

Synthetic Aperture Radar for Mapping Applications

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Course objective: The course gives a complete introduction to Synthetic Aperture Radar (SAR). The imaging geometry and radiometry are explained comprehensively using examples from currently available sensor systems. Sensor orientation and geocoding is treated from a geodetic viewpoint. SAR interferometry, SAR polarimetry, polarimetric interferometry and SAR tomography are treated intensively. Approaches making use of satellite-borne SAR for solving geodetic problems are discussed. Mapping applications are treated with an emphasis on high-resolution 3D object detection and reconstruction. The required computer vision and machine learning concepts are included. The course is of interest for both beginners in SAR remote sensing as well as advanced learners interested in the use of pattern analysis techniques.

Course outline:

- **Introduction to Synthetic Aperture Radar (SAR)**
 - Imaging Geometry
 - Radiometry
- **Available Sensor Systems and Application Specifics including exemplary datasets**
- **Sensor Orientation and Geocoding**
- **SAR Interferometry**
 - Terrain Modeling
 - Motion Detection
- **SAR Polarimetry**
 - Principles
 - Available Modalities
- **Polarimetric Interferometry**
- **SAR Tomography**
 - Principles
 - Modeling as a Compressive Sensing Problem
- **SAR Geodesy**
 - High-precision mapping with satellite-borne SAR
- **Mapping Applications**
 - Conventional mapping
 - Object detection and object reconstruction