Stanford University  
Department of Statistics  

DEPARTMENTAL SEMINAR  

4:15pm, Tuesday, December 11, 2012  
Sequoia Hall Room 200  
Cookies served at 3:45pm, 1st floor Lounge.

Speaker: Alessandro Rinaldo  
 Department of Statistics,  
 Carnegie Mellon University  

Title: Maximum Likelihood Estimation in Exponential Families  
for Discrete Data  

Abstract:  
This talk is concerned with maximum likelihood estimation in exponential families with polyhedral support. I will focus on the geometric characterization of the conditions for existence of the MLE of the natural parameters, and describe a new construction of the closure of these families based on the normal fan to the support. In the first part of the talk I will motivate these results using exponential random graph models, or ERGMs, exponential families for network data. I will show that the seemingly pathological and strange behaviors that ERGMs often exhibit, known as degeneracy, can be accounted for by the geometry of the MLE.

In the second part, I will further specialize these result by discussing the problem of nonexistence of the MLE in log-linear models, and its implications for the analysis of sparse contingency tables. Although this issue is ubiquitous in high-dimensional data, it is virtually ignored in all statistical software available to practitioners, and remains in fact largely unsolved. I will characterize in a combinatorial fashion patterns of sampling zero leading to a nonexistent MLE and identify which model parameters are non-estimable. I will then suggest simple ways to modify standard procedures for goodness-of-fit testing and model selection that can accommodate for a nonexistent MLE.

This is joint work with Stephen E. Fienberg, Sonja Petrovic and Yi Zhou.