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A Message from the President

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I would first like to thank **Mike West** for his service as past president. Among many other issues Mike has provided invaluable service to ISBA by revising and reviving our IT infrastructure. Many of you must have already used the nifty new on-line membership service. The elected new officers for 2010 and the new editors were already mentioned in the last Bulletin. In addition to these new officers I welcome our new 2011 program chair **Igor Prünster**. Since joining the program council in January Igor has already worked hard to help with the selection of the ISBA travel awards. Thanks! Another new appointment is **David Dunson** as the new chair of the Membership Committee.

We will soon begin the process to organize the 2011 ISBA elections, starting with the formation of the nomination committee. As laid out in the ISBA bylaws the nomination committee is chaired by the past president. All members are invited to make suggestions for membership in the nomination committee. Please forward suggestions to me.

In the past years it has occasionally been proposed to initiate sections in ISBA. The constitution provides for the possibility of sections and the policy on sections lays out a very simple process to launch sections. I believe that the formation of sections could be a wonderful opportunity to keep ISBA relevant for our members, and to ensure that ISBA activities continue to reflect the forefront of current developments in Bayesian analysis. A specific proposal for an ISBA section on Bayesian nonparametrics (BNP) is currently being prepared by some members. There is a long running series of workshops that loosely defines a community of researchers with related interests. The process to form a new section is amazingly simple. Formally, all that is needed is a petition by 30 members to propose the bylaws and initial officers of a proposed section. The ISBA Board considers the proposal and votes on the proposal. That's all. I hope that ISBA/BNP will be followed by other section proposals. A natural focus point is any established series of workshops or other events. For example, for ISBA/BNP the organization of the BNP workshops is the natural purpose and activity of the new section.

Other exciting events in the upcoming year are several meetings organized and co-sponsored by ISBA. Alex Schmidt is summarizing the many upcoming meetings elsewhere in this Bulletin. If you are... *Continued on page 2.*

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MESSAGE FROM THE PRESIDENT, *Continued from page 1.* ... involved in organizing any event related to Bayesian analysis, please consider to include ISBA co-sponsorship. The rules for setting up ISBA co-sponsorship are laid out on our homepage http://www.bayesian.org (select ”ISBA business” and ”meetings”).

Surely the most important ISBA event in 2010 is the ISBA World Meeting and Valencia Meeting. The scientific program committee, chaired by the 2009 program chair Herbie Lee, has done an outstanding job to prepare a stunning program. The process included open submission of abstracts and a blinded selection process. We are very happy to note that the resulting program includes a large percentage of young researchers, and thus naturally many new ideas. Please join us in particular for the Savage award session when the finalists for the Savage thesis award are presenting. The Savage prize is jointly organized by ISBA and ASA/SBSS (the Section on Bayesian Statistical Science of the American Statistical Association). The Savage finalists session is a wonderful opportunity to meet tomorrow’s leaders of Bayesian statistics.

The Savage prize is one of several prizes that are awarded by ISBA. Besides the Savage Award ISBA organizes and awards the *De Groot Prize* for a book in statistical science, the *Lindley Prize* for the best contributed paper presented at the World Meeting, and the *Mitchell Prize* for the best applied Bayesian paper. Please watch out for the announcements for submissions for these prizes. In particular, we will consider a re-organization of the submission process for the Lindley Prize. If you notice a particularly outstanding paper presented at the upcoming World Meeting, please consider to nominate the paper for the Lindley Prize.

For the upcoming World Meeting we are happy to be able to provide a large number of travel awards. Supported from a variety of funding sources we are able to provide partial support for 62 participants. This includes travel support from ASA/SBSS for the finalists of the jointly ISBA and SBSS supported Savage award, additional SBSS travel support for several senior graduate students and young researchers within 2 years of their Ph.D. degree. An important funding source is an NSF (US National Science Foundation) conference grant that provides partial travel support for 13 young US investigators. NIH (US National Institutes of Health) is providing partial travel support for 7 young US investigators who present cancer related work (The award is still subject to final approval). This reflects the increasing importance of Bayesian statistics in biomedical research in general and in cancer research in particular. More travel awards are supported by ISBA, including the *Pilar Iglesias* travel fund to support participants from developing countries and the *ISBA Lifetime Members Award*.

One of the most important decisions for ISBA in the upcoming year is the choice of the site for the *2012 ISBA World Meeting*. We have received several excellent pre-proposals and have invited representatives for each pre-proposal to present their proposals during the upcoming World Meeting in Benidorm. The proposals will be discussed in the General Member Meeting and a final choice will be made by the Board. ISBA has the wonderful problem of chosing between several outstanding alternatives! ▲

A Message from the Editor

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In November 1992, the first issue of this Bulletin appeared as the ISBA NEWSLETTER under the editorship of Tom Leonard. During almost 18 years, we have all witnessed the steady improvement of this means of communication of our society. This achievement has been possible only because of the collaboration of all in the Bayesian community and the enthusiastic work of the past Editors. I am now delighted to continue these efforts. First, I want to thank Rapahel Gottardo for his work as Editor and for the advice and help he has provided me during this transition. I also want to thank Mayetri Gupta who last December finished her term as Associate Editor of the Applications section. On the other hand, I can say that it has been a pleasure to work on the production of this first 2010 issue. The team of Associated Editors that have, very kindly, agreed to continue their work for the Bulletin are quite experienced and this makes my task enjoyable. I am sure that we will produce a Bulletin with the quality standard that our community requires and that several new proposals will emerge from our ongoing exchange of ideas.

In this number, you will find most of the usual sections with interesting information. Particularly, I would like to call your attention to the article by Marc Suchard, Chris Holmes and Mike West on graphic processing unit computing. This is a timely introduction to a rather new approach to massive computing, whose long-term impact in Bayesian Analysis is highly promising. We thank the authors for bringing this innovative subject to our Bulletin. In close relation, the article on Bayesian functional data by Ciprian Crainiceanu explores the analysis of complex data from a different perspective. I also hope you will find interesting the contribution by Tapen Sinha and myself on the History of Bayesian Statistics.

I want to encourage all members of ISBA to contribute with their suggestions and specific manuscripts and announcements for the existing sections. Please do not hesitate to contact any member of the Editorial Board. Finally, I also want to thank Pedro Regueiro for his technical assistance with the typesetting of this Bulletin. ▲

BAYESIAN ANALYSIS - A MESSAGE FROM THE EDITOR

First Words

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I am greatly honored to be following Rob Kass and Brad Carlin as the next Editor-in-Chief of Bayesian Analysis, our society's journal. They have done a great job launching and growing the journal, and I hope to continue its upward trajectory. We just published our first issue of Volume 5, have recently joined the Science Citation Index, and we are looking forward to receiving our first impact factor in 2010.

Our new issue features a discussion paper introducing a Bayesian approach for the analysis of small-angle neutron scattering experiments. This paper by Charles Hogg, Joseph Kadane, Jong Soo Lee, and Sara Majetich was originally chosen as one of the invited case studies for the 2009 Case Studies in Bayesian Statistics and Machine learning Workshop, and the Bayesian approach allows the authors to gain new insights relative to the traditional methodology. Discussions by Nick Hengartner and by John Skilling and Devinder Sivia give additional context for the problem and the methodology. The remainder of the issue features seven other fine articles on topics from priors to methodology to an application in medical image analysis.

We have a great team assembled on our editorial board, and I am grateful for all their help. I am particularly thankful that Pantelis Vlachos is continuing on as system managing editor, as he continues to be invaluable in the running and production of the journal. I am also thankful that production editor Angelika van der Linde is continuing, and that Alyson Wilson is joining us as the new managing editor. Our wonderful set of editors are Kate Cowles, David Dunson, David Heckerman, Michael Jordan, Antonietta Mira, Bruno Sansó, Mark Steel, and Kert Viele, and we have a large team of great associate editors.

We look forward to your submissions (and to your help with occasional requests for reviews). Bayesian Analysis publishes articles in all areas of Bayesian statistics, from theory to methodology to case studies, as well as other types of insightful articles. If you have any questions or suggestions, please let me know. ▲

FROM THE PROGRAM COUNCIL

ISBA NEWS

Alexandra M. Schmidt, Herbie Lee & Igor Prüenster

If you are thinking about proposing a site for an ISBA meeting then we encourage you to refer to the ISBA Program Council Procedures (http://www.bayesian.org/business/newmeetingsprocedures.html) on meetings, which provides the guidelines that will be used to recommend venues for these meetings. We are currently (co-)sponsoring the following meetings:

ISBA 2010 World Meeting/9th Valencia Meeting

The ISBA 2010 World Meeting will be held in conjunction with the Ninth Valencia International Meeting on Bayesian Statistics from June 3 to June 8, 2010 in Benidorm, Spain. We believe we have an exciting program covering a wide range of subjects. The program comprises contributed talks and poster sessions. We have also organized a Student Video competition. Below follows more details:

- **Contributed Talks**

  We received 164 abstracts for 36 contributed talks, so the process was highly competitive. We conducted blinded reviews, with each submission read and scored by two members of the program committee, and the top scorers were organized into nine coherent sessions. We note that two-thirds of the selected talks are new researchers, and almost half of those are current students. These proportions are over-represented compared to the submission pool, so we think the blinding worked well in helping us select cutting-edge talks. We are looking forward to a great program which can be checked at http://www.bayesian.org/events/isba2010/schedule.html.

- **Posters**

  We have received over 370 abstracts for posters presentations. These will be presented in five sessions, every evening from June 3rd through June 7th.

- **Student Video Competition**

  This year, the ISBA Student Video Competition gave PhD students a unique opportunity to win travel funding to attend ISBA 2010. The challenge was for students to create a video describing their PhD research that appealed to undergraduate students interested in a career in statistics. With initial entry based on abstract submission, short listed entries were invited to submit 3-5 minute video to be judged by students and members of the ISBA 2010 Organizing Committee. The final videos were of extremely high quality, including everything from animation to supervisor cameo appearances. For all attending ISBA 2010, a selection of videos will be screened at the contributed talk sessions.

- **ISBA Travel awards**

  We received over 150 applications, but we had limited funds and are supporting around 40 awards, covering applicants from different locations in the world, e.g. Singapore, South Africa, Chile, Brazil, Spain, Portugal, UK, USA.

Regional Meetings of ISBA Local Chapters

EBEBX (www.dme.ufrj.br/ebebx), the 10th Brazilian Bayesian meeting, will be held from the 21st until the 24th of March, 2010 in Angra dos Reis, in the state of Rio de Janeiro.

Co-sponsored and Endorsed Meetings

- Frontiers of Statistical Decision Making and Bayesian Analysis (in honor of James Berger) http://bergerconference2010.utsa.edu/ will take place March 17-20, 2010 in San Antonio, Texas, USA.

- A Workshop on Model Uncertainty (http://www2.warwick.ac.uk/fac/sci/statistics/crism/workshops/model-uncertainty/), hosted by CRiSM, will take place May 30 - June 1, 2010 at the University of Warwick.

- The Carlo Alberto Stochastics Workshop (http://www.carloalberto.org/stats_ workshop.html) will take place June 11, 2010 in Moncalieri, Italy.

- The CBMS Conference on Bayesian Nonparametric Statistical Methods (http://www.ams.ucsc.edu/CBMS-NPBayes) will take place August 16-20, 2010 in Santa Cruz, California, USA.
- The Eighth ICSA International Conference (http://www.icsa2.org/Intl_2010/) will take place December 19-22, 2010 in Guangzhou, China.
- AdapskIII (http://www.maths.bris.ac.uk/~maxca/adapskIII/), the satellite meeting to MCMSki III, will take place January 3-4, 2011 in Park City, Utah, USA.
- MCMSki III (http://madison.byu.edu/mcmski/) will take place January 5-7, 2011 in Utah, USA.
- A Conference in Honour of Professor Adrian F. M. Smith on Hierarchical Models and Markov Chain Monte Carlo (http://www.afmsmith.com/) will take place June 2-5, 2011 in Heraklion, Greece.
- International Research Conference on Bayesian Learning (http://marc.yeditepe.edu.tr/yircobl11.htm) will take place in Istanbul Turkey during June 10-12, 2011. It will celebrate the 310th anniversary of the birth of Reverend Thomas Bayes, in Istanbul.

ISBA Topic Contributed Session at JSM, Vancouver, August 2010

This ISBA session is sponsored by the Section on Bayesian Statistical Science (SBSS) of the American Statistical Association (ASA). This year the theme of the session is "Bayesian Inference in Massive Data Problems". The speakers are: Christian Robert (Université Paris-Dauphine, France), Long Nguyen (University of Michigan, USA), Yuan Ji (MD Anderson Cancer Center), and Bhramar Mukherjee (University of Michigan, USA). The discussant is Michele Guindani from The University of New Mexico, USA.

ANNOTATED BIBLIOGRAPHY

PRIOR DISTRIBUTIONS FOR COVARIANCE/PRECISION MATRICES, PART 2

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In this issue we continue our consideration of priors for covariance matrices. The last issue was devoted to priors on full matrices. Graphical models, developed after the seminal work by Dempster (1972), take a slightly different tack on the covariance estimation problem. In graphical Gaussian models, the precision parameter belongs to the cone P_G of positive definite matrices with fixed zeros according to the missing edges in the graph G underlying the graphical Gaussian model.The main task is model selection in the class of graphical Gaussian model, and once a model is chosen, the structure is imposed rather than shrank towards. Indeed, In a parallel way, the covariance parameter does not belong to the cone of positive definite matrices but rather to the cone Q_G of incomplete partially positive definite matrices with entries missing according to G. By "partially positive definite", we mean that any submatrix corresponding to a complete subgraph of G is positive definite. The number of parameters to be estimated is thus reduced and graphical Gaussian models have become an essential tool in the analysis of high-dimensional data, especially in a "large p, small n" situation. Working in Q_G gave rise to the analog of the inverse Wishart on Q_G, a distribution called the hyper inverse Wishart (Dawid and Lauritzen, 1993). Like its analog, the hyper inverse Wishart suffers from the fact that it only has one shape parameter. Some work has been done to study shrinkage properties for priors on P_G or Q_G but much remains to be done.

- Dempster, A. (1972) Covariance selection,

[1]This author was supported by NSERC grant A 8947.

Biometrics, **28**, 157-175. A seminal paper for graphical Gaussian models. The reduction of the number of parameters in the covariance matrix is achieved by expressing conditional independences between components of the Gaussian model as zeros in the precision matrix.

- Dawid, A.P. and Lauritzen, S.L. (1993) Hyper Markov laws in the statistical analysis of decomposable graphical models, *Ann. Statist.*, **21**, 1272-1317. The authors introduce the concept of hyper Markov laws. Applied to the covariance parameter of graphical Gaussian models Markov with respect to a decomposable graph, this concept roughly means that the conjugate prior for the covariance parameter (recall this parameter belongs to Q_G) can be written as a Markov combination of conjugate priors for the covariance parameters of the marginal distribution of the Gaussian model for cliques and separators of the graph. For the marginal distributions on the cliques and separators, these conjugate priors are inverse Wisharts and the prior on Σ in Q_G is called the hyper inverse Wishart. This prior is conjugate in the sense of Diaconis-Ylvisaker. The normalising constant can be obtained analytically and sampling from the posterior is easy and does not require MCMC techniques. It also has the very useful property of being strong hyper Markov which means that computations can be done locally within each clique. However, like the inverse Wishart, it only has one shape parameter. This is a remarkable paper which is a seed paper for most subsequent studies on prior distributions for graphical models.

- Roverato, A. (2002) Hyper Inverse Wishart distributions for nondecomposable graphs and its application to Bayesian inference for Gaussian graphical models, *Scand. J. Statist.*, **29**, 391-411. The author identifies the Diaconis-Ylvisaker conjugate prior for the precision parameter Σ^{-1} for graphical Gaussian models Markov with respect to an arbitrary (not necessarily decomposable) undirected graph and derives the induced prior on Σ. He shows that in the case of a decomposable graph, this induced distribution is the hyper inverse Wishart. The normalising constant of this prior (and posterior) has to be computed numerically. This computation is crucial in graphical Gaussian model selection and has been the subject of much research. Sampling from the posterior is not considered in the paper but can be done using Bayesian iterative proportional fitting.

- Wong, F. and Carter, C.K. and Kohn, R. (2003), Efficient estimation of covariance selection models, *Biometrika*, **90**, 809-830. This paper uses a decomposition of the DRD type for the precision matrix in graphical Gaussian models Markov with respect to an arbitrary graph, thus constraining the entries of the R matrix corresponding to missing edges to be 0. The D_t are assumed i.i.d. Gamma(α, β). A hierarchical prior for the R matrix taking into account the total number of nonzero entries in $\tilde{R}$ leads to heavy computations for the posterior.

- Andersson, S.A. and and Wojnar, G.G. (2004) Wishart Distributions on Homogeneous Cones, *Journal of Theoretical Probability*,**17**, 781-818. Though no prior is formally offered in this paper, the authors give the expression of the Wishart distribution on homogeneous cones which can include some of the priors given in Sun and Sun (2005) as extreme cases and coincide with the results of Letac and Massam (2007) for homogeneous graphs.

- Sun, D. and Sun, X. (2005) Estimation of the multivariate normal precision and covariance matrices in a star-shape model, *Ann. Inst. Statist. Math.*, **57**, 455 - 484. The authors consider a Gaussian model Markov with respect to a star-shaped graph which is a particular type of homogeneous graph. These graphs themselves form a subclass of the class of decomposable graphs. The corresponding Gaussian models are invariant under the action of the group of lower triangular matrices with zeros where edges are missing in the star-shaped graph. The authors work out the right and left invariant measures under that triangular group as well as the reference priors under a given grouping of the elements of the Cholesky decomposition $\Sigma^{-1} = T^tT$ where T is lower triangular. The Bayes estimators of Σ and Σ^{-1} under the various objective priors can be obtained explicitly.

- Letac, G. and Massam, H. (2007) Wishart distributions for decomposable graphs, *Ann. Statist.*, **35**, 1278-1323. The authors identify the inverse of the hyper inverse Wishart (the G-Wishart for decomposable graphs) as an exponential family generated by a measure which depends upon one parameter only. Using a generalization of this measure with $k+1$ shape parameters where k is the number of cliques of the underlying decomposable graph G, they define a more flexible Wishart family on P_G called the W_{P_G} The shape parameters are taken so that the normalising constant is explicit and of the same general form as that of the G-Wishart. The inverse of the W_{P_G}, the IW_{P_G}, is shown to be conjugate for the covariance parameter $\Sigma \in Q_G$. The IW_{P_G} offers conjugacy and flexibility for the shape parameters. It is also strong directed hyper Markov. The induced prior on the ϕ and D parameters is also derived. For the complete model, the prior on (ϕ, D) coincides with that of Brown et al. (1994) or Consonni and Veronese (2003). Sampling from the posterior distribution of Σ is easy and does not require MCMC techniques. A generalized Wishart on Q_G is also defined and can be considered as a prior (though not conjugate) for the covariance parameter of marginal independence models.

- Rajaratnam, B., Massam, H. and Carvalho, C., (2008) Flexible covariance estimation in graphical Gaussian models, *Ann. Statist.*, **36**, 2818–2849. This paper defines the Bayes estimators under various losses and the IW_{P_G}. These are the posterior means of Σ and Σ^{-1} under the IW_{P_G} and W_{P_G} respectively and are given explicitly. A reference prior for Σ is also worked out and the risk properties of these estimators under the hyper inverse Wishart, the IW_{P_G} for various values of the shape and scale parameters and the reference prior are studied. The IW_{P_G} compares favorably with the other priors and its flexibility is illustrated with several examples. There is also empirical evidence that with the right choice of hyperparameters, the eigenvalues of the Bayes estimator under the IW_{P_G} can be made to closely fit the true eigenvalues.

- Khare,K. and Rajaratnam, B. (2009), *Manuscript*. A family of conjugate prior distributions is given for the covariance parameter of graphical Gaussian models with $\Sigma \in P_G$, that is, marginal independence models Markov with respect to the decomposable graph G. The number of shape parameters is equal to the dimension of the Gaussian vector. This family therefore offers flexibility as well as conjugacy. However, the normalizing constant has to be computed numerically and sampling from the posterior is done through a Gibbs sampler.▲

BAYESIAN HISTORY

LEONID HURWICZ AND THE TERM "BAYESIAN" AS AN ADJECTIVE

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Introduction

Justifiably, Fienberg (2006) wrote the first paper in the first number of the electronic journal *Bayesian Analysis*. His purported purpose was to elaborate on the term "Bayesian" as an adjective. In the process of his elaboration, Professor Fienberg produced a fine analysis of the history of what we know today as Bayesian Statistics. His bibliography is extensive with 184 items. Some of them (like his correspondence with Jack Good and John Pratt) are in the form of personal correspondence. He takes us on a marvelous journey of two hundred years of history of Bayes and Bayesian thinking. He divides the history into three distinct phases. First came Bayes and Laplace with a reminder of Stigler's Law of Eponymy ("no scientific discovery is named after its original discoverer"). Then, as a precursor to the modern development, he discussed contributions during the first five decades of the Twentieth Century. Finally, he brought in the Neo-Bayesian Revival of the 1950s. Fienberg quotes from Lindley (2000), "When I began studying statistics in 1943 the term 'Bayesian' hardly existed; 'Bayes' yes, we had his theorem, but not the adjective." Fienberg also notes that Good (1950) "writing on the weighing of evidence using Bayes' Theorem, in the third paragraph of the preface used the phrase 'subjective probability judgments,' but nowhere in the book [of Good's book published in 1950] did he use the adjective 'Bayesian'." Fienberg also notes that the usage of the term "Bayesian" was published during 1950–1951: One by Ronald Fisher in 1950 (in a pejorative way) and by Jimmie Savage in 1951 where he used the phrase "unBayesian" (Savage, 1951, p. 58). Neither usage would count as we use the term today as an adjective. Fienberg then writes "[a] search of JSTOR reveals no earlier usage in any of the main American and British statistical journals." He then goes on to suggest that it was Jimmie Savage that brought the Bayesian adjective to the fore. In what follows, we will discuss the role that economists have played during the critical period of the development of the Neo-Bayesian Revival along with the contribution of Jimmie Savage in economics. In particular, we point out the contribution of the 2007 Nobel Prize winner in Economics, Professor Leonid L Hurwicz.

Jimmie Savage and Economics

Fienberg justifiably examines Savage's book "The Foundation of Statistics" as a milestone for the Neo-Bayesian Revival. It is striking that the first five chapters of the book could very well have been called "The Foundation of Economic Theory Under Risk and Uncertainty." It begins with the (Expected) Utility Theory—which has become the cornerstone of modern micro and macro economic theories of today. Savage's book did more than provide the foundation of modern economic theory. His book (unwittingly) propagated an expansion. For example, in 1952, at the Econometric Society's meeting in Paris, Maurice Allais, presented Savage (and other participants) with the following hypothetical choices.

Situation 1: Choose between

Gamble 1: $500,000$ with probability 1; and

Gamble 2: $2,500,000$ with probability 0.1, $500,000$ with probability 0.89, status quo with probability 0.01.

Situation 2: Choose between

Gamble 3: $500,000$ with probability 0.11, status quo with probability 0. 89; and

Gamble 4: $2,500,000$ with probability 0.1, status quo with probability 0.90.

Savage chose gambles 1 and 4 respectively. Allais noted that it contradicted expected utility theory—the very foundation of a rational decision maker of The Foundations of Statistics! As we all know, in the book, Savage goes on to describe why such a choice was not rational (even though he himself made the choice initially).

A small exchange like this could have just been a curiosity—a footnote in the history of economics. But it did not turn out that way. Allais went on to develop the theory of Non-Expected Utility for which he, and later Daniel Kahneman, went on to win Nobel Prizes in Economics (Amos Tversky—a close collaborator of Kahneman would also have won the prize had he not died before the prize was awarded). Thus, we contend that Jimmie Savage strongly influenced the critical development of economic theory as a whole. To prove our point, we did some bean-counting. There were slightly less than one thousand references to Savage's book in JSTOR (late 2008). Of them around 30 percent were in economics journals. For sure, some of them occurred in journals that were right in the intersection of these two disciplines: Economics and Statistics. A classic example is Chernoff (1954). He refers to Savage's "Notes on the Foundations of Statistics" with the comment that it would be published in a book form. In turn, Savage's research was also influenced by economics. To wit, around a quarter of his references are directly from the economics literature. In contrast to mainstream economics, Savage's book was not very well received by many classical statistical theorists. For example, Chung (1955) reviewed the book with the following comment. "A book like this is necessarily part philosophy, and one who is not philosophically bent, as Mr. Savage clearly is, is often hard put to tell between what is critical thinking and what is quibbling about words. To such a person a good part of the discussion of the foundations of probability is typified by the following two examples. 1. Re probability: when a coin is tossed there is besides head and tail the possibility of the coin's standing on its edge or disappearing into a crevice. (For a variation on this theme see p. 15 on whether a rotten egg spoils an omelet.) 2. Re utility: some people gamble for a monetary loss in order to kill time or to cultivate good relations. (For a variation see p. 101 on the show-off flier.) I do not know how to draw a line between such bull session stunts and more serious argumentationÉ" To contrast the impact of Savage's book on Statistics, we counted the number of citations it received in the Statistics literature. The total count in JSTOR is 483 (end of 2006). Of them, around 24 percent occurred during the 1980s—the time during which the Bayesian concept received a big boost from computational breakthroughs. Comparing JSTOR citations in economics versus statistics can be tricky. There are twice as many economics journals in JSTOR.

The Cowles Commission in Chicago

Nobel Prizes in Economics have been awarded since 1969. And the list of names participating in the Cowles Commission who have won the Nobel Prize is long. The list includes (with the year of the award in parenthesis): Tjalling Koopmans (1975), Kenneth Arrow (1972), Herbert Simon (1978), Gerard Debreu (1983), Franco Modigliani (1985), Harry Markowitz (1990), Trygve Haavelmo (1989), James Tobin (1981), Edmund Phelps (2006), Joseph Stiglitz (2001), Lawrence Klein (1980) and Leonid Hurwicz (2007). Thus, about one in five of Nobel Prize winners in Economics were associates of the Cowles Commission. It is also noteworthy that Savage's book includes references to two members of this Cowles-Nobel list above (Arrow and Markowitz). The Cowles Commission for Research in Economics emerged as the second most influential institution in economics (after the National Bureau of Economic Research) both at the policy level and more importantly, for its contribution to economic theory. In the late 1940s and early 1950s, it was a hotbed of research in both economics and statistics. Thus, it is not surprising to find that researchers there were intensely working on Bayesian issues. In particular, Leonid Hurwicz was working on Bayesian formulations of decision making under risk and uncertainty. More on Bayesian work at the Cowles Commission can be found in Fienberg and Zellner (1975). The Cowles Commission for Research in Economics started in Colorado Springs between 1932 and 1938, operated at the University of Chicago between 1939 and 1954, before moving to its permanent home at Yale University. When it moved to Yale, it had changed its name to Cowles Foundation for Research in Economics.[2] Hildreth (1981) provides a history of the Commission during this period.

Leonid Hurwicz and the Bayesian adjective

Hurwicz was a remarkable man. He was born in Moscow in 1917, grew up in Poland, survived the Holocaust by just a hair, took the last boat to leave Europe to arrive in New Jersey with no money and a degree in Law from the University of Warsaw. That was his only degree he ever earned (apart from honorary degrees from a number of universities). Yet he went on to become one of the foremost economic theorists of the Twentieth Century and the oldest recipient of a Nobel Prize in any subject (at the age of 91). He also became the only person to have received a Nobel Prize without ever formally studying economics (Sinha, 2008).

Before Savage joined the University of Chicago's newly founded Statistics Department in 1949, Hurwicz was already there. He became a Research Associate at the Cowles Commission in 1942.[3] During the war, Hurwicz was moonlighting: teaching electronics to the U.S. Army Signal Corps at the Illinois Institute of Technology. At the University of Chicago, he was a member of the faculty of the Institute of Meteorology and taught statistics in the Department of Economics. He worked under Jacob Marschak and Tjalling Koopmans at the Cowles Commission for Research in Economics and Statistics at the University of Chicago.

His work overlapped with what Savage was doing. This fact is evident from the Cowles Commission Annual Report of 1950–51: "...Many statisticians feel that, in their own practice, they have to choose a 'decision function' (i.e., they have to design a sample or an experiment and derive in advance a formula relating action to ob-

[2] We are indebted to Kenneth Arrow for pointing out this important distinction between the two entities: the Cowles Commission and the Cowles Foundation.

[3] http://cowles.econ.yale.edu/P/reports/1942.htm

servation) without any advance knowledge as to the relative probabilities of alternative states of nature. The same is true of many practical situations. In fact, only in exceptional cases (such as life insurance, games of chance, and scientific predictions based on much past experience) does the decision-maker have good information on the relevant probabilities. In the general case, such information is not available; hence moral expectation cannot be computed. Additional criteria become necessary. Thus a pessimist will assume the worst possible state of nature to be true and hence will maximize the lowest possible moral expectation; while, as pointed out by Franco Modigliani, the optimist will maximize the maximum moral expectation. Leonid Hurwicz formulated a certain compromise between the two attitudes. In general, the compromise may be slanted toward optimism or pessimism, the extent of the slant being part of a person's 'tastes'. Another criterion was suggested by L. J. Savage and, independently, by Jurg Niehans of Zurich: for any given state of nature define as 'loss' (or 'regret') the difference between the highest moral expectation that could be obtained if that state were known and the moral expectation obtained from a given action; then choose the action for which the highest loss is lower than for any other action."[4]

In the paper referred to in the previous paragraph, Hurwicz (1951a) introduced his famous "alpha" that mitigated between minimax and maximax rules of decision. Milnor (1951) in his now famous RAND Research Memorandum expanded upon this rule. On page 2 of the same paper, Hurwicz notes: "The solution has been called 'Bayesian' (or 'Bayes Optimal') with regard to $H^{(0)}(b)$." Thus, already in February of 1951, we have documented proof that Hurwicz was using the term Bayesian as an adjective. In a subsequent Discussion Paper, Hurwicz (1951b) mentions "the Bayesian case" once more. Thus, not only was he using the phrase Bayesian as an adjective, he was also anticipating the difference between Bayesian and non-Bayesian cases in the ambit of decision making under uncertainty. In footnote 1 of the same paper, he notes, "The more usual procedure is first to form a 'risk function' $\rho(I_F, \Psi)$ with ρ depending on the statistician's preferences when $\vartheta_{\ni} *$ is of the Bayesian type".

Is that the earliest reference to a clearly documented Bayesian we find in the Neo-Bayesian Revival movement? The answer is no. In a paper dated December 25, 1950, Hurwicz (1950a) develops a technique of estimation using Bayes Theorem. In discussing the method, he remarks, "The foregoing techniques . . . can be applied to justify (from the Bayesian point of view) the maximum likelihood method of estimation of the mean μ of a normal distribution with a known variance σ^2".

At around the same time, Hurwicz (1950b) noted "At the opposite extreme there exists the 'Bayesian' formulation, where it is assumed that a probability measure ξ on ϑ (an 'a priori distribution') is known to the statistician."

The main contribution, for which Hurwicz shared his Nobel Prize with two others (Roger Myerson and Eric Maskin), was pioneering work on Mechanism Design. He also received the National Medal of Science in 1990 in Behavorial and Social Science "for his pioneering work on the theory of modern decentralized allocation mechanisms". He became the only economist to receive that honor before winning the Nobel Prize. This shows the diversity of Hurwicz's research.

On more than one occasion, researchers have discovered results only to find that Hurwicz was there first. He was a true scientific "Kilroy". For example, in an interview, Jack Good once noted that after he introduced the notion of hierarchical Bayesian analysis: "the econometrician, L. Hurwicz, turned out to have published an abstract a few months before my 1951 paper, suggesting the minimax exampleÉ" (Banks, 1996). Not only did Hurwicz use the term "Bayesian" as an adjective in his research papers in the early part of 1950s, he was already using these notions for the course he was teaching in the statistics department at the University of Minnesota. The following paragraph reproduces the first question in the PhD prelim examination in December 1953 written by Hurwicz.

> A has two coins $(c1, c2)$ of identical appearance but different weight and weight distribution. B his permitted to observe one of the coins and is then required to guess whether it was $c1$ or $c2$. He knows that the probability of heads is $1/3$ for $c1$ and $3/4$ for $c2$
>
> (a) List all the possible non-randomized decision functions;
>
> (b) Indicate inadmissibility if found;
>
> (c) Find the maximum likelihood solution;

[4] http://cowles.econ.yale.edu/P/reports/1950-51a.htm

(d) Find a Bayesian solution;

(e) Find a minimax solution.

(In the later two cases, make such additional assumptions as necessary.) Show that (c) is a special case of Bayesian solution.

This example shows that Hurwicz propagated the notion of Bayesian Statistics to the next generation of students. Some of these students went on to become outstanding econometricians in their own rights. Indeed, one such shining example was Daniel McFadden who went on to win a Nobel Prize in Economics for his work on discrete choice econometrics. In fact, in his econometrics class notes[5] dated April 8, 1952 Hurwicz clearly distinguishes between three Bayesian concepts: Bayesian, Parametric Bayesian and Generalized Bayesian (see pages 15–18 of the aforementioned document).

Final Remarks

We provided evidence that Leonid Hurwicz might be the first person to have used the term Bayesian as an adjective. We have shown that during the Neo- Bayesian Revival, a strong interaction took place among Economists and Statisticians: the ideas of an axiomatic foundation for the rational behavior of an economic agent on one hand, as well as for the coherent production of statistical inference, on the other. They were essentially variations of the same theme. In the case of Economics, the resulting criteria of maximizing the expected utility came to occupy the central stage of modern (neoclassical) economic theory. On statistical theory, the effect was somehow different. The Neo-Bayesian Revival led to a new paradigm: the axiomatic development of Bayesian Theory of Statistics.

Acknowledgements

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APPLICATIONS

SOME OF THE *What?*, *Why?*, *How?*, *Who?* AND *Where?* OF GRAPHICS PROCESSING UNIT COMPUTING FOR BAYESIAN ANALYSIS

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Over the last 20 years or so, a number of Bayesian researchers and groups have invested a good deal of time, effort and money in parallel computing for Bayesian analysis. The growth of "small research group" to "institutionally supported" cluster computational facilities has had a substantial impact on a number of areas of Bayesian analysis, enabling analyses that are otherwise practically infeasible. Parallel computing has also motivated new approaches to simulation and optimisation-based Bayesian computations that aim to maximally exploit the "master-slave" and "embarrassingly parallel" computational model [e.g., 3, 4, 6]. In more recent years, increasingly prevalent multi-core CPUs in standard servers, desktops and laptops have engendered some interest in relatively simple and easy multi-threading of existing Bayesian analysis code, whether implemented in low level languages (C/C++) or through parallelisation facilities in environments such as R and Matlab®. Much progress in research and in advancing the use of Bayesian methods in increasingly computationally challenging problems has resulted. As we look ahead, however, the potential impact of parallel computation on both immediate research and the development of more broadly useful software is clearly – to some of us – *dramatically* enhanced by the advent of scientific computation using desktop and laptop graphical processing units (GPUs). Major new opportunities for orders-of-magnitude speed-up in computation are emerging through GPU programming, and the technology is cheap, both to purchase and run, and easily available.

We have been exploring these opportunities and developing a base of experience and examples in Bayesian analysis that bear out this "opportunistic" view; each of us is now firmly committed to exploiting GPU computation as a norm in our research. Current directions for technological developments include emerging-technology GPUs that are squarely aimed at the scientific computing community, clusters of GPUs, and integration of GPU and CPU processing in increasingly nimble commodity machines that enable massive parallelisation on the desktop. This will be a big part of the compute environment for us all in a short few years, and it seems clear (again to us!) that this technology promises to impact far more profoundly on statistical computation and software development than cluster facilities for parallelisation ever have or are ever likely to.

Some of these experiences and examples may be of broader interest to the Bayesian communities and ISBA members, in particular.

What?

GPUs are dedicated numerical processors designed for rendering 3-dimensional computer graphics. They are the graphics card "engines" in high-end graphics computers and gaming machines. In essence, a GPU consists of hundreds of processor cores on a single chip, and each core can be programmed to apply the same numerical operations simultaneously to each element of large data arrays – the so-called single instruction, multiple data (SIMD) paradigm. Since the same operations (called "kernels") function simultaneously, GPUs can achieve extremely high arithmetic intensity so long as we can enable sufficiently fast and efficient transfer of required input data "onto" the processers and, correspondingly, of the ouput data "off" the processors.

As an extension to common programming languages, CUDA [7, 9] opens up the GPU to general purpose computing, and the computational power of these units has increased to the stage where they can process data intensive problems many orders of magnitude faster than conventional CPUs. The development of open-source libraries (OpenCL: *www.khronos.org/opencl*) is advancing, and in the coming year or two can be expected to simply mushroom as broader ranges of computational scientists press for, and themselves develop, supporting software tools.

GPUs are graphics processing work-horses in many standard desktop and laptop computers, as well as high-end graphical workstations. Among manufacturers, the NVIDIA corporation is way ahead in technology and in addressing the increasing interest for scientific computation. The current NVIDIA GPUs include GTX and Tesla varieties; these are inexpensive, commodity parallel machines that can be installed – singly or in small multiples – in many desktops and laptops, as well as in small cluster arrangements. NVIDIA's next-generation (2010 release expected) Fermi GPU promises substantial increases in numbers of cores, in processing speed per core, in on-card memory shared by the hundreds of cores for fast data access, input and output, as well being more heavily targeted towards computational uses in addition to graphics.

Why?

For scientific computing, GPU utility emerges when computations are inherently "massively parallel," i.e., the computation can exploit parallelization across many (hundreds or thousands of) GPU cores simultaneously. This structure emerges in many statistical models in Bayesian analysis, while in others we may capitalize on GPU architecture with appropriately restyled computational strategies. Among our own interests has been developing effective code for Bayesian mixture models for data in several tens of dimensions, with hundreds of mixture components and with large data sets – millions to tens of millions of observations. In such contexts, MCMC or posterior mode search computations are intensive, but massively dominated by the within-iterate (whether MCMC or EM, or other) calculations. In these *"moderate-to-large p, large k, very large n"* problems, massive fragmentation of calculations induced by conditional independencies are ideally suited to GPU parallelization. GPU machines have potential to define major speed-up – on cheaply and easily accessible hardware – for these computations as a routine, and the potential is realised; some of our recent examples show that first-version implementations of MCMC and Bayesian EM in standard Bayesian mixture models enables scale-ups on desktop personal computers that are simply not achievable using multi-threaded CPU desktops and simply impractical across distributed-memory computing clusters. Scale-ups of 100-fold in raw processing time are dramatic in terms of the ability to run analyses routinely, and – as this typical benchmark uses just first-generation GPUs and supporting software tools – this is just the start. Recent advanced Monte-Carlo methods such as population-MCMC, SMC samplers and particle-MCMC [e.g. 1] are naturally aligned to GPU computation, and effective parallel implementations allow us to realize their advantages in terms of increased mixing and exploration of high-dimensional and complex target densities for little overheard.

Novel, GPU-oriented approaches to modifying existing algorithms and software design not only provide the opportunity for vast speed-up, however; critically, they also enable statistical analyses that presently will simply not be considered due to compute time and other limitations in traditional computational environments. In one of our motivating application areas for *"massive mixtures"*, that of routine analyses of many, very large data sets in experimental biology studies [2], laboratory culture is hugely resistant to the notion of accessing institutional clusters – for reasons of cost and access, and also due to the norms and established practice of "computing in the lab." Software for GPU-enabled desktops will provide the opportunity for complex, practically relevant Bayesian analyses to move more aggressively into practice as a result.

How?

GPU programming is fundamentally an exercise in parallel programming. As such, key concepts include those of clearly and explicitly identifying the major, core compute demands of any specific model analysis, and the inherent "bottlenecks" that limit the ability to achieve efficiencies via parallelization. MCMC algorithms, for example, are intrinsically *serial* algorithms, but can still benefit (potentially massively in large-scale, highly structured problems) from GPU parallelisation if the "per iterate" computations can be parallelised. That GPU cores share memory on the unit means that data stored "locally" can be quickly and efficiently accessed, so consideration must also be given to the basic programming issues of simply *moving data around*.

For NVIDIA GPUs, CUDA is a parallel computing technology, and programming language, that enables access to GPU computing via modifications of standard computing (in C/C++). OpenCL is an emerging library that provides access to GPUs from several hardware providers. Both require low-level programming for which researchers new to GPU programming should develop basic facility. On the near horizon stand higher-level, flexible interfaces for GPU programming, such as Thrust (*code.google.com/p/thrust*) that provides many standard parallel algorithms in an easier-to-use form than CUDA. We currently recommend prototyping using Thrust and then re-implementing critical code parts in CUDA for raw speed and performance.

To capitalise on the opportunities for Bayesian computations that are offered by GPUs – in the near term – requires some investment of time and effort (though limited money!) to adapt standard code to the GPU environment. This involves relatively modest changes in programming perspectives and strategy for algorithm implementation, and can rely on the already established base of experience in a number of groups. The required investment in developing programming skills certainly challenges researchers for whom low-level programming has never been a focus, However, for researchers and statistical programmers aiming to transform the efficiency, potential impact and broader use of Bayesian models and methods, the investment will be extremely worthwhile. As a rough guide we estimate that a programmer proficient in a language such as C or C++ should be comfortable with programming in CUDA within around 4 weeks.

Our own groups have defined a base of experiences that others may find useful – both as entry points for perspective, and possibly also in terms of access to existing code and examples. For example, we have defined some initial code and manuscripts with overtly "tutorial" flavour, focusing on some more-or-less standard Bayesian model contexts that will be of broad use and appeal. We have developed these to show the flow of the analyses so as to engage researchers that may be interested in developing in this direction in related or other classes of statistical models.

Who & Where?

Some links to groups involved in GPU computation for statistical research and application generally, as well as specific groups and projects in Bayesian analysis that provide resources – papers, examples, software – include those noted and linked below, among others. The current authors are committed to working towards the merging of their own sites to provide a central resource for the field.

- `www.stat.duke.edu/gupstatsci`
  Massively parallel GPU-based computing for statistical science, and Bayesian analysis, at Duke University, headed by Mike West. This site links to articles and software with a focus on GPU in Bayesian analysis broadly. Readers can find there the tutorial-level *"How to?"* material, as well as code, for efficient GPU analysis of Bayesian mixture models described in [12]. The site is developing to include additional GPU software for a range of complex Bayesian models (e.g., for the large-scale, spatial (and 3D spatio-temporal) models of [5]) and to add links and resources of broader interest to

the Bayesian community.

- www.oxford-man.ox.ac.uk/gpuss/
Bayesian GPUSS, the GPU stochastic simulation group at Oxford University, headed by Chris Holmes. Readers can find links to current research papers and online resources as well as a series of tutorial papers and coded examples, including the overview paper on advanced Monte Carlo methods for Bayesian inference [8]. The site aims to maintain a list of papers published in the field relevant to statistical computation using GPUs.

- www.biomath.ucla.edu/msuchard/
Marc Suchard's group at UCLA. This site provides access to some of the first detailed GPU work in Bayesian analysis in challenging problems in computational biology and high-dimensional optimization [10, 11, 14].

- brainarray.mbni.med.umich.edu/Brainarray/rgpgpu/:
R+GPU. This R package off-loads several common data-summary tools from R to the GPU.

- www.stat.psu.edu/~mharan/
Murali Haran's group at PSU. This site provides a GPU example involving slice sampling [13].

- gpgpu.org/
The community site, resource and networking arena for researchers interested in *General-Purpose computation on Graphics Processing Units*.

- www.nvidia.com/page/home.html
www.nvidia.com/object/cuda_home_new.html
The NVIDIA and NVIDIA/CUDA site for CUDA progamming of GPUs; keep up with the latest technology and software advances, and access scientific computing networks.

- www.khronos.org/news/C124/
The Kronos Group web site with information and resources related to the OpenCL library that brings general purpose GPU programming to a variety of hardware platforms.

- code.google.com/p/thrust/
Thrust, Code at the Speed of Light. Thrust is a CUDA library of parallel algorithms with a high-level interface to enhance developer productivity.

▲

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SOFTWARE HIGHLIGHT

BAYESIAN FUNCTIONAL DATA ANALYSIS USING WINBUGS

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Modern observational and experimental biological data has undergone a revolution. Driven by new biotechnology and computing advances, high dimensional, high density, functional multilevel and longitudinal biological signals are becoming commonplace in medical and public health research. These types of signals historically occurred in small clinical or experimental settings, often referred to as the "small n, large p" problem. The extension of these biological signals to cohort studies with longitudinal or hierarchical structure is the next generation of Biostatistical problems. We have taken to calling this the "hierarchical large n, large p" problem. A now-standard example of this type of data is observational studies containing images or biosignals, such as Electroencephalograms (EEG) or Electrocardiograms (ECG), on thousands of subjects over time. Our research group is currently working on 6 studies of this type with a total of more than 30 Terabytes (Tb) of data.

These new and complex data have led to a resurgence of interest in powerful techniques like the principal component analysis, singular value decomposition, multilevel models, mixed models and Bayesian methods. Functional Data Analysis (FDA) [6] is a particularly powerful set of inferential tools for data where some or all variables are functions. Functional principal component analysis (FPCA) is one of the main techniques for functional data compression. FPCA has been extended to the multilevel case [3, 5] and to multilevel functional regression [2, 4]. The success of these approaches is essentially based on: 1) the massive amounts of compression achieved by PCA; 2) the flexible mixed effects framework that allows simple generalizations and adaptation of methods; and 3) the Bayesian and frequentist computational advancements over the last $15 - 20$ years.

Our paper [1] presents a compilation of Bayesian FDA analyses implemented in WinBUGS. Examples start from standard models and build incrementally more complexity to models that are not yet implemented in any other software; see, for example, the section on functional regression using penalized B-splines. The most important contribution of our software is to provide a glimpse into the enormous potential of Bayesian computational methods applied to the emerging problems raised by new types of observational studies. Accompanying software can be downloaded for free from the Journal of Statistical Software website

http://www.jstatsoft.org/v32/i11

Models considered

The software allows to specify a wide range of exposure and regression models.

- *Functional principal component analysis*
- *Functional regression models*

  - *Classical functional regression*
  - *Functional penalized regression*
  - *Regression with functional scores as outcomes*
- *Functional multilevel models*

The excellent properties of Bayesian analysis in this context are due to: 1) low dimensional projection bases; 2) mixed model representation; and 3) modularity and flexibility.

A simple example

Consider 500 time series, $W_i(t)$, representing the observed EEG fraction of δ-power, for subject $i = 1, \ldots, I = 500$, recorded for 1 hour after sleep onset at the 30-second interval $t = 1, \ldots, T = 120$; for a detailed description see [2, 3]. After subtracting the population mean from $W_i(t)$, we assume that $W_i(t) = X_i(t) + \epsilon_i(t)$, where $X_i(t)$ is the true fraction of δ-power. By using the spectral decomposition of the estimated covariance operator of $X_i(t)$ and by retaining the first 10 eigenfunctions, $\psi_k(t)$, $k = 1, \ldots, 10$, the model becomes

$$\begin{cases} W_i(t) & = & \sum_{k=1}^{K} \xi_{ik}\psi_k(t) + \epsilon_i(t); \\ \xi_{ik} & \overset{i.i.d.}{\sim} & \mathrm{N}(0, \lambda_k); \;\; \epsilon_i(t) \overset{i.i.d.}{\sim} \mathrm{N}(0, \sigma_\epsilon^2), \end{cases}$$

which is a mixed effects model with normally distributed principal component scores, ξ_{ik}. This is not a restriction and other distributions can be considered with minimal changes to the software. We use the following priors for the precision parameters $1/\lambda_k, 1/\sigma_\epsilon^2 \sim \Gamma(0.001, 0.001)$. The WinBUGS code for this model is:

```
{model
{for (i in 1:N_subj)
 {for (t in 1:N_obs)
   {W[i,t]~dnorm(m[i,t],taueps)
    m[i,t]<-inprod(xi[i,],psi[t,])}
  for (k in 1:dim.space)
   {xi[i,k]~dnorm(0,ll[k])}
}#End for i

for (k in 1:dim.space)
    {ll[k]~dgamma(1.0E-3,1.0E-3)
     lambda[k]<-1/ll[i]}
taueps~dgamma(1.0E-3,1.0E-3)
}#End model
```

Here `W[i,t]` is the observed percent δ-power, $W_i(t)$, `xi[i,]` is the vector of scores, ξ_{ik}, `psi[t,]` is the vector of eigenfunctions, $\psi_k(t)$, evaluated at t, `ll[k]` is the precision $\tau_k = 1/\lambda_k$ controling the amount of shrinkage of scores ξ_{ik}, $i = 1, \ldots, I$. We obtained 1500 simulations, discarded the first 500 as burn-in and used the remainder 1000 for inference. For $I = 500$ subjects and $T = 120$ grid points the total computation time was 4.8 minutes (Dual Core Processor 3GHz, 8Mb RAM PC). This number of simulations was enough for our purposes because convergence and mixing of the chains was excellent. Figure 1 shows the posterior mean δ-power and pointwise 95% credible intervals for four subjects for the first hour after sleep onset.▲

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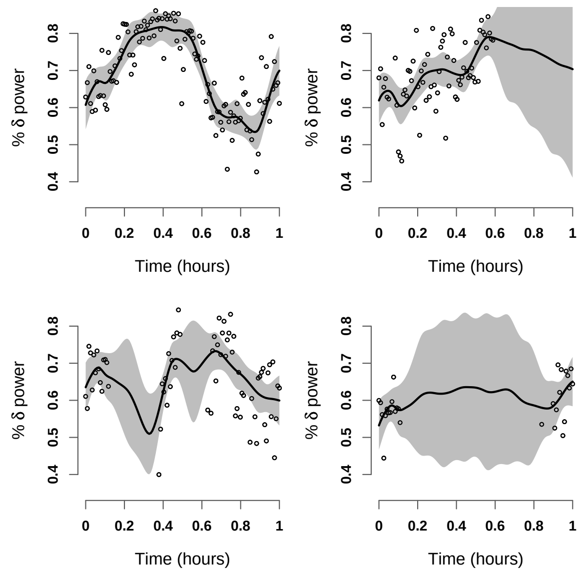

Figure 1: Data for first hour from sleep onset (black dots), posterior mean (black line) and 95% pointwise credible intervals for 4 subjects.

STUDENTS' CORNER

CALL FOR DISSERTATION ABSTRACTS

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Recent Ph.D graduates, having your dissertation abstract published is as simple as emailing it to the email address above. Publishing your abstract will not only provide exposure for your research, but it may potentially lead to collaborations with future colleagues. In addition, you are providing an important service to the Bayesian community by giving established researchers a taste of the interests of young researchers. Faculty, please encourage your students' participation.▲

NEWS FROM THE WORLD

CALL FOR ANNOUNCEMENTS

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I would like to encourage those who have any announcements or would like to draw attention to an up-coming conference, to get in touch with me and I would be happy to place them here.

Meetings and conferences

10th Bayesian Statistics Brazilian Meeting, Green Coast, Brazil. 21-24th March, 2010.

The 10th EBEB will take place at Portogalo Suites Hotel, located in the pleasant Green Coast area of the State of Rio de Janeiro, Brazil. It is about 150km far from the city of Rio de Janeiro. In this 10th edition, we aim to discuss recent developments in the area both from the methodological and computational points of view. These developments will be presented and discussed by leading researchers in the world with a short course, 13 plenary talks, 8 oral presentations and 2 poster sessions. Since its 6th edition, EBEB is organized by ISBrA, the Brazilian chapter of ISBA, EBEB X is supported by ISBA.

Submissions and registration can be made at www.dme.ufrj.br/ebebx.

ISBA 2010 World Meeting/Ninth Valencia International Meeting on Bayesian Statistics, Benidorm, Spain. 3-8th June, 2010.

The ISBA 2010 World Meeting will be held in conjunction with the Ninth Valencia International Meeting on Bayesian Statistics in Benidorm, Spain. As already announced in Valencia 8, this will be the last Valencia meeting personally organized by José M. Bernardo (who will be 60 when the conference takes place). After Valencia 9, the Valencia meetings will become regular ISBA World Meetings (which will not necessarily take place in the State of Valencia). ISBA world meetings will therefore take place every two years. The meeting will be structured in tutorials on the first day, contributed talks in the late afternoons, and poster sessions in the evenings.

Additional information can be found at http://www.uv.es/valenciameeting.

CBMS Regional Conference - Bayesian Nonparametric Statistical Methods: Theory and Applications, Santa Cruz, CA. 16-20th August, 2010.

Bayesian nonparametric (BNP) methods combine the advantages of Bayesian modeling (e.g., ability to incorporate prior information, full and exact inference, ready extensions to hierarchical settings) with the appeal of nonparametric inference. In particular, they provide data-driven, albeit model-based, inference and, importantly, more reliable predictions than parametric models.

Theoretical research on BNP methods and their applications has grown dramatically in the last fifteen years. This has produced a massive body of scattered literature, which can be daunting for newcomers and hard to follow even for specialists. This CBMS conference, to be held between August 16th and August 20th, 2010, aims at providing a comprehensive introduction to the field for new researchers, and in particular graduate students postdocs and junior researchers.

Additional information can be found at http://www.ams.ucsc.edu/CBMS-NPBayes.

Short courses and workshops

Summer Institute 2010: Workshops in Quantitative Research Methodology, Charleston, SC. 3-4th May, 2010.

The 2010 Summer Institute at the Medical University of South Carolina (MUSC) offers 4 two-day workshops that introduce current quantitative methods in key areas of biomedical and clinical research and offer hands on experience with implementing these methods. The targeted audience includes graduate students, residents, fellows, clinical researchers, biostatisticians, biomedical researchers and epidemiologists.

The Bayesian Biostatistics course is intended to provide a basic introduction to the principles and use of Bayesian methods in biostatistics. Day 1 will be an introduction to Bayesian hierarchical modeling and to the use of Winbugs. Day 2 features hands on by the participant and will cover a series of topics and particular interest in biostatistics applications including longitudinal analysis, missing data methods, survival analysis and measurement error modeling.

More information can be found at http://academicdepartments.musc.edu/dbe.

Bayesian Econometrics - A Short Course, Washington, DC. 24-28th May, 2010.

The Info-Metrics Institute and the Department of Economics of American University, Washington, DC, are pleased to announce two upcoming summer program courses, “Bayesian Econometrics & Decision-Making” with John Geweke, U Iowa and UTS, Australia. . The primary purpose of the summer program in applied econometrics is to provide students, researchers and faculty with state of the art econometric methods for analyzing data in the Social Sciences. Each day of the week-long course consists of morning lectures that develop the basic concepts and philosophy as well as their applications to real economic problems and data. Each afternoon, these methods will be applied and practiced in the computer lab. These daily tutorials and work in the computer lab provide students with ‘hands on’ experience in using these methods with real data.

More information can be found at http://www.american.edu/cas/economics/info-metrics/econometrics.cfm.

Advanced Bayesian Disease Mapping, Charleston, SC. 3-4th June, 2010.

This course is designed to provide advanced coverage of Bayesian disease mapping topics in applications to Public Health and Epidemiology. Emphasis on the course is placed on spatial and spatio-temporal Bayesian modeling issues, and some knowledge of Bayesian computation and WinBUGS is assumed.

More information can be found at http://academicdepartments.musc.edu/dbe.

Carlo Alberto Stochastics Workshop, Turin, Italy. 11th June, 2010.

The theme of the workshop is Bayesian asymptotics and the meeting aims at presenting some of the latest advances on asymptotics of Bayesian infinite-dimensional models. The increasing use of Bayesian nonparametric models in statistical practice has stimulated a very active area of research which analyses their large sample properties according to frequentist criteria. Indeed, in the last decade there has been a wealth of results establishing convergence of the posterior distribution to the "true" distribution that has generated the data and the speed with which such a convergence is achieved. Moreover, also other different approaches to study asymptotic properties of Bayesian models have been pursued leading to interesting and important results. This meeting will feature invited talks delivered by some of the scholars who have been contributing to the field in recent years.

It will be held at the Collegio Carlo Alberto, a Research Institution housed in an historical building located in Moncalieri on the outskirts of Turin, Italy.

More information can be found at www.carloalberto.org/stats_workshop.

2010 Summer Program on Semiparametric Bayesian Inference: Applications in Pharmacokinetics and Pharmacodynamics, Research Triangle Park, North Carolina. 12-23rd July, 2010.

The purpose of this program is to bring together a mix of experts in pharmacokinetics (PK) and pharmacodynamics (PD) modeling, nonparametric Bayesian inference, and computation. The aims of the program and workshop are (i) to identify the critical new developments of inference methods for PK and PD data; (ii) to determine open challenges; and (iii) to establish inference for PK and PD as an important motivating application area of non-parametric Bayes.

The program will begin with a week of tutorials and workshop activities. There will be extended, tutorial-style talks during morning sessions, and contributed and invited research talks during the afternoons. Afternoon talks will be selected to complement topics covered in the morning sessions. At the end of the first week workshop research working groups will be formed. The working groups will tackle particular research problems in the area. Working group activities can include workshop-style presentations by group members to stimulate discussion on specific issues

A detailed description of activities, along with application information is available at http://www.samsi.info/programs/2010bayes-summer-program.shtml.

8th Workshop on Bayesian Nonparametrics, Veracruz, Mexico. 26-30 June, 2011.

The workshop aims at presenting the latest developments on Bayesian nonparametric statistics, covering a wide range of theoretical, methodological and applied areas. The workshop will feature tutorials on hot topics, invited and contributed talks and poster sessions.

Scientific committee: David B. Dunson, Subhashis Ghosal, Jim Griffin, Nils L. Hjort, Michael I. Jordan, Yongdai Kim, Antonio Lijoi, Ramses H. Mena, Peter Mueller, Luis E. Nieto, Igor Pruenster, Fernando A. Quintana, Yee W. Teh and Stephen G. Walker.

Open Positions

1. University of Connecticut

The University of Connecticut Department of Statistics at Storrs invites applications for tenure track assistant professor in Environmental / Spatial Statistics, beginning August, 2010.

Responsibilities will include methodological and collaborative research in environmental and spatial statistics, teaching at both graduate and undergraduate levels, and supervision of students.

Candidates are expected to hold a doctoral degree in Statistics or related fields. Equivalent foreign degrees are acceptable. The new faculty is expected to demonstrate excellence in all the above referenced activities. Strong interpersonal and communication skill is preferred. Incumbent may be required to work at the University of ConnecticutÕs main campus located in Storrs, and/or the campuses at Avery Point, Hartford, Stamford, Torrington, Waterbury, and West Hartford. Salary is competitive based on experience and qualifications.

Applicants must send a cover letter, curriculum vita, statements of research and teaching interests, copy of transcript, and three letters of reference in pdf files by e-mail to search@stat.uconn.edu or by regular mail to Dr. Ming-Hui Chen, Department of Statistics University of Connecticut , 215 Glenbrook Road, U-4120, Storrs, CT 06269-4120 Inquiries should be addressed to Ming-Hui Chen, search committee chair at mhchen at st@uconn.edu (Search 2010 220)

2. University of Connecticut

The Department of Statistics at the University of Connecticut invites nominations and applications for one full time position in the Biostatistics core of the Connecticut Institute of Clinical and Translational Science (CICATS). This position is a full-time, tenure track position at any level.

This biostatistician faculty member will have an appointment within the Department of Statistics at the UConn Storrs Campus, but will have major responsibility for the CICATS Biostatistics Core that will facilitate the proposed growth of Clinical and Translational Science across the CICATS Consortium. In addition to his/her own original research and research collaborations, he/she will be responsible for the operations of the Research Design, Epidemiology and Biostatistics core. CICATS investigators will include trainees and both junior and senior faculty members from multiple disciplines. The faculty, in collaboration with a team of epidemiologists and masterÕs level staff, will provide guidance to transdisciplinary teams for the development of research studies. He/she will also be responsible for biostatistical teaching in the new Master of Science in Clinical and Translational Research.

The candidate must hold a doctorate in biostatistics or a closely related discipline and demonstrate past success with self-initiated research, extramural funding and published scholarship, the ability to work in collaboration with clinical and/or basic scientists. The candidate must contribute through research, teaching, and/or public engagement to the diversity and excellence of the learning experience.

Curriculum vitae and a cover letter sent to the Chair search committee, Department of Statistics, University of Connecticut. We request that the application materials in pdf files to be sent through e-mail to biosearch@stat.uconn.edu ▲