Graduate students abstracts

1. Eigenfaces vs. Fisherfaces - Face Recognition

Xiwei Chen, Rochester Institute of Technology

In the modern life, the need for personal security and access control is becoming an important issue. Biometrics is the technology which is expected to replace traditional authentication methods that are easily stolen, forgotten and duplicated. Face recognition is a nonintrusive method, and facial images are probably the most common biometric characteristic used by humans to make a personal recognition. There are two methods commonly used for face recognition: eigenfaces and fisherfaces. The eigenfaces method use principal components analysis (PCA) for dimensionality reduction. It yields projection directions that maximize the total scatter across all classes, i.e. across all images of all faces. In the process of modeling, given a collection of n labeled training images, it computes mean image and covariance matrix first and k eigenvectors (note that these are images) of covariance matrix corresponding to k largest eigenvalues. And then it projects the training images to the k-dimensional eigenspace. On the other hand, the fisherfaces method maximizes the ratio of between-class scatter to that of within-class scatter. It is faster than eigenfaces in some cases and works well even if different illumination and different facial express. We present and discuss both of the face recognition techniques using two different databases. Yet, extensive experimental results demonstrate that the proposed “Fisherfaces” method has error rates that are lower than those of the Eigenfaces technique for tests on the Harvard and Yale Face Databases.

2. A Geometric Invariant for Finitely Generated Groups

Keith Jones, SUNY Binghamton

In 1987, Bieri, Neumann, and Strebel introduced a new geometric invariant for a finitely generated group G. The invariant is obtained by placing an inner product on a naturally occurring vector space V associated with G. Viewing the set of directions emanating from the origin of V as a sphere, the invariant is a subset of this sphere which contains useful information about the structure of G. Since then, this invariant has been generalized in a number of ways, and it is now viewed as a special case of an invariant, Sigma1, which measures connectivity properties for certain actions by finitely generated groups. I will illustrate how these invariants are defined, discuss some interesting examples and

applications, and discuss recent work in calculating the invariant for actions on locally finite trees.

3. Rank One Lattice Vertex Operator Algebras

Michael Penn, SUNY Albany

This talk will review the general definition of a Vertex Operator Algebra and explore some standard examples, including those built from integral lattices. We will explore the basis of a canonical subspace of a VOA built from a general rank 1 lattice.The result has applications in q series.

4. Cantor's Diagonalization Revisited: Constructing Transcendental Numbers.

Viji Z. Thomas, SUNY Binghamton

Cantor's famous diagonalization is used to show that the reals are uncountable. Knowing that the real algebraic numbers are countable, we obtain as a corollary to Cantor's result that there exist transcendental numbers. What is less well known is that Cantor's diagonalization gives a method to construct transcendental numbers. In a recent paper, M.R. Bacon and L.-C. Kappe provided an explicit method to construct transcendentals using Cantor's diagonalization. The topic of this talk is the construction of transcendental numbers by this method.

5. Generalized linear models and actuarial science

Yang Zhao, Rochester Institute of Technology

Actuarial science is concerned with the financial management of financial security systems ---these can be defined as 'mechanisms for reducing the adverse financial impact of random events that prevent the fulfillment of reasonable expectations' (Bowers et al., 1986). Such systems have certain fundamental limitations. For example, they are restricted to reducing the consequences of random events that create losses that can be measured in monetary terms. Secondly, such systems do not directly reduce the probability that a loss occurs. One of the most important tasks for an actuary working in financial security systems is management of uncertainty. We can break the process down into several distinct stages: identification of information sources;

collection of data; analysis; model construction; sensitivity testing; prediction; monitoring the model assumptions in the light of emerging experience and updating the model. The aim of this study is to present that Generalized Linear Models (GLMs) have a wide area of applications in actuarial work and are not confined. We demonstrate several separate practical applications in actuarial work.