-Valls, G. and Bruzzone, L. Kernel-based methods for hyperspectral image classification. *IEEE Transactions on Geoscience and Remote Sensing*, 43(6):1351–1362, 2005.

[33] Camps-Valls, G., Marsheva, T. V. B., and Zhou, D. Semi-supervised graph-based hyperspectral image classification. *IEEE Transactions on Geoscience and Remote Sensing*, 45(10):3044–3054, 2007.

[34] Camps-Valls, G., Tuia, D., Bruzzone, L., and Benediktsson, J. A. Advances in hyperspectral image classification: Earth monitoring with statistical learning methods. *IEEE Signal Processing Magazine*, 31(1):45–54, 2013.

[35] Carrizo, C., Gilerson, A., Foster, R., Golovin, A., and El-Habashi, A. Characterization of radiance from the ocean surface by hyperspectral imaging. *Optics Express*, 27(2):1750–1768, 2019.

[36] Cavallaro, G., Falco, N., Dalla Mura, M., and Benediktsson, J. A. Automatic attribute profiles. *IEEE Transactions on Image Processing*, 26(4):1859–1872, 2017.

[37] Challa, A., Danda, S., Sagar, B. D., and Najman, L. Watersheds for semi-supervised classification. *IEEE Signal Processing Letters*, 26(5):720–724, 2019.

[38] Chang, C.-C. and Lin, C.-J. LIBSVM: a library for support vector machines. *ACM Transactions on Intelligent Systems and Technology*, 2(3):27, 2011.

[39] Chang, C.-I. Spectral information divergence for hyperspectral image analysis. In *IEEE International Geoscience and Remote Sensing Symposium (IGARSS'99)*, pages 509–511. IEEE, 1999.

[40] Chang, C.-I. *Hyperspectral data exploitation: theory and applications*. John Wiley & Sons, Hoboken, New Jersey, 2007.

[41] Chang, C.-I. and Wang, S. Constrained band selection for hyperspectral imagery. *IEEE Transactions on Geoscience and Remote Sensing*, 44(6): 1575–1585, 2006.

[42] Chen, Y., Miao, D., and Wang, R. A rough set approach to feature selection based on ant colony optimization. *Pattern Recognition Letters*, 31(3):226–233, 2010.

[43] Chen, Y., Nasrabadi, N. M., and Tran, T. D. Hyperspectral image classification using dictionary-based sparse representation. *IEEE Transactions on Geoscience and Remote Sensing*, 49(10):3973–3985, 2011.

[44] Chen, Y., Jiang, H., Li, C., Jia, X., and Ghamisi, P. Deep feature extraction and classification of hyperspectral images based on convolutional neural networks. *IEEE Transactions on Geoscience and Remote Sensing*, 54(10): 6232–6251, 2016.

[45] Cheng, S. and Shih, F. Y. An improved incremental training algorithm for support vector machines using active query. *Pattern Recognition*, 40(3): 964–971, 2007.

[46] Chutia, D., Bhattacharyya, D. K., Sarma, K. K., Kalita, R., and Sudhakar, S. Hyperspectral remote sensing classifications: a perspective survey. *Transactions in GIS*, 20(4):463–490, 2016.

[47] Clark, M. L. and Kilham, N. E. Mapping of land cover in northern California with simulated hyperspectral satellite imagery. *ISPRS Journal of Photogrammetry and Remote Sensing*, 119:228–245, 2016.

[48] Cohn, D. A., Ghahramani, Z., and Jordan, M. I. Active learning with statistical models. *Journal of Artificial Intelligence Research*, 4:129–145, 1996.

[49] Comon, P. Independent component analysis, a new concept? *Signal Processing*, 36(3):287–314, 1994.

[50] Copa, L., Tuia, D., Volpi, M., and Kanevski, M. Unbiased query-by-bagging active learning for VHR image classification. In *Image and Signal Processing for Remote Sensing XVI*, page 78300K. International Society for Optics and Photonics, 2010.

[51] Corson, M. R., Korwan, D. R., Lucke, R. L., Snyder, W. A., and Davis, C. O. The hyperspectral imager for the coastal ocean (HICO) on the international

space station. In *IEEE International Geoscience and Remote Sensing Symposium (IGARSS'08)*, volume 4, pages IV – 101–IV – 104. IEEE, 2008.

[52] Cover, T. M. and Thomas, J. A. *Elements of information theory*. John Wiley & Sons, Hoboken, New Jersey, 2012.

[53] Dagan, I. and Engelson, S. P. Committee-based sampling for training probabilistic classifiers. In *Machine Learning Proceedings*, pages 150–157. Elsevier, 1995.

[54] Dale, L. M., Thewis, A., Boudry, C., Rotar, I., Dardenne, P., Baeten, V., and Pierna, J. A. F. Hyperspectral imaging applications in agriculture and agro-food product quality and safety control: a review. *Applied Spectroscopy Reviews*, 48(2):142–159, 2013.

[55] Dalla Mura, M., Benediktsson, J. A., Waske, B., and Bruzzone, L. Extended profiles with morphological attribute filters for the analysis of hyperspectral data. *International Journal of Remote Sensing*, 31(22):5975–5991, 2010.

[56] Dalla Mura, M., Benediktsson, J. A., Waske, B., and Bruzzone, L. Morphological attribute profiles for the analysis of very high resolution images. *IEEE Transactions on Geoscience and Remote Sensing*, 48(10):3747–3762, 2010.

[57] Dalla Mura, M., Villa, A., Benediktsson, J. A., Chanussot, J., and Bruzzone, L. Classification of hyperspectral images by using extended morphological attribute profiles and independent component analysis. *IEEE Geoscience and Remote Sensing Letters*, 8(3):542–546, 2010.

[58] Dalla Mura, M., Villa, A., Benediktsson, J. A., Chanussot, J., and Bruzzone, L. Classification of hyperspectral images by using extended morphological attribute profiles and independent component analysis. *IEEE Geoscience and Remote Sensing Letters*, 8(3):542–546, 2011.

[59] Das, A., Bhardwaj, K., and Patra, S. Morphological complexity profile for the analysis of hyperspectral images. In *IEEE International Conference on Recent Advances in Information Technology (RAIT'18)*, pages 1–6. IEEE, 2018.

[60] Das, S. Filters, wrappers and a boosting-based hybrid for feature selection. In *International Conference on Machine Learning (ICML'01)*, pages 74–81, 2001.

[61] Datt, B., McVicar, T. R., Van Niel, T. G., Jupp, D. L., and Pearlman, J. S. Preprocessing EO-1 hyperion hyperspectral data to support the application of agricultural indexes. *IEEE Transactions on Geoscience and Remote Sensing*, 41(6):1246–1259, 2003.

[62] Daya Sagar, B. and Serra, J. Spatial information retrieval, analysis, reasoning and modelling. *International Journal of Remote Sensing*, 31(22): 5747–5750, 2010.

[63] Demir, B. and Bruzzone, L. Histogram-based attribute profiles for classification of very high resolution remote sensing images. *IEEE Transactions on Geoscience and Remote Sensing*, 54(4):2096–2107, 2016.

[64] Demir, B. and Erturk, S. Hyperspectral image classification using relevance vector machines. *IEEE Geoscience and Remote Sensing Letters*, 4(4):586–590, 2007.

[65] Demir, B. and Erturk, S. Empirical mode decomposition of hyperspectral images for support vector machine classification. *IEEE Transactions on Geoscience and Remote Sensing*, 48(11):4071–4084, 2010.

[66] Demir, B., Bovolo, F., and Bruzzone, L. Detection of land-cover transitions in multitemporal remote sensing images with active-learning-based compound classification. *IEEE Transactions on Geoscience and Remote Sensing*, 50(5):1930–1941, 2011.

[67] Demir, B., Persello, C., and Bruzzone, L. Batch-mode active-learning methods for the interactive classification of remote sensing images. *IEEE Transactions on Geoscience and Remote Sensing*, 49(3):1014–1031, 2011.

[68] Demir, B., Minello, L., and Bruzzone, L. Definition of effective training sets for supervised classification of remote sensing images by a novel cost-sensitive active learning method. *IEEE Transactions on Geoscience and Remote Sensing*, 52(2):1272–1284, 2014.

[69] Demir, B., Minello, L., and Bruzzone, L. An effective strategy to reduce the labeling cost in the definition of training sets by active learning. *IEEE Geoscience and Remote Sensing Letters*, 11(1):79–83, 2014.

[70] Derin, H. and Kelly, P. A. Discrete-index markov-type random processes. *Proceedings of the IEEE*, 77(10):1485–1510, 1989.

[71] Dhillon, I. S., Guan, Y., and Kulis, B. *A unified view of kernel k-means, spectral clustering and graph cuts*. Citeseer, 2004.

[72] Di, W. and Crawford, M. Active learning via multi-view and local proximity co-regularization for hyperspectral image classification. *IEEE journal of selected Topics in Signal Processing*, 5(3):618–628, 2011.

[73] Di, W. and Crawford, M. M. Multi-view adaptive disagreement based active learning for hyperspectral image classification. In *IEEE International Geoscience and Remote Sensing Symposium (IGARSS'10)*, pages 1374–1377. IEEE, 2010.

[74] Du, Q. and Yang, H. Similarity-based unsupervised band selection for hyperspectral image analysis. *IEEE Geoscience and Remote Sensing Letters*, 5(4):564–568, 2008.

[75] Dubes, R. C. and Jain, A. K. *Algorithms for clustering data*. Prentice hall Englewood Cliffs, 1988.

[76] Duda, R. O., Hart, P. E., and Stork, D. G. *Pattern classification*. John Wiley & Sons, Hoboken, New Jersey, 2012.

[77] Eismann, M. T. *Hyperspectral remote sensing*. SPIE Bellingham, 2012.

[78] Ellis, R. J. and Scott, P. W. Evaluation of hyperspectral remote sensing as a means of environmental monitoring in the St. Austell China clay (kaolin) region, Cornwall, UK. *Remote Sensing of Environment*, 93(1-2):118–130, 2004.

[79] Falco, N., Benediktsson, J. A., and Bruzzone, L. Spectral and spatial classification of hyperspectral images based on ICA and reduced morphological attribute profiles. *IEEE Transactions on Geoscience and Remote Sensing*, 53(11):6223–6240, 2015.

[80] Fang, L., Li, S., Kang, X., and Benediktsson, J. A. Spectral–spatial hyperspectral image classification via multiscale adaptive sparse representation. *IEEE Transactions on Geoscience and Remote Sensing*, 52(12):7738–7749, 2014.

[81] Fang, L., Li, S., Kang, X., and Benediktsson, J. A. Spectral–spatial classification of hyperspectral images with a superpixel-based discriminative sparse model. *IEEE Transactions on Geoscience and Remote Sensing*, 53(8):4186–4201, 2015.

[82] Fauvel, M., Benediktsson, J. A., Chanussot, J., and Sveinsson, J. R. Spectral and spatial classification of hyperspectral data using SVMs and morphologi-

cal profiles. *IEEE Transactions on Geoscience and Remote Sensing*, 46(11): 3804–3814, 2008.

[83] Fauvel, M., Tarabalka, Y., Benediktsson, J. A., Chanussot, J., and Tilton, J. C. Advances in spectral-spatial classification of hyperspectral images. *Proceedings of the IEEE*, 101(3):652–675, 2013.

[84] Feng, J., Jiao, L., Zhang, X., and Sun, T. Hyperspectral band selection based on trivariate mutual information and clonal selection. *IEEE Transactions on Geoscience and Remote Sensing*, 52(7):4092–4105, 2013.

[85] Foody, G. M. Thematic map comparison: evaluating the statistical significance of differences in classification accuracy. *Photogrammetric Engineering and Remote Sensing*, 70:627–633, 2004.

[86] Freund, Y., Seung, H. S., Shamir, E., and Tishby, N. Selective sampling using the query by committee algorithm. *Machine Learning*, 28:133–168, 1997.

[87] Fu, W., Li, S., Fang, L., Kang, X., and Benediktsson, J. A. Hyperspectral image classification via shape-adaptive joint sparse representation. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 9(2):556–567, 2016.

[88] Fukunaga, K. *Introduction to statistical pattern recognition.* Academic press, London, 2013.

[89] Ghamisi, P., Couceiro, M. S., Ferreira, N. M., and Kumar, L. Use of Darwinian particle swarm optimization technique for the segmentation of remote sensing images. In *IEEE International Geoscience and Remote Sensing Symposium (IGARSS'12)*, pages 4295–4298. IEEE, 2012.

[90] Ghamisi, P., Benediktsson, J. A., and Sveinsson, J. R. Automatic spectral–spatial classification framework based on attribute profiles and supervised feature extraction. *IEEE Transactions on Geoscience and Remote Sensing*, 52(9):5771–5782, 2014.

[91] Ghamisi, P., Benediktsson, J. A., and Ulfarsson, M. O. Spectral–spatial classification of hyperspectral images based on hidden Markov random fields. *IEEE Transactions on Geoscience and Remote Sensing*, 52(5):2565–2574, 2014.

[92] Ghamisi, P., Couceiro, M. S., Fauvel, M., and Benediktsson, J. A. Integration of segmentation techniques for classification of hyperspectral images. *IEEE Geoscience and Remote Sensing Letters*, 11(1):342–346, 2014.

[93] Ghamisi, P., Couceiro, M. S., Martins, F. M., and Benediktsson, J. A. Multilevel image segmentation based on fractional-order Darwinian particle swarm optimization. *IEEE Transactions on Geoscience and Remote sensing*, 52(5): 2382–2394, 2014.

[94] Ghamisi, P., Benediktsson, J. A., and Phinn, S. Land-cover classification using both hyperspectral and LiDAR data. *International Journal of Image and Data Fusion*, 6(3):189–215, 2015.

[95] Ghamisi, P., Dalla Mura, M., and Benediktsson, J. A. A survey on spectral–spatial classification techniques based on attribute profiles. *IEEE Transactions on Geoscience and Remote Sensing*, 53(5):2335–2353, 2015.

[96] Ghamisi, P., Maggiori, E., Li, S., Souza, R., Tarablaka, Y., Moser, G., De Giorgi, A., Fang, L., Chen, Y., Chi, M., et al. New frontiers in spectral-spatial hyperspectral image classification: The latest advances based on mathematical morphology, markov random fields, segmentation, sparse representation, and deep learning. *IEEE Geoscience and Remote Sensing Magazine*, 6(3):10–43, 2018.

[97] Ghosh, A., Datta, A., and Ghosh, S. Self-adaptive differential evolution for feature selection in hyperspectral image data. *Applied Soft Computing*, 13 (4):1969–1977, 2013.

[98] Girolami, M. Mercer kernel-based clustering in feature space. *IEEE Transactions on Neural Networks*, 13(3):780–784, 2002.

[99] Goldberg, D. *Genetic Algorithms in Search, Optimization, and Machine Learning.* Addison Wesley, New York, 1989.

[100] Grahn, H. and Geladi, P. *Techniques and applications of hyperspectral image analysis.* John Wiley & Sons, Hoboken, New Jersey, 2007.

[101] Gu, Z., Duncan, C., Grant, P., Cowan, C., Renshaw, E., and Mugglestone, M. Textural and spectral features as an aid to cloud classification. *International Journal of Remote Sensing*, 12(5):953–968, 1991.

[102] Guo, B., Gunn, S. R., Damper, R. I., and Nelson, J. D. Band selection for hyperspectral image classification using mutual information. *IEEE Geoscience and Remote Sensing Letters*, 3(4):522–526, 2006.

[103] Guyon, I. and Elisseeff, A. An introduction to variable and feature selection. *Journal of Machine Learning Research*, 3(Mar):1157–1182, 2003.

[104] Halimi, A., Altmann, Y., Dobigeon, N., and Tourneret, J.-Y. Nonlinear unmixing of hyperspectral images using a generalized bilinear model. *IEEE Transactions on Geoscience and Remote Sensing*, 49(11):4153–4162, 2011.

[105] Hao, S., Wang, W., Ye, Y., Li, E., and Bruzzone, L. A deep network architecture for super-resolution-aided hyperspectral image classification with classwise loss. *IEEE Transactions on Geoscience and Remote Sensing*, 56 (8):4650–4663, 2018.

[106] Hao, S., Wang, W., Ye, Y., Nie, T., and Bruzzone, L. Two-stream deep architecture for hyperspectral image classification. *IEEE Transactions on Geoscience and Remote Sensing*, 56(4):2349–2361, 2018.

[107] Hoi, S. C., Jin, R., and Lyu, M. R. Batch mode active learning with applications to text categorization and image retrieval. *IEEE Transactions on Knowledge and Data Engineering*, 21(9):1233–1248, 2009.

[108] Hoque, N., Bhattacharyya, D. K., and Kalita, J. K. MIFS-ND: A mutual information-based feature selection method. *Expert Systems with Applications*, 41(14):6371–6385, 2014.

[109] Hou, C., Nie, F., Li, X., Yi, D., and Wu, Y. Joint embedding learning and sparse regression: A framework for unsupervised feature selection. *IEEE Transactions on Cybernetics*, 44(6):793–804, 2013.

[110] Hsu, P.-H. Feature extraction of hyperspectral images using wavelet and matching pursuit. *ISPRS Journal of Photogrammetry and Remote Sensing*, 62(2):78–92, 2007.

[111] Huang, H. and Yang, M. Dimensionality reduction of hyperspectral images with sparse discriminant embedding. *IEEE Transactions on Geoscience and Remote Sensing*, 53(9):5160–5169, 2015.

[112] Huang, H., Luo, F., Liu, J., and Yang, Y. Dimensionality reduction of hyperspectral images based on sparse discriminant manifold embedding. *ISPRS Journal of Photogrammetry and Remote Sensing*, 106:42–54, 2015.

[113] Huang, S.-J., Jin, R., and Zhou, Z.-H. Active learning by querying informative and representative examples. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 36(10):1936–1949, 2014.

[114] Huang, X., Han, X., Zhang, L., Gong, J., Liao, W., and Benediktsson, J. A. Generalized differential morphological profiles for remote sensing image classification. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 9(4):1736–1751, 2016.

[115] Hughes, G. On the mean accuracy of statistical pattern recognizers. *IEEE Transactions on Information Theory*, 14(1):55–63, 1968.

[116] Iordache, M.-D., Bioucas-Dias, J. M., and Plaza, A. Sparse unmixing of hyperspectral data. *IEEE Transactions on Geoscience and Remote Sensing*, 49(6):2014–2039, 2011.

[117] Jensen, J. R. and Lulla, K. Introductory digital image processing: a remote sensing perspective. *Geocarto International*, 2(1):65, 1987.

[118] Jia, S., Tang, G., Zhu, J., and Li, Q. A novel ranking-based clustering approach for hyperspectral band selection. *IEEE Transactions on Geoscience and Remote Sensing*, 54(1):88–102, 2015.

[119] Jia, X. and Richards, J. A. Efficient maximum likelihood classification for imaging spectrometer data sets. *IEEE Transactions on Geoscience and Remote Sensing*, 32(2):274–281, 1994.

[120] Jolliffe, I. *Principal component analysis*. Wiley Online Library, 2002.

[121] Jun, G. and Ghosh, J. An efficient active learning algorithm with knowledge transfer for hyperspectral data analysis. In *IEEE International Geoscience and Remote Sensing Symposium (IGARSS'08)*, pages I–52–I–55. IEEE, 2008.

[122] Jusoff, K. Precision forestry using airborne hyperspectral imaging sensor. *Journal of Agricultural Science*, 1(1):142–147, 2009.

[123] Kalluri, H. R., Prasad, S., and Bruce, L. M. Decision-level fusion of spectral reflectance and derivative information for robust hyperspectral land cover classification. *IEEE Transactions on Geoscience and Remote Sensing*, 48 (11):4047–4058, 2010.

[124] Kang, X., Li, S., Fang, L., and Benediktsson, J. A. Intrinsic image decomposition for feature extraction of hyperspectral images. *IEEE Transactions on Geoscience and Remote Sensing*, 53(4):2241–2253, 2015.

[125] Karegowda, A. G., Manjunath, A., and Jayaram, M. Comparative study of attribute selection using gain ratio and correlation based feature selection.

International Journal of Information Technology and Knowledge Management, 2(2):271–277, 2010.

[126] Keith, D. J., Schaeffer, B. A., Lunetta, R. S., Gould Jr, R. W., Rocha, K., and Cobb, D. J. Remote sensing of selected water-quality indicators with the hyperspectral imager for the coastal ocean (HICO) sensor. *International Journal of Remote Sensing*, 35(9):2927–2962, 2014.

[127] Keshava, N. A survey of spectral unmixing algorithms. *Lincoln Laboratory Journal*, 14(1):55–78, 2003.

[128] Kettig, R. L. and Landgrebe, D. Classification of multispectral image data by extraction and classification of homogeneous objects. *IEEE Transactions on Geoscience Electronics*, 14(1):19–26, 1976.

[129] Kruse, F. A., Boardman, J. W., and Huntington, J. F. Comparison of airborne hyperspectral data and eo-1 hyperion for mineral mapping. *IEEE Transactions on Geoscience and Remote Sensing*, 41(6):1388–1400, 2003.

[130] Kuching, S. The performance of maximum likelihood, spectral angle mapper, neural network and decision tree classifiers in hyperspectral image analysis. *Journal of Computer Science*, 3(6):419–423, 2007.

[131] Kuo, B.-C. and Landgrebe, D. A. A robust classification procedure based on mixture classifiers and nonparametric weighted feature extraction. *IEEE Transactions on Geoscience and Remote Sensing*, 40(11):2486–2494, Nov 2002.

[132] Kwak, N. and Choi, C.-H. Input feature selection by mutual information based on parzen window. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 24(12):1667–1671, 2002.

[133] Lambin, E. and Ehrlich, D. The surface temperature-vegetation index space for land cover and land-cover change analysis. *International Journal of Remote Sensing*, 17(3):463–487, 1996.

[134] Landgrebe, D. A. *Signal theory methods in multispectral remote sensing*, volume 29. John Wiley & Sons, Hoboken, New Jersey, 2005.

[135] Lee, C. and Landgrebe, D. A. Feature extraction based on decision boundaries. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 15 (4):388–400, Apr 1993.

[136] Lee, C. and Landgrebe, D. A. Analyzing high-dimensional multispectral data. *IEEE Transactions on Geoscience and Remote Sensing*, 31(4):792–800, 1993.

[137] Lee, C. and Lee, G. G. Information gain and divergence-based feature selection for machine learning-based text categorization. *Information Processing and Management*, 42(1):155–165, 2006.

[138] Lemire, D. A better alternative to piecewise linear time series segmentation. In *The SIAM International Conference on Data Mining (ICDM'07)*, pages 545–550. SIAM, 2007.

[139] Li, J., Bioucas-Dias, J. M., and Plaza, A. Hyperspectral image segmentation using a new bayesian approach with active learning. *IEEE Transactions on Geoscience and Remote Sensing*, 49(10):3947–3960, 2011.

[140] Li, J., Bioucas-Dias, J. M., and Plaza, A. Spectral–spatial classification of hyperspectral data using loopy belief propagation and active learning. *IEEE Transactions on Geoscience and Remote Sensing*, 51(2):844–856, 2013.

[141] Li, N., Huang, X., Zhao, H., Qiu, X., Geng, R., Jia, X., and Wang, D. Multiparameter optimization for mineral mapping using hyperspectral imagery. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 11(4):1348–1357, 2018.

[142] Li, W., Prasad, S., Fowler, J. E., and Bruce, L. M. Locality-preserving dimensionality reduction and classification for hyperspectral image analysis. *IEEE Transactions on Geoscience and Remote Sensing*, 50(4):1185–1198, 2011.

[143] Liao, W., Chanussot, J., Dalla Mura, M., Huang, X., Bellens, R., Gautama, S., and Philips, W. Promoting partial reconstruction for the morphological analysis of very high resolution urban remote sensing images. *IEEE Geoscience and Remote Sensing Magazine*, 5(2):8–28, 2017.

[144] Lillesand, T., Kiefer, R. W., and Chipman, J. *Remote sensing and image interpretation.* John Wiley & Sons, Hoboken, New Jersey, 2014.

[145] Liu, S., Bruzzone, L., Bovolo, F., and Du, P. Unsupervised multitemporal spectral unmixing for detecting multiple changes in hyperspectral images. *IEEE Transactions on Geoscience and Remote Sensing*, 54(5):2733–2748, 2016.

[146] Liu, S., Marinelli, D., Bruzzone, L., and Bovolo, F. A review of change detection in multitemporal hyperspectral images: Current techniques, applications, and challenges. *IEEE Geoscience and Remote Sensing Magazine*, 7(2):140–158, 2019.

[147] Luo, T., Kramer, K., Goldgof, D. B., Hall, L. O., Samson, S., Remsen, A., and Hopkins, T. Active learning to recognize multiple types of plankton. *Journal of Machine Learning Research*, 6(Apr):589–613, 2005.

[148] Ma, L., Crawford, M. M., Yang, X., and Guo, Y. Local-manifold-learning-based graph construction for semisupervised hyperspectral image classification. *IEEE Transactions on Geoscience and Remote Sensing*, 53(5):2832–2844, 2014.

[149] Ma, N., Peng, Y., Wang, S., and Liu, D. Hyperspectral image anomaly targets detection with online deep learning. In *IEEE International Instrumentation and Measurement Technology Conference (I2MTC'18)*, pages 1–6. IEEE, 2018.

[150] Mahmood, Z., Thoonen, G., and Scheunders, P. Automatic threshold selection for morphological attribute profiles. In *IEEE International Geoscience and Remote Sensing Symposium (IGARSS'12)*, pages 4946–4949. IEEE, 2012.

[151] Makki, I., Younes, R., Francis, C., Bianchi, T., and Zucchetti, M. A survey of landmine detection using hyperspectral imaging. *ISPRS Journal of Photogrammetry and Remote Sensing*, 124:40–53, 2017.

[152] Mamitsuka, N. A. H. et al. Query learning strategies using boosting and bagging. In *International Conference on Machine Learning (ICML'98)*. Morgan Kaufmann Pub, 1998.

[153] Mao, K. Z. Orthogonal forward selection and backward elimination algorithms for feature subset selection. *IEEE Transactions on Systems, Man, and Cybernetics, Part B (Cybernetics)*, 34(1):629–634, 2004.

[154] Marconcini, M., Camps-Valls, G., and Bruzzone, L. A composite semisupervised svm for classification of hyperspectral images. *IEEE Geoscience and Remote Sensing Letters*, 6(2):234–238, 2009.

[155] Marinelli, D., Bovolo, F., and Bruzzone, L. A novel method for unsupervised multiple change detection in hyperspectral images based on binary spectral change vectors. In *9th International Workshop on the Analysis of*

Multitemporal Remote Sensing Images (MultiTemp'17), pages 1–4. IEEE, 2017.

[156] Marinelli, D., Bovolo, F., and Bruzzone, L. A novel change detection method for multitemporal hyperspectral images based on binary hyperspectral change vectors. *IEEE Transactions on Geoscience and Remote Sensing*, 57(7):4913–4928, 2019.

[157] Marpu, P., Neubert, M., Herold, H., and Niemeyer, I. Enhanced evaluation of image segmentation results. *Journal of Spatial Science*, 55(1):55–68, 2010.

[158] Marpu, P. R., Pedergnana, M., Dalla Mura, M., Peeters, S., Benediktsson, J. A., and Bruzzone, L. Classification of hyperspectral data using extended attribute profiles based on supervised and unsupervised feature extraction techniques. *International Journal of Image and Data Fusion*, 3(3):269–298, 2012.

[159] Marpu, P. R., Pedergnana, M., Dalla Mura, M., Benediktsson, J. A., and Bruzzone, L. Automatic generation of standard deviation attribute profiles for spectral–spatial classification of remote sensing data. *IEEE Geoscience and Remote Sensing Letters*, 10(2):293–297, 2013.

[160] Martínez-Usó, A., Pla, F., Sotoca, J. M., and García-Sevilla, P. Clustering-based hyperspectral band selection using information measures. *IEEE Transactions on Geoscience and Remote Sensing*, 45(12):4158–4171, 2007.

[161] Medjahed, S. A., Saadi, T. A., Benyettou, A., and Ouali, M. Gray wolf optimizer for hyperspectral band selection. *Applied Soft Computing*, 40: 178–186, 2016.

[162] Melgani, F. and Bruzzone, L. Classification of hyperspectral remote sensing images with support vector machines. *IEEE Transactions on Geoscience and Remote Sensing*, 42(8):1778–1790, 2004.

[163] Mercier, G. and Lennon, M. Support vector machines for hyperspectral image classification with spectral-based kernels. In *IEEE International Geoscience and Remote Sensing Symposium (IGARSS'03)*, pages 288–290. IEEE, 2003.

[164] Mitra, P., Shankar, B. U., and Pal, S. K. Segmentation of multispectral remote sensing images using active support vector machines. *Pattern Recognition Letters*, 25(9):1067–1074, 2004.

[165] Moser, G., Serpico, S. B., and Benediktsson, J. A. Land-cover mapping by markov modeling of spatial–contextual information in very-high-resolution remote sensing images. *Proceedings of the IEEE*, 101(3):631–651, 2013.

[166] Muslea, I., Minton, S., and Knoblock, C. A. Active learning with multiple views. *Journal of Artificial Intelligence Research*, 27:203–233, 2006.

[167] Nascimento, J. M. and Dias, J. M. Vertex component analysis: A fast algorithm to unmix hyperspectral data. *IEEE Transactions on Geoscience and Remote Sensing*, 43(4):898–910, 2005.

[168] Noyel, G., Angulo, J., and Jeulin, D. Morphological segmentation of hyperspectral images. *Image Analysis and Stereology*, 26(3):101–109, 2007.

[169] Pal, M. Hybrid genetic algorithm for feature selection with hyperspectral data. *Remote Sensing Letters*, 4(7):619–628, 2013.

[170] Pal, M. and Mather, P. M. An assessment of the effectiveness of decision tree methods for land cover classification. *Remote Sensing of Environment*, 86(4):554–565, 2003.

[171] Pan, B., Shi, Z., and Xu, X. Mugnet: Deep learning for hyperspectral image classification using limited samples. *ISPRS Journal of Photogrammetry and Remote Sensing*, 145:108–119, 2018.

[172] Paoletti, M., Haut, J., Plaza, J., and Plaza, A. A new deep convolutional neural network for fast hyperspectral image classification. *ISPRS Journal of Photogrammetry and Remote Sensing*, 145:120–147, 2018.

[173] Parra, L. C., Spence, C., Sajda, P., Ziehe, A., and Müller, K.-R. Unmixing hyperspectral data. In *Advances in neural information processing systems*, pages 942–948, 2000.

[174] Pasolli, E., Melgani, F., Tuia, D., Pacifici, F., and Emery, W. J. Svm active learning approach for image classification using spatial information. *IEEE Transactions on Geoscience and Remote Sensing*, 52(4):2217–2233, 2014.

[175] Patra, S. and Bruzzone, L. A fast cluster-assumption based active-learning technique for classification of remote sensing images. *IEEE Transactions on Geoscience and Remote Sensing*, 49(5):1617–1626, 2011.

[176] Patra, S. and Bruzzone, L. A batch-mode active learning technique based on multiple uncertainty for SVM classifier. *IEEE Geoscience and Remote Sensing Letters*, 9(3):497–501, 2012.

[177] Patra, S. and Bruzzone, L. A cluster-assumption based batch mode active learning technique. *Pattern Recognition Letters*, 33(9):1042–1048, 2012.

[178] Patra, S. and Bruzzone, L. A novel SOM-SVM-based active learning technique for remote sensing image classification. *IEEE Transactions on Geoscience and Remote Sensing*, 52(11):6899–6910, 2014.

[179] Patra, S., Gautam, R., and Singla, A. A novel context sensitive multilevel thresholding for image segmentation. *Applied Soft Computing*, 23:122–127, 2014.

[180] Patra, S., Modi, P., and Bruzzone, L. Hyperspectral band selection based on rough set. *IEEE Transactions on Geoscience and Remote Sensing*, 53 (10):5495–5503, 2015.

[181] Patra, S., Bhardwaj, K., and Bruzzone, L. A spectral-spatial multicriteria active learning technique for hyperspectral image classification. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 10(12):5213–5227, 2017.

[182] Pearson, K. LIII. On lines and planes of closest fit to systems of points in space. *The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science*, 2(11):559–572, 1901.

[183] Pedergnana, M., Marpu, P. R., Dalla Mura, M., Benediktsson, J. A., and Bruzzone, L. A novel technique for optimal feature selection in attribute profiles based on genetic algorithms. *IEEE Transactions on Geoscience and Remote Sensing*, 51(6):3514–3528, 2013.

[184] Peerbhay, K. Y., Mutanga, O., and Ismail, R. Random forests unsupervised classification: The detection and mapping ofsolanum mauritianumin-festations in plantation forestry using hyperspectral data. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 8(6): 3107–3122, 2015.

[185] Peng, H., Long, F., and Ding, C. Feature selection based on mutual information: criteria of max-dependency, max-relevance, and min-redundancy. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 27(8): 1226–1238, 2005.

[186] Pesaresi, M. and Benediktsson, J. A. A new approach for the morphological segmentation of high-resolution satellite imagery. *IEEE Transactions on Geoscience and Remote Sensing*, 39(2):309–320, 2001.

[187] Plaza, A., Martínez, P., Pérez, R., and Plaza, J. Spatial/spectral endmember extraction by multidimensional morphological operations. *IEEE Transactions on Geoscience and Remote Sensing*, 40(9):2025–2041, 2002.

[188] Plaza, A., Martinez, P., Plaza, J., and Pérez, R. Dimensionality reduction and classification of hyperspectral image data using sequences of extended morphological transformations. *IEEE Transactions on Geoscience and Remote Sensing*, 43(3):466–479, 2005.

[189] Plaza, A., Benediktsson, J. A., Boardman, J. W., Brazile, J., Bruzzone, L., Camps-Valls, G., Chanussot, J., Fauvel, M., Gamba, P., Gualtieri, A., et al. Recent advances in techniques for hyperspectral image processing. *Remote Sensing of Environment*, 113:S110–S122, 2009.

[190] Rajan, S., Ghosh, J., and Crawford, M. M. An active learning approach to hyperspectral data classification. *IEEE Transactions on Geoscience and Remote Sensing*, 46(4):1231–1242, 2008.

[191] Rajbanshi, S., Bhardwaj, K., and Patra, S. Spectral–spatial active learning techniques for hyperspectral image classification. In *Computational Intelligence in Data Mining*, pages 339–350. Springer, 2020.

[192] Richards, J. A. and Jia, X. Using suitable neighbors to augment the training set in hyperspectral maximum likelihood classification. *IEEE Geoscience and Remote Sensing Letters*, 5(4):774–777, 2008.

[193] Rigollet, P. Generalization error bounds in semi-supervised classification under the cluster assumption. *Journal of Machine Learning Research*, 8: 1369–1392, 2007.

[194] Roger, R. E. Sparse inverse covariance matrices and efficient maximum likelihood classification of hyperspectral data. *International Journal of Remote Sensing*, 17(3):589–613, 1996.

[195] Roy, N. and McCallum, A. Toward optimal active learning through monte carlo estimation of error reduction. In *International Conference on Machine Learning (ICML'01)*, pages 441–448, 2001.

[196] Sagar, B. D. Mathematical morphology in geosciences and gisci: An illustrative review. In *Handbook of Mathematical Geosciences*, pages 703–740. Springer, 2018.

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

[198] Sandidge, J. C. and Holyer, R. J. Coastal bathymetry from hyperspectral observations of water radiance. *Remote Sensing of Environment*, 65(3):341–352, 1998.

[199] Sathymoorthy, D., Palanikumar, R., and Sagar, B. Morphological segmentation of physiographic features from dem. *International Journal of Remote Sensing*, 28(15):3379–3394, 2007.

[200] Schohn, G. and Cohn, D. Less is more: Active learning with support vector machines. In *International Conference on Machine Learning (ICML'00)*. Citeseer, 2000.

[201] Schölkopf, B., Smola, A., and Müller, K.-R. Kernel principal component analysis. In *International Conference on Artificial Neural Networks (ICANN'97)*, pages 583–588. Springer, 1997.

[202] Schölkopf, B., Smola, A., and Müller, K.-R. Nonlinear component analysis as a kernel eigenvalue problem. *Neural Computation*, 10(5):1299–1319, 1998.

[203] Schowengerdt, R. Remote sensing: models and methods for image processing. Technical report, Academic Press, San Diego, CA, 1997.

[204] Serpico, S. B. and Bruzzone, L. A new search algorithm for feature selection in hyperspectral remote sensing images. *IEEE Transactions on Geoscience and Remote Sensing*, 39(7):1360–1367, 2001.

[205] Serra, J. *Image analysis and mathematical morphology*. Academic Press, Inc. London, 1983.

[206] Serra, J. and Vincent, L. An overview of morphological filtering. *Circuits, Systems, and Signal Processing*, 11(1):47–108, 1992.

[207] Seung, H. S., Opper, M., and Sompolinsky, H. Query by committee. In *Fifth Annual Workshop on Computational Learning Theory*, pages 287–294. ACM, 1992.

[208] Shawe-Taylor, J. and Cristianini, N. *Kernel methods for pattern analysis*. Cambridge university press, 2004.

[209] Siedlecki, W. and Sklansky, J. A note on genetic algorithms for large-scale feature selection. *Pattern Recognition Letters*, 10(5):335–347, 1989.

[210] Song, B., Li, J., Dalla Mura, M., Li, P., Plaza, A., Bioucas-Dias, J. M., Benediktsson, J. A., and Chanussot, J. Remotely sensed image classification using sparse representations of morphological attribute profiles. *IEEE Transactions on Geoscience and Remote Sensing*, 52(8):5122–5136, 2014.

[211] Sotoca, J. M. and Pla, F. Supervised feature selection by clustering using conditional mutual information-based distances. *Pattern Recognition*, 43(6): 2068–2081, 2010.

[212] Spolaôr, N., Cherman, E. A., Monard, M. C., and Lee, H. D. Filter approach feature selection methods to support multi-label learning based on relieff and information gain. In *Brazilian Symposium on Artificial Intelligence (BSAI'12)*, pages 72–81. Springer, 2012.

[213] Srinivas, N. and Deb, K. Muiltiobjective optimization using nondominated sorting in genetic algorithms. *Evolutionary Computation*, 2(3):221–248, 1994.

[214] Stuffler, T., Förster, K., Hofer, S., Leipold, M., Sang, B., Kaufmann, H., Penné, B., Mueller, A., and Chlebek, C. Hyperspectral imagingan advanced instrument concept for the EnMAP mission (Environmental Mapping and Analysis Programme). *Acta Astronautica*, 65(7-8):1107–1112, 2009.

[215] Su, Y., Li, J., Plaza, A., Marinoni, A., Gamba, P., and Chakravortty, S. Daen: Deep autoencoder networks for hyperspectral unmixing. *IEEE Transactions on Geoscience and Remote Sensing*, 57(7):4309–4321, 2019.

[216] Sun, S., Zhong, P., Xiao, H., and Wang, R. Active learning with Gaussian process classifier for hyperspectral image classification. *IEEE Transactions on Geoscience and Remote Sensing*, 53(4):1746–1760, 2015.

[217] Sun, S., Zhong, P., Xiao, H., and Wang, R. An MRF model-based active learning framework for the spectral-spatial classification of hyperspectral imagery. *IEEE Journal of Selected Topics in Signal Processing*, 9(6):1074–1088, 2015.

[218] Sun, Y., Lei, W., and Ren, X. The research status and application of hyperspectral image target detection. In *Selected Papers of the Chinese Society for Optical Engineering Conferences held October and November 2016*, page 102554T. International Society for Optics and Photonics, 2017.

[219] Talukdar, U., Hazarika, S. M., and Gan, J. Q. A kernel partial least square based feature selection method. *Pattern Recognition*, 83:91–106, 2018.

[220] Tan, K., Hu, J., Li, J., and Du, P. A novel semi-supervised hyperspectral image classification approach based on spatial neighborhood information and classifier combination. *ISPRS Journal of Photogrammetry and Remote Sensing*, 105:19–29, 2015.

[221] Tarabalka, Y., Chanussot, J., and Benediktsson, J. A. Segmentation and classification of hyperspectral images using minimum spanning forest grown from automatically selected markers. *IEEE Transactions on Systems, Man, and Cybernetics, Part B (Cybernetics)*, 40(5):1267–1279, 2009.

[222] Tarabalka, Y., Benediktsson, J. A., Chanussot, J., and Tilton, J. C. Multiple spectral–spatial classification approach for hyperspectral data. *IEEE Transactions on Geoscience and Remote Sensing*, 48(11):4122–4132, 2010.

[223] Tarabalka, Y., Chanussot, J., and Benediktsson, J. A. Segmentation and classification of hyperspectral images using watershed transformation. *Pattern Recognition*, 43(7):2367–2379, 2010.

[224] Tarabalka, Y., Fauvel, M., Chanussot, J., and Benediktsson, J. A. SVM- and MRF-based method for accurate classification of hyperspectral images. *IEEE Geoscience and Remote Sensing Letters*, 7(4):736–740, 2010.

[225] Thenkabail, P. S. Optimal hyperspectral narrowbands for discriminating agricultural crops. *Remote Sensing Reviews*, 20(4):257–291, 2001.

[226] Tong, S. and Koller, D. Support vector machine active learning with applications to text classification. *Journal of Machine Learning Research*, 2 (Nov):45–66, 2001.

[227] Tuia, D., Pacifici, F., Kanevski, M., and Emery, W. J. Classification of very high spatial resolution imagery using mathematical morphology and support vector machines. *IEEE Transactions on Geoscience and Remote Sensing*, 47 (11):3866–3879, 2009.

[228] Tuia, D., Ratle, F., Pacifici, F., Kanevski, M. F., and Emery, W. J. Active learning methods for remote sensing image classification. *IEEE Transactions on Geoscience and Remote Sensing*, 47(7):2218–2232, 2009.

[229] Tuia, D., Volpi, M., Copa, L., Kanevski, M., and Munoz-Mari, J. A survey of active learning algorithms for supervised remote sensing image classification. *IEEE Journal of Selected Topics in Signal Processing*, 5(3):606–617, 2011.

[230] Urbach, E. R., Roerdink, J. B., and Wilkinson, M. H. Connected shape-size pattern spectra for rotation and scale-invariant classification of gray-scale

images. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 29(2):272–285, 2007.

[231] Vincent, L. Grayscale area openings and closings, their efficient implementation and applications. In *First Workshop on Mathematical Morphology and its Applications to Signal Processing*, pages 22–27, 1993.

[232] Vlachos, A. A stopping criterion for active learning. *Computer Speech & Language*, 22(3):295–312, 2008.

[233] Wang, M., Wu, C., Wang, L., Xiang, D., and Huang, X. A feature selection approach for hyperspectral image based on modified ant lion optimizer. *Knowledge-Based Systems*, 168:39–48, 2019.

[234] Wang, X., Yang, J., Teng, X., Xia, W., and Jensen, R. Feature selection based on rough sets and particle swarm optimization. *Pattern Recognition Letters*, 28(4):459–471, 2007.

[235] Wang, Z., Nasrabadi, N. M., and Huang, T. S. Semisupervised hyperspectral classification using task-driven dictionary learning with laplacian regularization. *IEEE Transactions on Geoscience and Remote Sensing*, 53(3): 1161–1173, 2014.

[236] Wang, Z., Du, B., Zhang, L., Zhang, L., and Jia, X. A novel semisupervised active-learning algorithm for hyperspectral image classification. *IEEE Transactions on Geoscience and Remote Sensing*, 55(6):3071–3083, 2017.

[237] Xia, J., Dalla Mura, M., Chanussot, J., Du, P., and He, X. Random subspace ensembles for hyperspectral image classification with extended morphological attribute profiles. *IEEE Transactions on Geoscience and Remote Sensing*, 53(9):4768–4786, 2015.

[238] Xu, H. and Wang, X.-j. Applications of multispectral/hyperspectral imaging technologies in military. *Infrared and Laser Engineering*, 36(1):13, 2007.

[239] Xu, Z., Yu, K., Tresp, V., Xu, X., and Wang, J. Representative sampling for text classification using support vector machines. In *European Conference on Information Retrieval (ECIR'03)*, pages 393–407. Springer, 2003.

[240] Yang, J.-M., Yu, P.-T., and Kuo, B.-C. A nonparametric feature extraction and its application to nearest neighbor classification for hyperspectral image data. *IEEE Transactions on Geoscience and Remote Sensing*, 48(3):1279–1293, 2010.

[241] Yu, L. and Liu, H. Feature selection for high-dimensional data: A fast correlation-based filter solution. In *International Conference on Machine Learning (ICML'03)*, pages 856–863, 2003.

[242] Zhang, H., Yang, K., Yang, Z., Zhang, P., Lu, Y., and Yan, P. Hyperspectral mineral mapping technology applied to geology based on HyMap data. In *Hyperspectral Remote Sensing Applications and Environmental Monitoring and Safety Testing Technology*, page 101560Y. International Society for Optics and Photonics, 2016.

[243] Zhang, R. and Ma, J. Feature selection for hyperspectral data based on recursive support vector machines. *International Journal of Remote Sensing*, 30(14):3669–3677, 2009.

[244] Zhang, R. and Rudnicky, A. I. A large scale clustering scheme for kernel k-means. In *Object Recognition Supported by User Interaction for Service Robots*, volume 4, pages 289–292. IEEE, 2002.

[245] Zhang, Z. and Crawford, M. M. A batch-mode regularized multimetric active learning framework for classification of hyperspectral images. *IEEE Transactions on Geoscience and Remote Sensing*, 55(11):6594 – 6609, 2017.

[246] Zhang, Z., Pasolli, E., Crawford, M. M., and Tilton, J. C. An active learning framework for hyperspectral image classification using hierarchical segmentation. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 9(2):640–654, 2016.

[247] Zhao, J., Zhong, Y., Jia, T., Wang, X., Xu, Y., Shu, H., and Zhang, L. Spectral-spatial classification of hyperspectral imagery with cooperative game. *ISPRS Journal of Photogrammetry and Remote Sensing*, 135:31–42, 2018.

[248] Zhao, Y., Shi, Z., Zhang, J., Chen, D., and Gu, L. A novel active learning framework for classification: using weighted rank aggregation to achieve multiple query criteria. *Pattern Recognition*, 93:581–602, 2019.

[249] Zhou, X. and Prasad, S. Transformation learning based domain adaptation for robust classification of disparate hyperspectral data. In *IEEE International Geoscience and Remote Sensing Symposium (IGARSS'17)*, pages 3640–3643. IEEE, 2017.

[250] Zhou, X., Prasad, S., and Crawford, M. M. Wavelet-domain multiview active learning for spatial-spectral hyperspectral image classification. *IEEE Jour-*

nal of Selected Topics in Applied Earth Observations and Remote Sensing, 9(9):4047–4059, 2016.

[251] Zhou, Y., Peng, J., and Chen, C. P. Dimension reduction using spatial and spectral regularized local discriminant embedding for hyperspectral image classification. *IEEE Transactions on Geoscience and Remote Sensing*, 53 (2):1082–1095, 2015.

[252] Zhuo, L., Zheng, J., Li, X., Wang, F., Ai, B., and Qian, J. A genetic algorithm based wrapper feature selection method for classification of hyperspectral images using support vector machine. In *Geoinformatics 2008 and Joint Conference on GIS and Built Environment: Classification of Remote Sensing Images*, page 71471J. International Society for Optics and Photonics, 2008.

[253] Zomer, S., Del Nogal Sánchez, M., Brereton, R. G., and Perez Pavon, J. L. Active learning support vector machines for optimal sample selection in classification. *Journal of Chemometrics: A Journal of the Chemometrics Society*, 18(6):294–305, 2004.