



The University of Chicago  
Department of Statistics  
Seminar Series

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**Ramsey Theory Reveals the Conditions when Sparse  
Coding on Subsampled Data is Unique**

**TUESDAY, May 31, 2011, at 4:00 PM**

110 Eckhart Hall, 5734 S. University Avenue

*Refreshments following the seminar in Eckhart 110.*

**ABSTRACT**

Sparse coding or dictionary learning has been widely used to reveal the sparse underlying structure of many kinds of sensory data. A related advance in signal processing is compressed sensing, a theory explaining how sparse data can be subsampled below the Nyquist-Shannon limit and then efficiently recovered from these subsamples. Here we study whether the conditions for recovery in compressed sensing are sufficient for dictionary learning to discover the original sparse causes of subsampled data. Using combinatorial Ramsey theory, we completely characterize when the learned dictionary matrix and sparse representations of subsampled data are unique (up to the natural equivalences of permutation and scaling). Surprisingly, uniqueness is shown to hold without any assumptions on the learned dictionaries or inferred sparse codes. This result has potential applications in data analysis and neuroscience. It suggests that sparse coding is applicable in cases when only subsampled measurements are available. Further, it identifies sparse coding as a possible learning mechanism for establishing lossless communication through severe bottlenecks, which might explain how different brain regions communicate through axonal fibers projections. (Joint with Friedrich Sommer, Redwood Center for Theoretical Neuroscience, U.C. Berkeley).

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For further information and about building access for persons with disabilities, please contact Laura Rigazzi at 773.702.8333 or send email ([lrigazzi@galton.uchicago.edu](mailto:lrigazzi@galton.uchicago.edu)). If you wish to subscribe to our email list, please visit the following website: <https://lists.uchicago.edu/web/arc/statseminars>.