

## **Image Analysis for Remote Sensing**

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Zentrum für Fernerkundung der Landoberfläche (ZFL)  
Bonn University*

### **Instructor:**

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### **Aim:**

Modern computing environments for processing remote sensing imagery are using increasingly sophisticated tools and algorithms for extracting information on spatial and temporal patterns, land use/land cover and associated dynamic processes. Many of these rely on multivariate statistics and on the principles of machine learning. The goal of the course is to provide a basic understanding of the theoretical foundation for image transformations, supervised classification, clustering methods, pattern recognition and change detection.

### **Content:**

Random variables and vectors, probability distributions, statistical sampling, hypothesis tests, probabilistic inference, entropy, mutual information; basic principles of statistical pattern recognition; spectral (PCA, MNF) image transformations; image fusion; supervised classification (maximum likelihood, neural networks, support vector machines, kernel methods), regularization, cross validation, accuracy assessment; clustering methods (fuzzy, expectation maximization, inclusion of spatial information); change detection (PCA, canonical correlation analysis).

All topics will be accompanied by examples and illustrations in the ENVI image analysis environment.

### **Prerequisites:**

Some experience with digital analysis of remote sensing data (e.g. in connection with GIS), basic familiarity with elementary calculus, vectors and matrices, although this will be communicated during the lectures.

**Literature:**

Image Analysis, Classification and Change Detection in Remote Sensing, with Algorithms for ENVI/IDL, M. J. Canty, Taylor & Francis 2007 ISBN 0-8493-7251-8

Pattern Recognition and Machine Learning, C. M. Bishop, Springer 2006 ISBN 0-387-31073-8

Remote Sensing Digital Image Analysis (4th Edition), J. A. Richards and X. Jia, Springer 2006 ISBN 354-0251-286