Berlin Mathematical School

# BMS Friday Colloquium

## Friday 16 February 2018 at 14:15

*Tea & Cookies starting at 13:00*

BMS Loft, Urania, An der Urania 17, 10787 Berlin

## Carola-Bibiane Schönlieb

*(U Cambridge)*

$$\min_{\lambda} \text{loss}(u(\lambda))$$

$$\text{s.t.} \quad u(\lambda) = \text{argmin}_v \mathcal{J}(v, \lambda)$$

The top picture shows images of the Berkeley segmentation dataset BSDS300, see

D. Martin, C. Fowlkes, D. Tal, and J. Malik.

A database of human segmented natural images and its application to evaluating segmentation algorithms and measuring ecological statistics. In Proc. 8th Int'l Conf. Computer Vision, volume 2, pages 416–423, July 2001.

## Model-based learning in imaging

One of the most successful approaches to solve inverse problems in imaging is to cast the problem as a variational model. The key to the success of the variational approach is to define the variational energy such that its minimiser reflects the structural properties of the imaging problem in terms of regularisation and data consistency.

Variational models constitute mathematically rigorous inversion models with stability and approximation guarantees as well as a control on qualitative and physical properties of the solution. On the negative side, these methods are rigid in a sense that they can be adapted to data only to a certain extent. Hence researchers started to apply machine learning techniques to "learn" more expressible variational models. In her talk, Schönlieb will discuss two approaches: bilevel optimisation (which was investigated over the last couple of years and aims to find an optimal model by learning from a set of desirable training examples), and quotient minimisation (which was only recently proposed as a way to incorporate negative examples in regularisation learning). To finish, she will also give a sneak-preview of recent efforts integrating deep learning in regularised image reconstruction. This talk is based on joint work.

Carola-Bibiane Schönlieb is an Austrian mathematician. She is the head of Cambridge Image Analysis at the Department of Applied Mathematics and Theoretical Physics, University of Cambridge. She completed her PhD there in 2009 and her research involves image analysis, image processing and partial differential equations. Schönlieb's awards and honors include a Philip Leverhulme Prize (2017), an Alan Turing Institute Fellowship (2016), and the Whitehead Prize (2016).

**www.math-berlin.de**