

T6A: Hyperspectral Image Processing and Analysis

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Abstract

Hyperspectral imagery, also called imaging spectroscopy, refers to images with a large number (typically a few hundreds) of narrow and contiguous spectral bands, covering a wide range of the electromagnetic spectrum from the visible to the infrared domain. Hyperspectral data is able to provide a very fine description of the chemical components in the sensed materials and ensure their detection, discrimination and characterization.

The application of hyperspectral imagery is rapidly growing, especially in the context of space and airborne remote sensing, as well as planetary exploration and astrophysics. Additional applications include, monitoring and management of the environment, physical analysis of materials, biomedical imaging, defense and security, food safety, detection of counterfeit objects (especially in pharmacology), and precision agriculture.

Unfortunately, every rose has its thorns and the price to pay for the enhanced spectral diversity is high dimensional data. The challenge is in defining appropriate signal and image processing methods. In this tutorial, we will review some processing and analysis techniques that explicitly handle the high dimensionality of the data, addressing various tasks, including image denoising, image segmentation, hierarchical analysis, target detection, spectral unmixing, and image compression. Results will be presented on images from a variety of contexts.

Speaker Bio:

Jocelyn Chanussot (M'04–SM'04–F'12) received the M.Sc. degree in electrical engineering from the Grenoble Institute of Technology (Grenoble INP), Grenoble, France, in 1995, and the Ph.D. degree from the Université de Savoie, Annecy, France, in 1998. In 1999, he was with the Geography Imagery Perception Laboratory for the Delegation Generale de l'Armement (DGA - French National Defense Department). Since 1999, he has been with Grenoble INP, where he was an Assistant Professor from 1999 to 2005, an Associate Professor from 2005 to 2007, and is currently a Professor of signal and image processing. He is conducting his research at the Grenoble Images Speech Signals and Automatics Laboratory (GIPSA-Lab). His research interests include image analysis, multicomponent image processing, nonlinear filtering, and data fusion in remote sensing. He has been a visiting scholar at Stanford University (USA), KTH (Sweden) and NUS (Singapore). Since 2013, he is an Adjunct Professor of the University of Iceland. In 2015-2017, he is a visiting professor at the University of California, Los Angeles (UCLA).

Dr. Chanussot is the founding President of IEEE Geoscience and Remote Sensing French chapter (2007-2010) which received the 2010 IEEE GRS-S Chapter Excellence Award. He was the co-recipient of the NORSIG 2006 Best Student Paper Award, the IEEE GRSS 2011 and 2015 Symposium Best Paper Award, the IEEE GRSS 2012 Transactions Prize Paper Award and the IEEE GRSS 2013 Highest Impact Paper Award. He was a member of the IEEE Geoscience and Remote Sensing Society AdCom (2009-2010), in charge of membership development. He was the General Chair of the first IEEE GRSS Workshop on Hyperspectral Image and Signal Processing, Evolution in Remote sensing (WHISPERS). He was the Chair (2009-2011) and Co-chair of the GRS Data Fusion Technical Committee (2005-2008). He was a member of the Machine Learning for Signal Processing Technical Committee of the IEEE Signal Processing Society (2006-2008) and the Program Chair of the IEEE International Workshop on Machine Learning for Signal Processing, (2009). He was an Associate Editor for the IEEE Geoscience and Remote Sensing Letters (2005-2007) and for Pattern Recognition (2006-2008). Since 2007, he is an Associate Editor for the IEEE Transactions on Geoscience and Remote Sensing. He was the Editor-in-Chief of the IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing (2011-2015). In 2013, he was a Guest Editor for the Proceedings of the IEEE and in 2014 a Guest Editor for the IEEE Signal Processing Magazine. He is a Fellow of the IEEE and a member of the Institut Universitaire de France (2012-2017).