

ICB seminar series 2018/19 chairman: Prof. Dr. Paolo Arosio

## IMAGE RECOVERY AND RESTO-RATION WITH NEURAL NET-WORKS AND ROBUST STORAGE OF INFORMATION ON DNA

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Abstract: In the current scientific and technological landscape, difficult technological problems are often no longer addressed within a solitary discipline, but rather by combining techniques and insights from two fields. In this talk we discuss two such examples, specifically how machine learning enables better imaging systems, and how DNA synthesis and sequencing combined with information theory enables better information storage systems. In the first part of this talk, we consider the inverse problem of recovering an image from measurements taken by an imaging systems such as a microscope or a magnetic resonance imaging machine. Deep neural networks have become highly effective tools for solving such inverse problems. This success if often attributed to large amounts of training data. In this talk, we offer an alternative view by demonstrating that a major contributing factor to this success is that neural networks impose strong prior assumptions on images—so strong that it is possible to perform image recovery with neural networks without any training data. In the second part of this talk, we consider the problem of storing information on DNA. We briefly discuss algorithmic and design aspects of DNA data storage systems, and in particular how error correcting codes enable trading off quality of synthesis and sequencing for a slight increase in recovery complexity.

**Bio:** Reinhard Heckel is a Rudolf Moessbauer assistant professor in the Department of Electrical and Computer Engineering at the Technical University of Munich, and an adjunct assistant professor at Rice University, where he was an assistant professor from 2017-2019. Before that, he spent one and a half years as a postdoctoral researcher in the Department of Electrical Engineering and Computer Sciences at the University of California, Berkeley, and a year in the Cognitive Computing & Computational Sciences Department at IBM Research Zurich. He completed his PhD in electrical engineering in 2014 at ETH Zurich and was a visiting PhD student at the Statistics Department at Stanford University. Reinhard is working in the intersection of machine learning and signal/information processing with a current focus on deep networks for solving inverse problems, learning from few and noisy samples, and DNA data storage.



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