

Recent Advances in Spectral–Spatial Hyperspectral Image Classification

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Abstract

Imaging spectroscopy, also known as hyperspectral imaging, has been transformed in the last four decades from being a sparse research tool into a commodity product available to a broad user community. Particularly, in the last 10 years, a significant number of new techniques have been introduced in the domain of hyperspectral image classification. Most of these techniques are characterized by their capacity to take into account both the spatial and spectral characteristics of the hyperspectral data, as opposed to classic techniques for hyperspectral classification that perform in pixel-by-pixel fashion. Spectral–spatial hyperspectral image classification techniques can achieve better performance than their pixel-wise counterparts, as they can combine the rich spectral information contained in the data with spatial-contextual information. In this talk, we provide a comprehensive overview of recent developments in spectral–spatial techniques for hyperspectral image classification in a unified context. The idea of spatial dependency system is first introduced, which involves pixel dependency and label dependency. Resulting from this concept, we categorize available approaches into fixed, adaptive, and global. Then, existing spectral–spatial methods are grouped into four categories according to the fusion stages in which spatial information becomes effective, i.e., preprocessing-based, integrated, postprocessing-based, and hybrid techniques. Finally, typical methodologies are outlined. The talk concludes with a detailed comparison of representative spectral–spatial classification methods using hyperspectral images collected by several instruments, in the context of different applications.



Jun Li received the Geographical Information Systems degree from Hunan Normal University in 2004, the M.Sc. degree in Remote Sensing and Photogrammetry from Peking University in 2007, and the Ph.D. degree in Electrical and Computer Engineering from Instituto Superior Tecnico, Technical University of Lisbon in 2011. She was a postdoctoral researcher with the hyperspectral Computing Laboratory, Department of Technology of Computers and Communications, University of Extremadura, Cáceres, Spain. She is currently a Full Professor with the School of Geography and Planning, Sun Yat-Sen University, China, where she founded her own research group on hyperspectral image analysis in 2013. Since then, she has obtained several prestigious funding grants at the national and international level. She has

published a total of 86 journal citation report (JCR) papers, 48 conference international conference papers, and 1 international book chapter. She has received a significant number of citations to her published works, with several papers distinguished as “Highly Cited Papers” in Clarivate Analytics’ Web of Science Essential Science Indicators (WoS-ESI). She was elevated to IEEE Senior Member status in 2016. Her students have also obtained important distinctions and awards at international conferences and symposia. Her main research interests comprise remotely sensed hyperspectral image analysis, signal processing, supervised/semi-supervised learning and active learning. Prof. Li is an Associate Editor for the *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing* (since 2014). She has been a Guest Editor for several journals, including the *Proceedings of the IEEE* and the *ISPRS Journal of Photogrammetry and Remote Sensing*. She has also been an active reviewer for several journals, including the IEEE Transactions on Geoscience and Remote Sensing, the IEEE Geoscience and Remote Sensing Letters, the IEEE Transactions on Image Processing, Pattern Recognition, Optical Engineering, Journal of Applied Remote Sensing and Inverse Problems and Imaging. She has received several important awards and distinctions, including the IEEE Geoscience and Remote Sensing Society (GRSS) Early Career Award in 2017. She was distinguished as a Best Reviewer of the *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing* (in 2013). One of her students received the Best Student Paper at the 2016 SPIE Remote Sensing Europe Symposium held in Edinburgh, UK. One of her students received the 2nd prize in the Student Paper competition held at the 2017 IEEE International Geoscience and Remote Sensing Symposium (IGARSS) held in Fort Worth, Texas.