

TUTORIAL by Andreas Krause (*ETH Zürich, Switzerland*)

Submodularity in Machine Learning and Vision

Abstract. Numerous problems in machine learning and vision are inherently discrete. More often than not, these lead to challenging optimization problems. While convexity is an important property when solving continuous optimization problems, submodularity, often viewed as a discrete analog of convexity, is key to solving many discrete problems. Its characterizing property, diminishing marginal returns, appears naturally in a multitude of settings. While submodularity has long been recognized in combinatorial optimization and game theory, it has seen a recent surge of interest in theoretical computer science, machine learning and computer vision. This tutorial will introduce the concept of submodularity and its basic properties, and outline recent research directions -- such as new approaches towards large-scale optimization and sequential decision making tasks. We will discuss recent applications to challenging machine learning and vision problems such as high-order graphical model inference, structured sparse modeling, multiple object detection, active sensing etc. The tutorial will not assume any specific prior knowledge on the subject.

Biography. Dr Andreas Krause is an Assistant Professor of Computer Science at ETH Zurich, where he leads the Learning & Adaptive Systems Group. Before that he was Assistant Professor of Computer Science at Caltech (2009-2012). He received his Ph.D. and M.Sc. in Computer Science from Carnegie Mellon University (2008) and his Diplom in Computer Science and Mathematics from the Technical University of Munich, Germany (2004). He is a Microsoft Research Faculty Fellow and a Kavli Frontiers Fellow of the US National Academy of Sciences. He received an ERC Starting Investigator grant, the Deutscher Mustererkennungspreis, an NSF CAREER award, the Okawa Foundation Research Grant recognizing top young researchers in telecommunications as well as the ETH Golden Owl teaching award. His research in learning and adaptive systems that actively acquire information, reason and make decisions in large, distributed and uncertain domains received awards at premier conferences (AAAI, KDD, IPSN, ICML, UAI) and journals (JAIR, JWRPM).