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RANDOM MATRIX THEORY: A PROGRAM OF THE STATISTICS AND APPLIED MATHEMATICAL SCIENCES INSTITUTE (SAMSI)[1]

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In 2004, Iain Johnstone proposed a special program on Random Matrix Theory to the Statistics and Applied Mathematical Sciences Institute. Eventually, Iain, Héléne Massam, Doug Nychka, Don Richards, Craig Tracy and I became co-organizers and the program's scope was enlarged.

It now included regularization issues, inference in graphical models, Bayesian multivariate analysis in such models, applications of random matrix theory particularly in electrical engineering, as well as applications of regularization and high dimensional multivariate analysis in geophysical models. The program was realized as a six-month session in 2006–2007 and featured not only the usual opening workshop at SAMSI but also two closing workshops, one at NCAR (National Center for Atmospheric Research) focused on applications, and one at AIM (American Institute of Mathematics) focused on theory. Two other workshops, one on scoping geophysical models at NCAR and another at SAMSI on Large Graphical Models and Random Matrices, a Bayesian focus week and a course in random matrices also resulted.

These activities were supported by an enthusiastic group of postdoctoral fellows, visitors and local faculty and graduate students, as well as a video link for weekly lectures alternating between Berkeley on the West Coast and SAMSI on the East.

The Editors of *The Annals of Statistics*, Susan Murphy and Bernard Silverman, agreed to devote this issue of *The Annals of Statistics* to exhibit some of the fruits of this program. Papers were submitted and subjected to the normal refereeing procedures.

The papers included touch on most of the interests present in the program. Zeitouni and Anderson's paper bridges the gap between Random Matrix Theory and Regularized Estimation by showing that statistics based on the bulk spectrum of regularized empirical covariance matrices behave as one would like them to do. Johnstone extends his powerful limiting result on covariance matrices to canonical correlations, making contributions to both Random Matrix Theory and Statistical Inference. Raj Rao, Mingo, Speicher and Edelman provide novel workable methods and algorithms for testing equality of eigenvalues which are robust in the

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presence of high dimension. Another distinct set of papers deals mainly with regularization issues. We include here the works of Fan and Fan, El Karoui, Bickel and Levina, all involving thresholding in one form or another and showing that taking advantage of sparsity makes a big difference.

Nadler's paper, in addition to giving the classical Random Matrix Theory approach, analyzes Principal Component Analysis based on the empirical covariance matrix in a novel fashion for this literature using small sigma asymptotics.

Rajaratnam, Massam and Carvalho pick up the Bayesian strain by introducing a set of Wishart-type priors concentrating on specific graphical submodels for which posterior means can be exactly calculated when the data have a multivariate Gaussian distribution.

Finally, Schwartzman, Mascarenhas and Taylor present the rich classical multivariate Gaussian theory of inference that arises in the context of DTI data, while Paul and Peng begin a thorough analysis of functional data both when the observations are sparse and when they're dense, a marriage of an important application and large p, large n theory.

As Associate Editor in charge of this issue, it was a pleasure to handle this excellent batch of papers (other than Levina's and mine) which truly reflects the broad scope of the program.

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