

## **Inverse Problems Network Meeting 2**

Thursday, 23<sup>rd</sup> November 2017 - Friday, 24<sup>th</sup> November 2017

Isaac Newton Institute, Cambridge

### **Abstract of Talk**

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## **MODEL-BASED LEARNING IN IMAGING**

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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. The basic principle is to consider a bilevel optimization problem, where the variational model appears as the lower-level problem and the higher-level problem is the minimization over a loss function that measures the reconstruction error for the solution of the variational model. In this talk we discuss bilevel optimisation, its analysis and numerical treatment, and show applications to regularisation learning, learning of noise models and of sampling patterns in MRI.

This talk includes joint work with M. Benning, L. Calatroni, C. Chung, J. C. De Los Reyes, M. Ehrhardt, G. Maierhofer, F. Sherry, and T. Valkonen.