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A MESSAGE FROM THE NEW PRESIDENT

by Jim Berger
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Being an ISBA member is the best deal I know of in the world. Bayesians are a diverse lot, being spread throughout virtually all areas of science and society, and staying connected to each other is difficult. ISBA has set out to be the connecting fiber, and is being highly successful in this regard. Let me remind you of why.

First, there are our meetings. We are enormously excited about our 2004 World Meeting, scheduled from the 23rd to 27th of May, 2004 in Viña Del Mar, Chile. The program, prepared by the Scientific Committee chaired by Fabrizio Ruggieri, is absolutely stellar, and the venue and local arrangements put in place by the Local Organizing Committee, chaired by Pilar Iglesias and Fernando Quintana, will make for the wonderful ambience that is the tradition of major Bayesian meetings. We owe a lot to these three individuals and those on their committees, as well as to Alicia Carriquiry, as chair of the Finance Committee. The meeting will also serve as the happy occasion for award of the second Degroot Prize, for an outstanding book in statistical science, and the inaugural award of the Lindley prize, for the outstanding contributed paper at the last Valencia/ISBA-World meeting.

I also hope to see you at the other upcoming ISBA cosponsored or endorsed meetings: the *Bayesian Nonparametrics - IV Workshop*, to be held June 13-16, 2004 in Rome, Italy; the *International Workshop on Bayesian Inference and Maximum Entropy Methods in Science and Engineering (MaxEnt04)*, to be held July 25-30, 2004 in Garching bei Mnchen, Germany; the *International Conference on Bayesian Statistics and its Applications*, to be held January 6-8, 2005 in Varanasi, India; and *MCMski: the Past, Present and Future of Gibbs Sampling*, the 2nd IMS-ISBA joint meeting, to be held January 12-14, 2005 in Bormio, Italy. The second great tie-in for Bayesians that is provided by ISBA is its Chapters. The current Chapters in Chile, India and South Africa are thriving, as is the new chapter in Brazil, which held the 7th Brazilian Meeting for Bayesian Statistics from February 8-11, 2004; I unfortunately was unable to attend the meeting, but heard from those who were there that it was a great success. We also are looking forward to the formation of new chapters, such as a proposed Australian chapter.

In my list of wonderful current reasons to belong to ISBA, I have left one of the best to last, namely the Bulletin. This is by far my favorite 'read' of any society newsletter, and we are highly indebted to Hedibert Freitas Lopes for his efforts in continuing the great tradition of the ISBA Bulletin.

ISBA is about to become even better. Coming this summer (Northern hemisphere summer) is the long-awaited new ISBA electronic journal *Bayesian Analysis*. This will be a new home for innovative research about Bayesian theory, methodology and application. It will serve as a highly visible centerpiece for ISBA, a magnet that will attract the very best in Bayesianism worldwide. We are incredibly fortunate to have Rob Kass leading this effort as Editor-In-Chief; he has assembled a stunning editorial board and the upcoming first issues of the journal are going to be masterpieces of Bayesian research, application and exposition.

During my year as president, I hope to establish another avenue for the worldwide integration of Bayesianism, namely the creation of sections of ISBA. A number of long-standing and highly prominent Bayesian groups exist in the world, such as the MaxEnt community (see, e.g., the MaxEnt conference mentioned above). These groups have their own scientific traditions and activities that are to be treasured. Still, communication between the groups could be greatly enhanced if they participated through a central organization, such as ISBA. Finding mechanisms to enable such communication is a win/win situation for all Bayesians.

I want to give a hearty welcome to our incoming officers: President-Elect Sylvia Richardson and Executive Secretary Deborah Ashby; and to our new Board Members, Brad Carlin, Merlise Clyde, David Higdon, and David Madigan. I very much look forward to working with you this year.

Finally, ISBA has grown into the present dynamic organization through the very considerable efforts of many, of whom I want to acknowledge a few that have been especially central to its development this past year and whose terms have ended. These include Past-President David Draper, Past-Chair of the Program Council Tony O'Hagan, and former Board members Nicky Best, Eduardo Gutiérrez-Peña, Tony O'Hagan and Raquel Prado; all these individuals are stepping down after three years of devoted service. Someone who is not stepping down, but whom I'll thank nevertheless, is Ed George; this past year he has done an incredible amount for ISBA (and Bayesian analysis in general), but luckily I will have the benefit of another year of his wisdom while he serves on the executive committee as Past-President.

A MESSAGE FROM THE EDITOR

by Hedibert Lopes
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Firstly, I would like to thank Lilla Di Scala and Luca La Rocca for their magnificent term ahead of the Student's Corner section for the last two years. Luca has now graduated (see his thesis title and abstract below) and soon Lilla is leaving us. They have worked hard and have always looked for new insights to improve the section. Wherever you go guys, just keep up the good work that things will turn out just right. My very best regards to you both.

Secondly, I would like to thank, in the name of the ISBA Bulletin team, Ed George for his explicit and crucial support for the 10th volume of the Bulletin during his 2004 presidency.

Finally, Let us welcome Jim Berger, the ISBA president for 2004. For the record, I first met Jim at a gathering in David Higdon's house back in 1997, right after he moved to Durham, North Carolina. Of course I "met" his book much earlier when I was studying for my Master's qualifying exam in Brazil. Anyway, we graduate students were extra excited to meeting him personally. I remember that a few hours and beers later, we were trying to elicit the curve that describes one's satisfaction towards pure tequila or cachaça, on one hand, and Margerita or caipirinha, on the other hand. It has always been a great learning experience to read, talk, chat, and listen to Jim. I look forward to work under your presidential supervision this year.

Contents

SUGGESTIONS

PLEASE, FEEL COMPLETELY FREE TO SEND US SUGGESTIONS THAT MIGHT IMPROVE THE QUALITY OF THE BULLETIN

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Bayesian Learning and Object Recognition

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The computer vision community has invested a great deal of effort toward the problem of recognizing specific objects, especially in recent years. However, less attention has been paid to formulating an understanding of general object recognition; that is, properly isolating and identifying many and varied classes of objects (e.g. ceiling, polar bear) in an agent's environment. We say an object is *recognized* when it is labelled with a concept in an appropriate and consistent fashion. This allows us to propose a practical answer to the question of what is an object: an object is a semantic concept (in our case, a noun) in an image caption. Pursuing general object recognition may appear to be premature, given that good unconstrained object representations remain elusive. However, we maintain that a principled exploration using simple, learned representations can offer insight for further direction. Our approach permits examination of the relations between high-level computer vision and language understanding.

Ideally, we would train our system on images where the objects have been properly segmented and accurately labelled (as in the rightmost image of Figure 1).

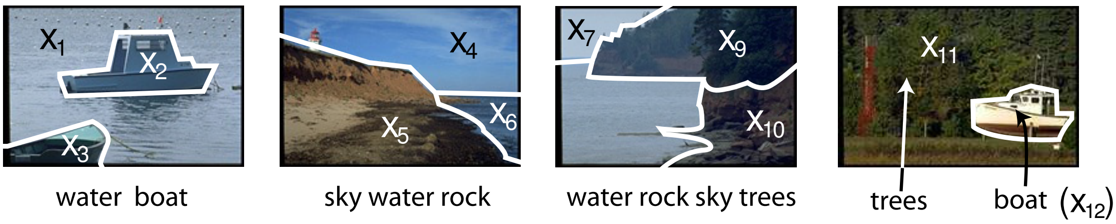

Figure 1: Annotated images from the Corel database. We would like to automatically match image regions to words in the caption. That is we don't know the right associations between image features (vectors x describing for example the colour and texture of the region) and text features.

However, the collection of supervised data by manually labelling semantically-contiguous regions of images is both time-consuming and problematic. We require captions at an image level, not at an image region level, and as a result we have large quantities of data at our disposal (e.g. thousands of Corel images with keywords, museum images with meta data, news photos with captions, and Internet photo stock agencies).

We stress that throughout our work we use annotations solely for testing — training data includes *only* the text associated with entire images. We do so at a cost since we are no longer blessed with the exact associations between objects and semantic concepts. In order to learn a model that *annotates*, *labels* or *classifies* objects in a scene, training implicates finding the *associations*, *alignments* or *correspondence* between objects and concepts in the data. As a result, the learning problem is unsupervised (or semi-supervised).

The data consists of images paired with associated text. Each image consists of a set of blobs that identify the objects in the scene. A *blob* is a set of features that describes an object. Note that this does not imply that the scene is necessarily segmented, and one could easily implement scale-invariant descriptors to represent object classes. Abstractly, a caption consists of a bag of semantic concepts that describes the objects contained in the image scene. For the time being, we restrict the set of concepts to English nouns (e.g. "bear", "floor"). The first three images in Figure 1 are typical examples of images paired with their captions.

This problem can be interpreted as a statistical language translation problem. We have paired sentences in two languages and the goal is to figure out what word in the English sentence matches a word in the French sentence. The probability of assigning a word w to a feature x can be interpreted as a translation probability $t(w|x)$. To obtain this probability we need to marginalize all the possible word to feature associations:

$$t(w|x) = \sum_a p(a|x)p(w|a,x)$$

Under independence assumptions, we can formulate this as a finite mixture model and run the EM algorithm to get estimates of the most likely associations and translation probabilities. This is essentially the approach first proposed in (Duygulu, Barnard, de Freitas and Forsyth 2002).

The vector x is made up of different features. To select or weight features according to their importance, it is possible to use Bayesian shrinkage (Carbonetto, de Freitas, Gustafson and Thompson 2003). That is, we can simultaneously carry out the estimation of the mixture parameters while selecting the most relevant features.

Recently, we have developed Markov random field (MRF) models to relax the assumption that blobs are statistically independent (Carbonetto and de Freitas 2003, Carbonetto, de Freitas and Barnard 2004). In these spatial models, the probability of an image blob being aligned to a particular word depends on the word assignments of its neighbouring blobs. Due to the Markov assumption, we still retain some structure.

Dependence between neighbouring objects introduces spatial context to the classification. Spatial context increases expressiveness; two words may be indistinguishable using low-level features such as colour (e.g. "sky" and "water") but neighbouring objects may help resolve the classification (e.g. "airplane"). Context also alleviates some of the problems caused by a poor blob clustering. For example, birds tend to be segmented into many parts, which inevitably get placed in separate bins due to their different colours. The contextual model can learn the co-occurrence of these blobs and increase the probability of classifying them as "bird" when they appear next to each other in a scene. Our experiments have confirmed our intuition, that spatial context combined with a basic nonlinear decision boundary produces relatively accurate object annotations.

Spatial consistency learned with semantic information smooths labellings, and therefore our proposed contextual model learns to cope with oversegmented images. In fact, with this model, a plausible strategy is to start with image grid patches and let segmentations emerge as part of the labelling process.

MRFs and mixture models are often very hard to train in large parameter spaces. The exponential number of local minima can often lead to poor performance. To overcome this, we can convert the data association problem to a constrained semi-supervised learning problem (Kueck, Carbonetto and de Freitas 2004). We demonstrate this with the toy example of Figure 1. Suppose we are interested in being able to detect boats in images. We could assume that if the word *boat* does not appear in the caption, then there are no boats in the image In this case, we assign the label 0 to each segment in the image. If however the word *boat* appears in the caption, then we know that at least one of the segments corresponds to a boat. The problem is that we do not know which. So we assign question marks to the labels in this image. Sometimes, we might be fortunate and have a few segment labels as in the rightmost image of Figure 1.

By letting x_i denote the feature vector corresponding to the i-th segment and y_i denote the existence of a boat, our data association problem is mapped to the following semi-supervised binary classification task

	image 1			image 2			image 3				image 4	
Input x	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}
Labels y	?	?	?	0	0	0	0	0	0	0	0	1

Note that for the question marks, we have the constraint that at least one of them has to be a 1. To be able to annotate all the image segments, we need to build one classifier for each word of interest. Binary classifiers can then be combined in a second stage to generate multicategorical classifications.

We adopt Bayesian probit models as classifiers. These models can be trained efficiently with MCMC. These algorithms have been tested extensively in the supervised setting. In the constrained semi-supervised setting, we simply need to formulate our models to allow for constraints and then introduce smart rejection sampling procedures within the MCMC algorithms. We have found in practice that the MCMC algorithms mix well and that the results obtained with the probit models and MCMC tend to look better than the results obtained with mixture models and the EM algorithm. Much work lies ahead: annotating videos (i.e. bringing verbs into the problem), active learning and experiment design (letting a robot ask what label it needs in order to maximize its knowledge of the world) and combining MRFs with probit models for contextual semi-supervised classification. We finish by showing some test set results in Figure 2.

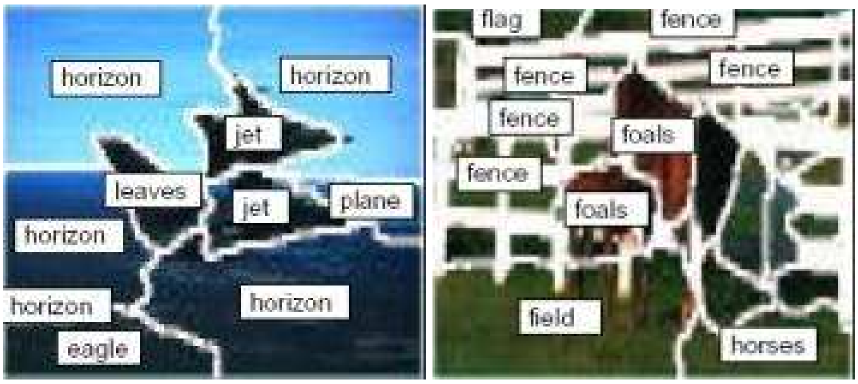

Figure 2: Recognitions results.

References

Carbonetto, P. and de Freitas, N. (2003). Why can't José read? the problem of learning semantic associations in a robot environment, *Human Language Technology Conference Workshop on Learning Word Meaning from Non-Linguistic Data*.

Carbonetto, P., de Freitas, N. and Barnard, K. (2004). A statistical model for general contextual object recognition, *European Conference on Computer Vision*, Prague.

Carbonetto, P., de Freitas, N., Gustafson, P. and Thompson, N. (2003). Bayesian feature weighting for unsupervised learning, with application to object recognition, *AI-STATS*, Florida, USA.

Duygulu, P., Barnard, K., de Freitas, N. and Forsyth, D. (2002). Object recognition as machine translation: Learning a lexicon for a fixed image vocabulary, *ECCV*, pp. 97–112.

Kueck, H., Carbonetto, P. and de Freitas, N. (2004). A constrained semi-supervised learning approach to data association, *European Conference on Computer Vision*, Prague.

Some Recent Bayesian Applications in Marketing

by Duncan K. H. Fong
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In their Marketing Science paper Rossi and Allenby (2003) provided annotated citations of Bayesian applications in marketing. Here we adopt part of their materials, add more references including work after the publication of their paper, and arrange the articles in a chronological order from year 2000 to present.

2000

1. Ansari, Asim, Skader Essegaier and Rajeev Kohli. 2000. Internet recommendation systems. J. Marketing Res. 37 363-375.

Random-effect specification for respondents and stimuli are proposed within the same linear model specification. The model is used to pool information from multiple data sources.

2. Ansari, Asim, Kamel Jedidi and Sharan Jagapl. 2000. A hierarchical Bayesian methodology for treating heterogeneity in structural equation models. Marketing Sci. 19 328-347.

Covariance matrix heterogeneity is introduced into a structural equation model, in contrast to standard models in marketing, where heterogeneity is introduced into the mean structure of a model. The biasing effects of not accounting for covariance heterogeneity are documented.

3. Bradlow, Eric T. and Vithala R. Rao. 2000. A hierarchical Bayes model for assortment choice. J. Marketing Res. 37 259-268.

A statistical measure of attribute assortment is incorporated into a random-utility model to measure consumer preference for assortment beyond the effects from the attribute levels themselves. The model is applied to choices between bundled offerings.

4. Pammer, S. E., Fong, D. K. H. and Arnold, S. F. 2000. Forecasting the Penetration of a New Product – A Bayesian Approach. Journal of Business and Economic Statistics, 18, 428-435.

Prior information are incorporated into the data analysis for predicting the penetration of a new product into a market. The penetration curve is assumed to be a nondecreasing function of time and may be under shape constraints. An example on forecasting the penetration of color TV using the information from black-and-white TV is provided in the paper.

5. Shively, Thomas A., Greg M. Allenby and Robert Kohn. 2000. A non-parametric approach to identifying latent relationships in hierarchical models. Marketing Sci. 19 149-162.

Stochastic splines are used to explore the covariate specification in the distribution of heterogeneity. Evidence of highly nonlinear relationships is provided.

6. Wedel, Michel and Rik Pieters. 2000. Eye fixations on advertisements and memory for brands: A model and findings. Marketing Sci. 19 297-312.

A multilevel model of attention and memory response is used to investigate the effect of brand, pictorial, and text attributes of print advertisements. Information in the data is integrated through a multilayered likelihood specification.

7. Yang, Sha and Greg M. Allenby. 2000. A model for observation, structural, and household heterogeneity in panel data. Marketing Lett. 11 137-149.

Structural heterogeneity is specified as a finite mixture of nonnested likelihoods, and covariates are associated with the mixture point masses.

2001

8. Bradlow, Eric T. and Peter S. Fader. 2001. A Bayesian lifetime model for the "Hot 100" Billboard songs. J. Amer. Statist. Assoc. 96 368-381.

A time series model for ranked data is developed using a latent variable model. The deterministic portion of the latent variable follows a temporal pattern described by a generalized gamma distribution, and the stochastic portion is extreme value.

9. Huber, Joel and Kenneth Train. 2001. On the similarity of classical and Bayesian estimates of individual mean partworths. Marketing Lett. 12 259-269.

Classical and Bayesian estimation methods are found to yield similar individual-level estimates. The classical methods condition on estimated hyperparameters, while Bayesian methods account for their uncertainty.

10. Liechty, John, Venkatram Ramaswamy and Steven H. Cohen. 2001. Choice menus for mass customization. J. Marketing Res. 38 183-196.

A multivariate probit model is used to model conjoint data where respondents can select multiple items from a menu. The observed binomial data is modeled with a latent multivariate normal distribution.

11. Rossi, Peter E., Zvi Gilula and Gerg M. Allenby. 2001. Overcoming scale usage heterogeneity: A Bayesian hierarchical approach. J. Amer. Statist. Assoc. 96 20-31.

Consumer response data on a fixed-point rating scale are assumed to be censored outcomes from a latent normal distribution. Variation in the censoring cutoffs among respondents allow for scale use heterogeneity.

12. Sandsor, Zsolt and Michel Wedel. 2001. Designing conjoing choice experiments using managers' prior beliefs. J. Marketing Res. 28 430-444.

The information from an experiment involving discrete choice models depends on the experimental design and the values of the model parameters. Optimal designs are determined with an information measure that is dependent on the prior distribution.

2002

13. Andrews, Rick, Asim Ansari and Imran Currim. 2002. Hierarchical Bayes versus finite mixture conjoint analysis models: A comparison of fit, prediction, and partworth recovery. J. Marketing Res. 87-98.

A simulation study is used to investigate the performance of continuous and discrete distributions of heterogeneity in a regression model. The results indicate that Bayesian methods are robust to the true underlying distribution of heterogeneity, and finite mixture models of heterogeneity perform well in recovering true parameter estimates.

14. Kim, Jaehwan, Greg M. Allenby and Peter E. Rossi. 2002. Modeling consumer demand for variety. Marketing Sci. 21 223-228.

A choice model with interior and corner solutions is derived from a utility function with decreasing marginal utility. Kuhn-Tucker conditions are used to relate the observed data, with utility maximization in the likelihood specification.

15. Marshall, Pablo and Eric T. Bradlow. 2002. A unified approach to conjoint analysis models. J. Amer. Statist. Assoc. 97 674-682.

Various censoring mechanisms are proposed for relating observed interval, ordinal, and nominal data to a latent linear conjoint model.

16. Moe, Wendy and Peter Fader. 2002. Using advance purchase orders to track new product sales. Marketing Sci. 21 347-364.

A hierarchical model of product diffusion is developed for forecasting new product sales. The model features a mixture of Weibulls as the basic model, with a distribution of heterogeneity over related products. The model is applied to data on music album sales.

17. Steenburgh, Thomas J., Andrew Ainslie and Peder H. Engebretson. 2002. Massively categorical variables: Revealing the information in zipcodes. Marketing Sci. 22 40-57.

The effects associated with massively categorical variables, such as zip codes, are modeled in a random-effects specification. Alternative loss functions are examined for assessing the value of the resulting shrinkage estimates.

18. Talukdar, Debabrata, K. Sudhir and Andrew Ainslie. 2002. Investing new production diffusion across products and countries. Marketing Sci. 21 97-116.

The Bass diffusion model is coupled with a random effects specification for the coefficients of innovation, imitation, and market potential. The random effects model includes macroeconomic covariates that have large explanatory power relative to unobserved heterogeneity.

19. Ter Hofstede, Frenkel, Michel Wedel and Jan-Benedict E. M. Steenkamp. 2002. Identifying spatial segments in international markets. Marketing Sci. 21 160-177.

The distribution of heterogeneity in a linear regression model is specified as a conditional Gaussian field to reflect spatial associations. The heterogeneity specification avoids the assumption that the random effects are globally independent.

20. Ter Hofstede, Frenkel, Youngchan Kim and Michel Wedel. 2002. Bayesian prediction in hybrid conjoint analysis. J. Marketing Res. 34 253-261.

Self-state attribute-level importance and profile evaluations are modeled as joint outcomes from a common set of partworths. The likelihoods for the dataset differ and include other, incidental parameters that facilitate the integration of information to produce improved estimates.

21. Yang, Sha, Greg M. Allenby and Geraldine Fennell. 2002. Modeling variation in brand preference: The roles of objective environment and motivating conditions. Marketing Sci. 21 14-31.

Intraindividual variation in brand preference is documented and associated with variation in the consumption context and motivations for using the offering. The unit of analysis is shown to be at the level of a person-occasion, not the person.

2003

22. Boatwright, Peter, Sharad Borle and Joseph B. Kadane. 2003. A model of the joint distribution of purchase quantity and timing. J. Amer. Statist. Assoc. 98 564-572.

The authors model the marginal distribution of purchase timing and the distribution of purchase quantity conditional on purchase timing in their paper. They propose a hierarchical Bayes model that disentangles the weekly and daily components of the purchase timing.

23. Edwards, Yancy and Greg M. Allenby. 2003. Multivariate analysis of multiple response data. J. Marketing Res. 40 321-334.

Pick any of J data is modeled with a multivariate probit model, allowing standard multivariate techniques to be applied to the parameter of the latent normal distribution. Identifying restrictions for the model are imposed by post-processing the draws of the Markov chain.

24. Jen, Lichung, Chien-Heng Chou and Greg M. Allenby. 2003. A Bayesian approach to modeling purchase frequency. Marketing Lett. 14 5-20.

A model of purchase frequency that combines a Poisson likelihood with gamma mixing distribution is proposed, where the mixing distribution is a function of covariates. The covariates are shown to be useful for customers with short purchase histories or have infrequent interaction with the firm.

25. Lee, Jonathan, Peter Boatwright and Wagner Kamakura. 2003. A Bayesian model of prelaunch sales forecasting of recorded music. Management Sci. 49 179-196.

The authors study the forecasting of sales for new music albums prior to their introduction. A hierarchical logistic shaped diffusion model is used to combine a variety of sources of information on attributes of the album, effects of marketing variables, and dynamics of adoption.

26. Rossi, Peter E. and Greg M. Allenby. 2003. Bayesian Statistics and Marketing. Marketing Sci. 22 304-328.

The paper reviews the essence of the Bayesian approach and explains why it is particularly useful for marketing problems.

27. Yang, Sha and Greg M. Allenby. 2003. Modeling interdependent consumer preferences. J. Marketing Res. 40 282-294.

The distribution of heterogeneity is modeled using a spatial autoregressive process, yielding interdependent draws from the mixing distribution. Heterogeneity is related to multiple networks defined with geographic and demographic variables.

2004

28. Allenby, Greg M., Thomas Shively, Sha Yang and Mark J. Garratt. 2004. A choice model for packaged goods: Dealing with discrete quantities and quantity discounts. Marketing Sci. Forthcoming.

A method for dealing with the pricing of a product with different package sizes is developed from utility-maximizing principles. The model allows for the estimation of demand when there exist a multitude of size-brand combinations.

29. DeSarbo, W. S., D. K. H. Fong, J. Liechty and M. K. Saxton. 2004. A hierarchical Bayesian procedure for two-mode cluster analysis. Psychometrika. Forthcoming.

The paper introduces a Bayesian finite mixture methodology for the joint clustering of row and column stimuli/objects associated with two-mode asymmetric proximity, dominance, or profile data. A consumer psychology application is provided examining physician pharmaceutical prescription behavior for various brands of prescription drugs in the neuroscience health market.

30. DeSarbo, W. S., Fong, D. K. H., Liechty, J., and Chang, J. 2004. Evolutionary Preference/Utility Functions: A Dynamic Perspective. Psychometrika. Forthcoming.

The paper introduces a Bayesian dynamic linear methodology that permits the detection and modeling of potential changes to the underlying preference/utility structure of the respondent. An illustration of revealed/stated preference analysis is given involving students' preferences for apartments and their underlying attributes and features.

31. Montgomery, Alan, Shibo Li, Kannan Srinivasan and John C. Liechty. 2004. Predicting Online Purchase Conversion Using Web Path Analysis. Marketing Science. Forthcoming.

A dynamic Multinomial Probit model with autoregressive lags and a hidden Markov switching structure is used to model individual navigation paths through web pages, where the pages have been grouped into different categories. The model demonstrates that incorporating path specific data in this manner results in improved predictive power.

TURNING A PAGE

by Lilla Di Scala
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Dear Readers, please don't be surprised if you see only one name under this Section's heading! I am the only one formally authoring this Section as the Students' Corner features, among this issue's two Ph.D. thesis, the one recently defended by the second Associate Editor. I too am going to defend mine soonest, but you won't find an abstract in the Bulletin: strange as it sounds, it is not Bayesian! As a consequence, we now end our two-year appointment and this is the last Students' Section we submit to our Editor. New students with fresh and exciting ideas will be substituting us. We wish them all the best! Let me tell you that this has been an extremely interesting experience for us, one in which we have come in contact with statisticians all over the world. We hope to have given prospective students an idea of what kind of experience Statistics Ph.D.'s undergo. Having understood how hard it is to keep a publication on schedule, we thank our Editor not only for having given us the appointment in the first place but also for never having complained about our being late with the Section. Last but not least, we thank all of you who have had the curiosity and patience to read our small contribution to the Bulletin. Arrivederci!

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Thesis title: *Bayesian analysis of queueing systems*
Advisor: Rosa Lillo and Michael Wiper

Abstract While Bayesian analysis of queueing systems is a fairly developed research area, most work has been devoted to Markovian queues. However, the choice of queueing model is crucial when undertaking inference on the quantities of interest of a queue and the assumption of exponential interarrival or service times can be very unrealistic in practice. In order to describe the arrival and service processes, we consider flexible models based on two classes of mixtures of distributions which can approximate arbitrarily closely any continuous and positive distribution. These are mixtures of Erlang distributions and Coxian distributions. Reversible Jump and Birth Death Markov Chain Monte Carlo methods are used to estimate the predictive distribution of the interarrival and service time and to analyze the traffic congestion in the system. As the two mixture families considered are phase type distributions, it is possible to apply some known results from queueing theory which, combined with the MCMC methods, can be used to approximate the predictive distribution of various measures of performance, such as the queue size, the waiting time and the busy period. We also address optimal design problems in the case where there are multiple servers in the observed system. In this case, a cost model depending on the previously estimated characteristics of the queue is formulated. The proposed methodology is illustrated with two real examples: bed occupancy in a London hospital and arrival and service data at a bank in Madrid. Finally, we deal with the transient behaviour of the queue. We derive a result which let us numerically find the roots of some polynomial equations related to the transitory distributions of interest and use this, in combination with the Bayesian inference techniques introduced earlier to estimate various quantities of interest in the G/G/1 queueing system.

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Thesis title: *Bayesian non-parametric inference on the hazard rate with application to the assessment of seismic hazard in some Italian seismogenic zones*
Advisor: Renata Rotondi

Abstract This thesis deals with non-parametric inference on the hazard rate from a Bayesian point of view. Such topic constitutes a valid alternative to density estimation for positive variates and also offers the possibility of considering right-censored as well as exact observations; furthermore, as the thesis shows, it is an approach which can be exploited to give a non-parametric and time-varying assessment of seismic hazard in a given seismogenic zone. Indeed, probabilistic hazard assessment is a challenge for modern seismology and the Bayesian paradigm provides a natural framework of definition for it. In particular, Italy is a country where a strong seismic activity has been recorded during the past centuries, with the advantage that a long tradition of analyses has produced a rich and reliable seismic catalogue. In this thesis, some historical data are analyzed in the light of the latest seismogenic zoning.

A new class of non-parametric priors is proposed for the unknown distribution of positive variates, by building the corresponding hazard rates as convolution mixtures of a probability density with a compound Poisson process. First of all, conditions are given in order for the prior definition to be well posed and the prior hazard rate to be almost surely smooth. Then a time-scale invariant procedure is suggested for the choice of hyper-parameters in such a way as to assign a constant expected prior hazard rate, while controlling prior variability. Finally, by introducing suitable latent variables, an MCMC approximation for the posterior distribution is proposed, implemented and validated on some test data-sets. Moreover, with minor changes, the above extends to deal with the proportional hazards model.

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Master's Thesis title: *Bayesian inference in smooth transition autoregressive models for mean and variance*
Advisor: Hedibert Lopes

Abstract The main contribution of this work is the Bayesian approach to a special class of nonlinear time series models, called logistic smooth transition autoregressive models (LSTAR). The first part of this work compare models through both subjective and objective priors. A Gibbs sampler is proposed for the LSTAR model of order k, or simply LSTAR(k). Afterwards, k is treated as an additional model parameter and a reversible jump Markov chain Monte Carlo (RJMCMC) algorithm, that permit jumps between parameter spaces of different dimensionality, is proposed. For model selection, we compare our RJMCMC algorithm to well-known information criteria, such as the AIC and the BIC, as well as more recent ones, such as the deviance information criterion (DIC), proposed by Spiegelhalter *et al* (2002). The final two chapters of the thesis extend both the univariate and factor stochastic volatility models by incorporting LSTAR processes to the evolution of the series' and common factor's log-volatilities. Our methods are extensively studied in simulated and real financial applications.

Juan Vivar - `jcvivar@dme.ufrj.br`
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Master's Thesis title: *A New Class of Spatio-Temporal Models for Areal Data*
Advisor: Marco Ferreira

Abstract In this work, we present a new class of spatio-temporal models for areal data based on Bayesian dynamic models with errors following proper Gaussian Markov random fields processes. We use dynamic linear models framework to specify our proposed models, hence, errors in system and observation equations are spatially correlated. Depending on characteristics of the system and design matrices, we may have different kinds of models, like first order polynomial models, second order polynomial models, contamination models; original or reduced state vector dimension, etc. We develop parameter estimation using Markov Chain Monte Carlo (MCMC) methods and *forward filtering backward sampling* algorithm, improved in some cases with matrix spectral decompositions. This new class of models can be potentially applied to environmental processes and epidemiologic and socioeconomic processes. We illustrate this new class of models and the estimation methodology developed with an application to a dataset related to wind velocity over the tropical Pacific region.

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Master's Thesis title: *Dynamic and Static Survival Models with Spatial Frailty*
Advisor: Dani Gamerman

Abstract Spatial frailty survival models besides explaining which is the covariates effect in the risk of an individual to fail, aim at describing non-observed heterogeneity between the units in the study with some spatial information, introduced in a latent term (frailty). The modeling will be initially based on proportional risk models where the baseline hazard function will be adjusted in three ways: assuming parametric form, using Gamma processes and using dynamic models. Another form of modeling is based on survival dynamic models, that assume that the covariates effect can change over time. The spatial frailty will be modeled using Gaussian processes. The estimates will be based on computational methods using MCMC. The models will be applied to two data sets: a study of survival of residents in England who suffer from Leukemia and a study of the employment duration time in the industrial sector in the State of Rio de Janeiro.

Numerical Integration is an Art, Not a Science

by Diego Kuonen
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This is an extended summary of Kuonen (2003), where current quadrature methods for approximate calculation of integrals within S-PLUS or R were reviewed. The aim of this survey paper was to help readers, not expert in computing, to apply numerical integration methods and to realize that numerical integration is an art, not a science. Herein we only give a short overview of the art of numerical integration within statistics.

For the available implementations within S-PLUS or R, for further details on the mentioned techniques and for the results of an extensive comparison study we refer the interested reader to Kuonen (2001, 2003).

1 Introduction

Numerical integration, also called *quadrature*, is the study of how the numerical value of an integral can be found. All quadrature methods are based, in one way or another, on the obvious device of adding up the value of the integrand at a sequence of points within the range of integration. Hence, most of the approximations have the form

$$\int \cdots \int_{R_m} w(x_1, \ldots, x_m) f(x_1, \ldots, x_m) dx_1 \cdots dx_m \approx \sum_{i=1}^{M} W_i f(y_{i,1}, \ldots, y_{i,m}), \quad (1)$$

where R_m is a given region in a m-dimensional Euclidean space E_m and $w(x_1, \ldots, x_m)$ is a given weight function. The $(y_{i,1}, \ldots, y_{i,m})$ lie in E_m and are called the *points* of the formula. The W_i are constants which do not depend on $f(x_1, \ldots, x_m)$ and are called the *coefficients* of the formula. We say that formula (1) has a *degree of exactness* r if it is exact for all polynomials in $x_1, \ldots, x_m$ of degree $\leq r$ and there is at least one polynomial of degree $r+1$ for which it is not exact.

The theory of integration formulae for functions of one variable ($m = 1$) is well developed; see Davis and Rabinowitz (1984) or Evans (1993). The integral of a function is approximated by the sum of its values at a set of equally spaced points, multiplied by certain aptly chosen coefficients of the formula. Examples include the trapezoidal and Simpson's rules. Hence only the W_i are free to be used to force the quadrature rule to have a certain degree of exactness. The freedom to fix the points y_i has been thrown away, presumably in the interests of getting linear equations for the W_i. If the y_i are also left free, the result is a set of non-linear equations which can be shown to have solutions based on the zeros of the associated sets of orthogonal polynomials for the given interval $[a, b]$ and weight function $w(x)$. This leads to the elegant theory of Gaussian quadrature.

2 Gaussian quadrature

The idea is to give ourselves the freedom to choose not only the coefficients W_i, but also the location of the points at which the function is to be evaluated. Moreover, the integration formula is forced to have a certain degree of exactness, *e.g.* $2M - 1$. Because of the computational expense of generating a new Gaussian formula, only commonly used combinations of the interval and weight functions are normally tabulated. The most commonly used rule is the Gauss–Legendre rule with interval $[-1, 1]$ and weight function $w(x) = 1$. To apply it to any finite range quadrature on the interval $[a, b]$, the linear transformation

$$x = \frac{b-a}{2} t + \frac{b+a}{2}$$

to the standard interval $[-1, 1]$ can be used.

For the multi-dimensional case we reduce the multiple integral on the left-hand side of (1) into repeated integrals over $[-1, 1]$,

$$\int_{-1}^{1} dx_1 \int_{-1}^{1} dx_2 \cdots \int_{-1}^{1} f(x_1, \ldots, x_m) dx_m. \quad (2)$$

Then we apply a classical quadrature formula to each integral in (2), which yields using the right-hand side of (1) a product rule of the form

$$\sum_{i_m=1}^{M} \cdots \sum_{i_1=1}^{M} W_{i_1} \cdots W_{i_n} f(y_{i_1}, \ldots, y_{i_m}), \quad (3)$$

where the weights W_{i_j} and the points y_{i_j}, $j = 1, \ldots, m$, are chosen to be appropriate for the specific dimension to which they are applied.

For M quadrature points in each dimension the sum in (3) is over M^m terms. Therefore the numerical effort of Gaussian quadrature techniques increases exponentially with the integral dimension.

Furthermore, the trouble with Gaussian quadrature is that you have no real idea of how accurate the answer is. You can always increase the accuracy by using a higher order Gauss method or by applying it piecewise over smaller periods but you still do not know the accuracy in terms of correct decimal places. To get a prescribed accuracy one needs adaptive integration, which keeps reducing the step size until a specified error has been achieved.

3 Adaptive methods

Indeed, Gaussian quadratures are formulae which are said to be *progressive*, as the points for any point-number M are in general quite different from those for any other point-number. Another term used to describe quadrature rules is *adaptive*. A rule is adaptive if it compensates for a difficult subrange of an integrand by automatically increasing the number of quadrature points in the awkward region. Adaptive rules are usually based on a standard underlying quadrature rule, often a progressive one. Adaptive algorithms are now used widely for the numerical calculation of multiple integrals. Genz (1992) suggested that such subregion adaptive integration algorithms can be used effectively in some multiple integration problems arising in statistics. The key to good solutions for these problems is the choice of an appropriate transformation from the infinite integration region for the original problem to a suitable finite region for the subregion adaptive algorithm. Care must be taken in the selection of the transformation. As a check on consistency and efficiency we encourage use of several transformations for different computations of the same integral, and then comparison of their results.

4 Monte Carlo methods

Numerical methods known as Monte Carlo (MC) methods can be loosely described as statistical simulation methods. For a complete introduction to MC integration we refer to Robert and Casella (1999, chap 3). The basic MC method iteratively approximates a definite integral by uniformly sampling from the domain of integration, and averaging the function values at the samples. The integrand is treated as a random variable, and the sampling scheme yields a parameter estimate of the mean, or expected value of the random variable. However, MC methods suffer from a slow convergence. To reduce the error, for example, by a factor of 10 requires a 100-fold increase in the number of sample points. Therefore, other methods have been studied for decreasing the error. Such approximations are called 'Quasi Monte Carlo' (QMC) methods, where the points used for evaluating the function are generated deterministically. The resulting accuracy of the integral is generally significantly better than in the MC method. Many different QMC methods are known. One method makes use of results from the the theory of numbers and is called the *number-theoretic* method; see Fang and Wang (1994) or Fang *et al.* (1994).

Additional methods have been employed to reduce the error of the MC method, such as importance sampling, stratified sampling, antithetic variates and non-random sequences (see Evans and Swartz, 1995, for a review). These methods are mostly concerned with finding sets of points that yield smaller integration errors. Importance sampling concentrates samples in the area where they are more effective by using *a priori* knowledge of the function. Stratified sampling tries to distribute samples evenly by subdividing the domain into subregions such as grids. It is possible to combine some of these techniques, or to apply them adaptively. For example, uniformly distributed samples generated by stratification can be employed for importance sampling.

As described above, MC integration draws samples from the required distribution, and then forms sample averages to approximate expectations. 'Markov Chain Monte Carlo' (MCMC) methods draw these samples by running a constructed Markov chain for a long time. An example of a way to construct such a chain is the Gibbs sampler. An introduction to MCMC methods and their applications is given in Gilks *et al.* (1996) or Robert and Casella (1999). But questions on convergence of the chains and efficient implementation remain unresolved (Cappé and Robert, 2000). Moreover, we do not feel so comfortable using the MC methods mentioned for an additional reason: one needs too many function evaluations to get a certain accuracy.

5 Discussion

Traditional quadrature methods (even newer adaptive ones) have been almost forgotten in the recent rush to MCMC methods. Genz and Kass (1997) argued that the reason why existing quadrature methods have been largely overlooked in statistics may be that when applied they are poorly suited for peaked-integrand functions.

Indeed, the numerical integration routine samples the function at a number of points, and then assumes that the function varies smoothly between these points. As a result, if none of the sample points come close to the peak, then it will go undetected, and its contribution will not be correctly included. Therefore it is very important to get an idea of the effective range of the integrand in a preliminary analysis. But, if such a problem is thought to have arisen, one could bypass these problems using the split-t transformations proposed in Genz and Kass (1997) prior to the use of adaptive numerical integration algorithms.

Finally, one should not forget that numerical integration in statistics, especially in multi-dimensional problems still raises many open questions.

Further information on the numerical computation of multiple integrals in statistics may be found in Evans and Swartz (2000) and in the references given in Kuonen (2001, 2003).

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VII BRAZILIAN MEETING OF BAYESIAN STATISTICS: A SUMMARY REPORT

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The VII Brazilian Meeting of Bayesian Statistics, endorsed and cosponsored by ISBA, was organized by ISBRA, the brazilian chapter of ISBA, and by the Statistics Department of the Universidade de São Carlos, in São Paulo, Brazil. The meeting was held last February, 8th-11th, in the Hotel Anacã. Around 110 participants contributed to this successful, diverse and rather multinational meeting: 101 participans from Brazil, 5 from the US, 2 from Chile, one from Canadá and one from Italy. The activities started with Dipak Dey's openning lecture and Peter Müller's tutorial on *Non-parametric Bayesian Data Analysis*, and was followed by 6 conference talks given by Peter Müller, Joseph Kadane, Jim Zidek, Liseo Brunero, Jorge Ashcar and Carlos Pereira. Sessions on *Statistics in Finance*, *Environmental Statistics*, *and Skewed Distributions*, a *young researcher* session and 57 posters completed the meeting. The best four posters, chosen by the participants, will appear in the second issue of the *Boletim ISBRA*, a brazilian analog of the ISBA bulletin. We have to acknowledge Josemar Rodrigues, and the organizing committee, for making the meeting possible and smooth. Keep your eyes open because the VIII meeting will be held in Rio de Janeiro, probably somewhere between October/2005 and March/2006, or in other words, summer in Rio!

News from the world

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✻ *denotes an ISBA activity*

➤ Events

Can Bayesian Approaches to Studying New Treatments Improve Regulatory Decision-Making? *May 20-21, 2004, National Institutes of Health, Masur Auditorium 9000 Rockville Pike Bldg. 10 Clinical Center Bethesda, Maryland 20892.*

Communicate the underlying concepts of Bayesian design and analysis of clinical trials in non-technical terms.

Illustrate the use of Bayesian approaches to clinical trials with case studies.

Demonstrate how a Bayesian approach uses evidence in the decision making process.

Review the experience of the Center for Devices & Radiological Health using Bayesian approaches and discuss the potential for application of Bayesian approaches in clinical trials of investigational pharmaceuticals.

Discuss how studies using a Bayesian approach can satisfy regulatory requirements.

Registration Information:
http://www.jhu.edu/advanced/bayesian.

Program Information: The agenda for this meeting can be found at:
http://www.fda.gov/oc/meetings/bayesian.html.

Applied Bayesian Statistics School. Statistics and Gene Expression Genomics: Methods and Computations. *June 15-19, 2004. Centro Congressi Panorama, Trento, Italy.*

Lecturer: Mike West, the Arts and Sciences Professor of Statistics and Decision Sciences at Duke University and Co-Director of the Computational and Applied Genomics Program at the Institute for Genome Sciences and Policy, Duke University.

Updated information on the school is available on the website (below). For more information, please contact the ABS04 Secretariat at abs04@mi.imati.cnr.it

Site: www.mi.imati.cnr.it/conferences/abs04.html

2004 WNAR/IMS Meeting. *June 26-30, 2004. Albuquerque, New Mexico.*

The 2004 joint WNAR/IMS meeting will be held June 26-30 at the University of New Mexico, in Albuquerque. More details on this meeting are now available on the website (below).

Site: www.math.unm.edu/conferences/wnarims

✻ 24th International Workshop on Bayesian Inference and Maximum Entropy Methods in Science and Engineering. *July 25-30, 2004. Munich, Germany*

Following up on the success of the past 23 conferences on applications of Bayesian Inference and Maximum Entropy Methods in Science and Engineering, the MaxEnt04 conference will be held in Garching near Munich, Germany, next summer, July 25-30, 2004 at the Max-Planck-Institut fuer Plasmaphysik (IPP) which hosted the conference already in July, 1998.

Traditional topics of the workshop are the application of the maximum entropy principle and Bayesian methods for statistical inference to diverse areas of scientific research. Practical numerical algorithms and principles for solving ill-posed inverse problems, image reconstruction and model building are emphasized. The workshop also addresses common foundations for statistical physics, statistical inference, and information theory. Typical applications are from the fields of Bayesian graphical models, experimental design, ICA/blind source separation, image reconstruction, Markov chain Monte Carlo, neural nets, quantum mechanics, philosophy of science, reference priors, and applications in various fields of science, e.g. astrophysics, plasma physics, material science, metrology, meteorology, biology, educational science, etc.

Our plan is to have invited talks, contributed talks and a poster session. Further details are available on the official conference website (below), where you may download the initial conference flyer. In particular, more details on the program, registration fee and the accommodations will be available. Please check the web site regularly or contact Rainer Fischer (Rainer.Fischer@ipp.mpg.de or maxent04@ipp.mpg.de).

Site: www.ipp.mpg.de/maxent04

✻ **International Workshop/Conference on Bayesian Statistics and its Applications.** *January 6-8, 2005. Varanasi, India.*

The Department of Statistics, Banaras Hindu University, is organizing an International Workshop/Conference on Bayesian Statistics and its Applications during January 6-8, 2005 as a follow up program of Bayesian conference/workshop at Indian Statistical Institute, Kolkata, in January, 2003. The workshop/conference is co-sponsored by the International Society for Bayesian Analysis, the Indian Bayesian Society and the Indian Chapter of International Society for Bayesian Analysis.

We expect to cover a lot of Bayesian applications and some Bayesian theory relating to:

Environmental and Spatial Statistics.
Survival Analysis and Epidemiology.
Bayesian Biostatistics.
Image Analysis.
Objective Bayesian methods.
Methods for high or infinite dimensional data.
Bayesian Econometrics.
MCMC Methods and their advancements.
Bayesian Reliability, etc.

Invited sessions on these topics will be spread on three days. We also welcome contributed papers.

The conference is combined with a workshop on Bayesian statistics and its applications. The aim of the workshop is to provide some sort of training to young researchers and practicing statisticians who are unaware with most of the recent developments and as a result not able to apply such improved techniques in solving their own complexities. The young researchers will find an amicable environment where they can discuss their problems with the International experts.

Sanjib Basu, Jose Bernardo, Dipak K. Dey, David Draper, Stephen E. Fienberg, J.K. Ghosh, Malay Ghosh, Sujit Ghosh, Prem Goel, Michael Goldstein, Valen Johnson, Giovanna Jona Lasinio, Kanti V. Mardia, Tony O'Hagan, Sonia Petrone, Mike West, Arnold Zellner and few other eminent Bayesians have confirmed their plans to join us to this exciting event. Besides, we have received favorable responses from M.J. Bayarri, Jim Berger, Alan Gelfand, Edward I. George, Bani Mallick, Peter Muller, Nozer Singpurwalla, Adrian Smith, Dongchu Sun and we are quite hopeful that their plans will be finalized soon. More information is available from the conference's webpage at:

www.bayesian.org/business/varanasi/varanasi.html

✻ **COBAL II First Announcement.** *February 6-10, 2005. San Jose del Cabo, Mexico.*

Following up on the success of COBAL I, the Second Latin American Congress on Bayesian Statistics (COBAL II) will be held February 6-10, 2005 at Hotel Presidente Intercontinental Los Cabos in San Jose del Cabo, Baja California, Mexico. This meeting will consist of invited talks and poster sessions. More details on the program, registration fees and lodging costs will be available soon at the congress' website (below). For more information, please send an e-mail to cobal2@sigma.iimas.unam.mx.
Site: http://www.iimas.unam.mx/cobal2

➤ Opportunities for Students

✻ **Student Travel Awards to Attend the 2004 Joint Statistical Meetings.**

SBSS will once again this year encourage student participation by awarding modest travel grants to full-time students giving talks in SBSS sponsored or cosponsored sessions. This year we expect to fund up to $500 per student.

Criteria for 2004 student travel funding are as follows:

(i) Student is presenting a talk with Bayesian content at the 2004 JSM or has organized a Topic Contributed Session of such talks under the aegis of the SBSS.

item[(ii)] Student must have separately submitted an abstract to the JSM through the regular abstract submission process.

(iii) Student is a current member of either SBSS or ISBA. Student may apply for membership at the time of application by completing the section membership form (www.amstat.org/membership/chapsection.pdf) and submitting it to the ASA.

(iv) Student travel awards will only be funded provided proof of membership and submission of travel receipts to the SBSS treasurer (Susan Paddock, susan_paddock@rand.org) after the JSM.

(v) Each application must include brief information about the applicant including:

(a) name,

(b) mailing address and email address,

(c) institution and program affiliation,

(d) number of years in program,

(e) thesis topic,

(f) name of major professor,

(g) copy of title/abstract of talk to be presented,

(h) estimated itemization of approximate hotel and transportation expenses.

Please send your application including this information, itemized as in this paragraph along with your CV, the title and abstract of the paper you will present in a SBSS session, and a recommendation from your advisor to: Professor Ming-Hui CHEN, SBSS Program Chair-elect at `mhchen@stat.uconn.edu`.

(vi) Application due date: March 15, 2004.

Successful applicants will need to supply receipts for reimbursement (but only after the JSM!). Since limited funds are available, it is likely that SBSS will not be able to fund all requests. Also, SBSS cannot fund the entirety of any student's travel, so applicants will obviously need to supplement any SBSS award with other funds. Students receiving awards are not eligible for travel awards in subsequent years. An exception is made for Savage Award finalists.
