Aachen Institute for Advanced Study in Computational Engineering Science

RWTH AACHEN UNIVERSITY

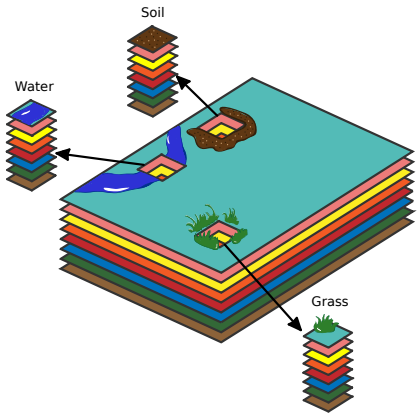
Doctoral Position

in DFG International Research Training Group 2379 “Modern Inverse Problems”

The new DFG International Research Training Group (IRTG) 2379 builds on a unique consortium, at RWTH Aachen University with its Aachen Institute of Advanced Study in Computational Engineering Science, and at the **University of Texas at Austin** with its **Institute for Computational Engineering and Sciences**. The projects are embedded in the field of modern inverse problems and introduce a new innovative perspective into the education of future scientists and engineers.

The advertised position is associated with the project “P2 Computational tools for chemical imaging”, and advised jointly by Prof. Benjamin Berkels at RWTH Aachen and Prof. Chandrajit Bajaj at UT Austin. The project will advance the state of the art in segmentation and unximing of data from chemical imaging, which is an umbrella term for image acquisition techniques that record a full spectral band of data at each pixel. A major challenge for the analysis of *hyperspectral* data is its huge size and high dimensionality.

Segmentation of hyperspectral data is the task of partitioning the image domain into disjoint sub-regions based on a suitable notion of spectral homogeneity, i.e. assigning a class label to each pixel based on its spectral vector data. For instance, for hyperspectral satellite images, such classes could be soil, water, grass, street, etc. A more general task than segmentation is called *unmixing*. Instead of belonging to just one class, unmixing considers each pixel to be a mixture of a number of constituents. Unmixing then needs to determine both the mixture ratios and the constituents. Nowadays, numerous hyperspectral image modalities are available, which makes this research relevant for a wide range of applications. One considered application will be cancer treatment, where Fourier transform infrared spectroscopy data of human tissue samples needs to be classified into classes like “highly cancerous”, “mildly cancerous” or “normal”.



A sketch of a hyperspectral data cube.

The main aims of this project are:

- Robust segmentation of hyperspectral data with large intra-class variation;
- Unmixing of mixture of mixtures data using hierarchical matrix/tensor factorization.

Your profile: We are seeking highly motivated candidates with strong mathematical skills. Requirement for this position is a master’s or equivalent degree in mathematics or a related field with a superior academic record. Knowledge in signal/image processing, optimization and/or data analysis is desired. Good programming skills are of advantage. Excellent written and spoken English language skills are required.

Our offer: The candidate will be a regular employee and must meet required personal qualifications. This is a full-time position with a civil service pay scale TV-L E 13: `https://www.aices.rwth-aachen.de/en/faq`

The expected appointment period is **three years**. Full involvement in the IRTG activities, including joint RWTH-UT colloquia, annual workshops and schools, and short courses is expected. A **six-month research** stay at University of Texas in Austin is part of the training program. Applications are being reviewed now.

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Starting date: April 2019

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