UNIVERSITY OF HOUSTON DEPARTMENT OF MATHEMATICS

Analysis Seminar

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An introduction to compressed sensing and its application to quantum process tomography

1:00 pm in 646 PGH September 13, 2019

Abstract

In compressed sensing one uses known structures of otherwise unknown signals to recover them from as few linear observations as possible. The structure comes in form of some compressibility. The two most popular compressibility promises are (i) sparsity in a known basis and (ii) a low matrix rank. This talk will provide an introduction to the topic and illustrate the general approach using natural images, which are sparse w.r.t. wavelet frames. As a second application, we will discuss quantum process tomography, i.e., the task of recovering a full classical description of a quantum process from measurement data. Specifically, we will discuss compressed sensing based recovery for an important class of quantum processes characterized by a unit matrix rank. The type of considered measurements are practically relevant and have a close connection to the so-called phase retrieval problem: For a quantum process given by a unitary U, the measurement values are of the form $|Tr[C * U]|^2$ with Clifford group unitaries C, which are randomly chosen by the observer. We provide a rigorously guaranteed and practical reconstruction method that works with an essentially optimal number of such measurements. Moreover, for a larger class of quantum processes, the unital ones, we provide an explicit expansion into a unitary 2-design, allowing for a practical and guaranteed reconstruction also in that case.

Persons with disabilities who desire accommodations should contact the Math Dept. at: 713-743-3500.