Compressed Sensing and Matrix Completion:
From Single Pixel Cameras to Quantum State Tomography

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Every time the release button of a digital camera is pressed, several megabytes of raw data are recorded. But the size of a typical jpeg output file is only 10% of that. What a waste! Can't we design a process which records only the relevant 10% of the data to begin with? The recently developed theory of compressed sensing achieves this trick for sparse signals. I will give a short introduction to the ideas and the math behind compressed sensing.

A basis-independent notion of "sparsity" for a matrix is its rank. One is thus naturally led to the "low-rank matrix recovery" problem: can one reconstruct and unknown low-rank matrix from few linear measurements? The answer is affirmative. The arguably simplest proof to date is based on ideas from quantum information theory. In the second half of the presentation, I will talk about applications and proof techniques for the matrix theory, including the links to quantum.