XXIII International Society for Photogrammetry and Remote Sensing (ISPRS) Congress
http://www.isprs.org/

ABSTRACT OF THE TUTORIAL 2

Synthetic Aperture Radar: How it works and modern Applications

Duration:
The tutorial is subdivided into three parts of 2 hours each - 11 July 2016

Convener:
1. Prof. Dr.-Ing. Uwe Sörgel
2. Prof. Mattia Crespi, PhD.
3. Dr. Michele Crosetto

Keywords:
SAR, applications, geotechnics, civil engineering, landslides, subsidence

Target Group:
Graduate and PhD students, young scientists, remote sensing specialists, geoscience professionals, preferably with some signal processing, engineering, programming,remote sensing or photogrammetry knowledge.

Abstract:

1. SAR and SAR Interferometry (DEM) given by Uwe Soergel
First, briefly the fundamentals of the microwave spectrum and radar as such are introduced before we turn to imaging radar (synthetic aperture radar, SAR). Then we discuss effects of the coherent and side-looking sensor principle such as speckle and layover, respectively. The second half of this part is dedicated to basics of SAR Interferometry and its application in terms of DEM generation.

2. SAR Stereo (Radargrammetry) given by Mattia Crespi
First, the fundamentals of radargrammetry, as sister methodology of photogrammetry able to exploit the amplitude information of the SAR imagery, are introduced, with particular concern to the orientation models (rigorous and RPCs ones) suitable for medium-high resolution satellite SAR imagery (COSMO-SkyMed, TerraSAR-X/TanDEM-X, RADARSAT-2, Sentinel-1, ALOS-2, and the coming PAZ) and the image matching strategy. Then, the DSMs and 3D points generation is discussed, focusing on potentials and problems and showing also practical examples.

3. PSI and GBSAR given by Michele Crosetto
In this last part of the tutorial we address the deformation monitoring based on SAR data. The fundamentals of Differential Interferometric SAR (DInSAR) are introduced. Then we discuss in detail the advanced DInSAR techniques, and in particular the Persistent Scatterer Interferometry (PSI) techniques. The pros and cons of these techniques are analysed considering case studies based on SAR data from different sensors. The final part is devoted to deformation monitoring based on ground-based SAR (GBSAR).

Uwe Soergel's CV
Uwe Soergel is Full Professor for *Remote Sensing and Image Analysis* at Technische Universität Darmstadt, Germany. He received the Diplomingenieur (M.Sc.) degree in electrical engineering from University of Erlangen-Nuremberg, Germany, in 1997. From fall 1997 to the end of 2005, he was a research associate with the Institute for Optronics and Pattern Recognition (FOM) located in Ettlingen (Germany). In parallel he earned a PhD in electrical engineering and computer science from the Leibniz Universität Hannover, Germany, in 2003. Prior to his current position starting from 2006 he was first Assistant Professor and later Associate Professor for *Radar Remote Sensing* and for *Radar Remote*

Sensing and Active Systems, respectively, at Leibniz Universität Hannover. Uwe's main research interests are remote sensing, automated image analysis, and pattern recognition. The focus areas of his scientific work comprise analysis of SAR and airborne laserscanning data, SAR Interferometry, and fusion of different kinds of remote sensing image data. He has authored and co-authored ca. 150 publications (about 50 peer-review) and three book chapters.

Mattia Crespi's CV

Mattia Crespi is Full professor of *Positioning and Geomatics* at the Engineering Faculty of the Sapienza University of Rome since 2005 and Member of the Ph.D. Governing Board of the Sapienza University of Rome. He received his M.Sc. degree in Civil Engineering (Summa cum Laude) in 1987 at Politecnico di Milano (Milan, Italy) and his Ph.D. in Geodesy and Surveying in 1992 at Politecnico di Torino. He served as Dean of the B.Sc. and M.Sc. Courses in Environmental Engineering and Coordinator of the Ph.D. Course in Transportation and Infrastructures from 2007 to 2013. His main research interests are within GNSS positioning for surveying, monitoring and navigation, Digital Surface Models generation from SAR (radargrammetry) and optical satellite imagery and statistical aspects of data analysis. He was awarded three international prizes: *DLR Special Topic Prize* and *Audience Award* of the European Satellite Navigation Competition in 2010 and *Success Story* recognition in 2012 for the VADASE algorithm for GNSS kinematic monitoring; ESA *Certificate for Galileo In-Orbit-Validation* in 2014. He is author and co-author of more than 250 publications (about 60 peer-reviewed, 2 book chapters), chairman of the EARSeL Special Interest Group on *3D Remote Sensing* since 2009 and Editor of 2 Int. Ass. Geodesy Symposia volumes. He is holder of two patents, one related to a matching algorithm for both SAR and optical satellite imagery.

Michele Crosetto's CV

Michele Crosetto holds a civil engineering degree from the Politecnico di Torino (1993) and a doctorate in Topographic and Geodesic Sciences from the Politecnico di Milano (1998). He specialized in Geodesy, Photogrammetry and GIS in Lausanne (EPFL) and Zurich (ETHZ) from 1993 to 1995. He has worked in the Joint Research Centre of the European Commission in Ispra, Italy (January 1999 - July 2000) and as a researcher at the Cartographic Institute of Catalonia. He has formed part of the Institute of Geomatics since 2002, when he began with a "Ramón y Cajal" research contract. Since January 2014 is with CTTC, where he is head of the Geomatics Divisions. His main research activity is related to the analysis of spaceborne, airborne and ground-based remote sensing data and the development of scientific and technical applications using active sensor types, as for example Synthetic Aperture Radar (SAR), Real Aperture Radar (RAR) and Laser Scanners.