3rd Hamilton Institute Workshop on Nonnegative Matrices & Related Topics

JH1, John Hume Building, NUI Maynooth

August 5th-7th, 2008

Abstracts

Professor Shmuel Friedland & Chee Wei Tan

Maximizing Sum Rates in Gaussian Interference-limited Channels

Abstract:

We study the problem of maximizing sum rates in Gaussian interference-limited channels. We show that this maximum problem can be restated as a maximization problem of a convex function on a closed convex set. We suggest three algorithms to ¯nd the exact and approximate values of the optimal rates. Our approach is intimately related to the extremal properties of the Perron-Frobenius theory of nonnegative matrices, in particular the log-convexity result of Kingman and the Friedland-Karlin inequalities.

For complete results see http://arxiv.org/abs/0806.2860

Professor Daniel Hershkowitz

From Diagonal Similarity and Equivalence of Nonnegative Matrices to Nonnegative Sign Equivalent and Sign Similar Factorizations of Matrices

Abstract:

In this talk we review results on diagonal similarity and diagonal equivalence of nonnegative matrices. We then move on to results on general matrices and to conditions for a matrix to be diagonally similar or equivalent to a nonnegative matrix. Finally, we discuss recent results on nonnegative sign equivalent and sign similar factorizations of matrices. We show that every square real matrix can be written as a product of nonnegative sign equivalent matrices, and even of nonnegative sign similar matrices and of totally positive sign equivalent matrices. We discuss the question of the minimal number of such factors.

Professor Leslie Hogben

Matrix Completion Problems for Classes of Nonnegative Matrices

Abstract:

This talk will survey results on matrix completion problems for classes of nonnegative matrices including positive or nonnegative P- or P_0- matrices, completely positive matrices, and doubly nonnegative matrices. Applications of nonnegative matrix techniques to these problems will be discussed and open questions will be presented.

Professor Chris King

Comparison of norms on non-commutative product spaces.

Abstract:

The Schatten norm is the non-commutative analog of the l^p-norm for the algebra of $n \times n$ matrices. There are several candidates for the non-commutative analog of the $l^p(l^q)$ norm on the product algebra of $nm \times nm$ matrices. We describe two of these norms, one due to Pisier and one due to Carlen and Lieb, and discuss their properties, and the relation between them.

Professor Steve Kirkland

The case of equality in the Dobrushin bound for stochastic matrices

Abstract:

Given an $n \times n$ row-stochastic matrix A, a bound due to Dobrushin asserts that for any eigenvalue λ of A such that $\lambda \ne 1$, we have $|\lambda| \le \frac{1}{2}max_{i,j=1,\dots, n} \sum_{k=1,\ldots,n} |a_{i,k}-a_{j,k}|.$ In this talk, we investigate the case of equality in this bound. In particular, we characterize the complex numbers λ such that there is a row-stochastic matrix A having λ as an eigenvalue for which equality holds in the bound. We also discuss the graphs G for which the transition matrix for the random walk on G yields equality in the bound. This is joint work with Michael Neumann.

Dr. Amy Langville

Rating and Rank Aggregation

Abstract:

There are many applications that rely heavily on ranked lists. For instance, search engines present a ranked list of results to users. Voters rank political candidates in an election. Companies like Netflix produce lists of the highest ranked movies. Algorithms from numerical linear algebra are typically used to create these ranked lists. Different algorithms produce different ranked lists. The aim of this talk is to merge the results from several ranked lists (and later rating lists) into one aggregated list that contains the best qualities from the various input lists. I will discuss a few algorithms for rank aggregation and conclude with some applications.

Professor Dusan Stipanovic

Row Stochastic Matrices and Consistent State and Parameter Estimation

Abstract:

In this talk, new algorithms for the overlapping state and parameter estimation based on the assumption of a consensus formulated in terms of row stochastic matrices will be presented. Different communication topologies that either guarantee or cannot achieve asymptotic denoising with respect to the measurement noise will be discussed. Finally, representative examples for the consistent decentralized parameter and state estimation using sensor networks will be provided.

Professor Dr. Fabian Wirth

Lyapunov functions for interconnected systems

Abstract:

For large scale interconnected systems we ask for conditions that guarantee the existence of a Lyapunov function for the overall system, given stability conditions on the subsystems and conditions on the coupling of the subsystems. The condition can be stated in terms on a monotone nonlinear operator on the positive orthant. The resulting condition is of a small gain type and can be verified numerically. Once this condition has been checked an explicit formula for the desired Lyapunov function is available.

On Optimal Condition Numbers For Markov Chains

Michael Neumann *

Abstract

Let $T = (t_{i,j})$ and $\tilde{T} = T - E$ be arbitrary nonnegative, irreducible, stochastic matrices corresponding to two ergodic Markov chains on n states. A function $\kappa(\cdot)$ is called a *condition number for Markov chains* with respect to the (α, β)–norm pair if $\|\pi - \tilde{\pi}\|_\alpha \leq \kappa(T)\|E\|_\beta$.

Various condition numbers, particularly with respect to the $(1, \infty)$ and (∞, ∞) have been suggested in the literature by several authors. They were ranked according to their size by Cho and Meyer in a paper from 2001. In this paper we first of all show that what we call the generalized ergodicity coefficient $\tau_p(A^\#) = \sup_{y^te=0} \frac{\|y^tA^\#\|_p}{\|y\|_1}$, where e is the n–vector of all 1's, is the smallest of the condition numbers of Markov chains with respect to the (p, ∞)–norm pair. We use this result to identify the smallest condition number of Markov chains among the (∞, ∞) and $(1, \infty)$–norm pairs. These are, respectively, κ_3 and κ_6 in the Cho–Meyer list of 8 condition numbers.

Kirkland has studied $\kappa_3(T)$. He has shown that $\kappa_3(T) \geq \frac{n-1}{2n}$ and he has characterized the properties of transition matrices for which equality holds. We prove again that $2\kappa_3(T) \leq \kappa(6)$ which appears in the Cho–Meyer paper and we characterize the transition matrices T for which $\kappa_6(T) = \frac{n-1}{n}$. There is only one such matrix: $T = (J_n - I)/(n-1)$. where J_n is the $n \times n$ matrix of all 1's. This result demands the development of the cyclic structure of a doubly stochastic matrix with a zero diagonal.

This is joint work with and Nung–Sing Sze [1]

*Department of Mathematics, University of Connecticut, Storrs, CT 06269–3009 (neumann@math.uconn.edu). Research supported in part by NSA Grant No. 06G–232

[1] Department of Mathematics, University of Connecticut, Storrs, CT 06269–3009 (sze@math.uconn.edu)