

Miniworkshop

Inverse problems and inspection techniques in neuroscience and other fields

Monday, June 4th, 2018

classroom 1, DMI, University of Ferrara, via Machiavelli 30, Italy

09:00 **Tomography and its application**

Prof. **Samuli Siltanen**, University of Helsinki, Finland

Abstract. Tomography is an imaging method where the internal structure of a patient or an object is recovered from projection data. The data can be collected using a variety of probing energies, such as X-rays, neutron beams, electrons or visible light. The common aspect in all tomography is the mathematical reconstruction algorithm which needs to be properly regularised to avoid excessive sensitivity to noise. This talk presents a few main approaches to regularisation and illustrates them with practical examples from medical imaging and nondestructive testing.

10:00 **Interfacing the human brain with artificial devices**

Prof. **Luciano Fadiga**, University of Ferrara & IIT, Italy

Abstract. The possibility to connect the brain with external devices is becoming more and more scientifically and technologically plausible. Main issues remain versatility and real utility of neuroprosthetic devices. The state of the art we have reached at the Center for Translational Neurophysiology of the Italian Institute of Technology will allow us to move towards neuroprostheses for speech and to explore the possibility of artificially reconnecting cortical centers disconnected by pathological events.

11:00 Coffee break

11:20 **Atmospheric turbulence profiling for telescope imaging**

Jonatan Lehtonen, University of Helsinki, Finland

Abstract. Adaptive optics (AO) is a technology for real-time correction of distortions due to turbulence in ground-based optical telescopes. AO systems require solid prior information of the turbulence, but the classical von Kármán model of turbulence statistics is not always valid close to the ground. We present a novel method for simultaneously recovering a vertical turbulence profile and a model for ground layer turbulence from AO telemetry.

11:45 **Inverse problems using an optimization-based neural network**

Carla Bertocchi, University of Modena and Reggio Emilia, Italy

Abstract. In this talk, we wish to exploit the structure of an algorithm used to minimize the criterion associated with an inverse problem, while making use of the "true" criterion which is the distance to the ground truth. This is done by creating a neural network which mimics the structure of an optimization algorithm while extracting itself the features of the input which drive the regularization. The network is trained based on the distance to the ground truth which is available for a given database.

12:10 **Computational approach for parametric imaging from PET data**

Serena Crisci, University of Ferrara, Italy

Abstract. Compartmental analysis is a well-known method to quantitatively study the metabolic process of a radioactive tracer, observed by using a set of dynamic PET images. In this context, in order to reconstruct the flux parameters of a glucose-like-tracer, called fluoro-deoxy-glucose (FDG), we solve an ill-posed nonlinear least squares problem with nonnegative constraints by using some regularization techniques.

12:35 Closing discussion

Organization

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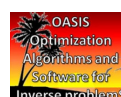
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