



September 2015

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## JSM Seattle “biggest yet”

Seattle is known for Starbucks and software... and now also for statisticians, as over 6,800 people attended the 2015 Joint Statistical Meetings, held at the Washington State Convention Center from August 8–13, 2015.

IMS invited program co-chairs Antonio Lijoi and Igor Prünster, said of their involvement, “The experience as IMS invited program co-chairs at the JSM in Seattle has been highly rewarding. Indeed, all sessions had large audiences and included talks of the highest quality that stimulated lively discussions. The whole organization procedures in the run up to JSM were quite smooth. Although putting together a program consisting of 30 invited sessions has not been an easy task, our work has benefited from helpful support from Judith Rousseau (IMS Program Secretary), Elyse Gustafson, previous IMS invited program chairs and members of the JSM organizing team at ASA who promptly replied to all our queries.”

Kathleen Wert, ASA’s Director of Meetings, said this JSM was the biggest yet. There were 702 sessions (including roundtable discussions). Over 3800 abstracts (paper, panel and poster presentations) were submitted, and there were more than 400 poster presentations (including invited posters), and 183 Speed presentations. New at JSM this year were the “Spotlight Seattle” feature in the exhibit hall, with food, coffee, popcorn and beer and wine tastings; the opening mixer held inside the exhibit hall Sunday evening; and the live Social Media wall with selfie station.

Next year’s JSM will be in Chicago, July 30–August 4, 2016. Organizers have issued a **final call for invited session proposals**: see page 19 for details.



Seattle’s famous Pike Place Market: see the fish fly!



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# IMS Members' News

## Aad van der Vaart receives Spinoza Prize

The Netherlands Organisation for Scientific Research (NWO) Spinoza Prize is the highest Dutch award in science. This year, NWO awarded Spinoza Prizes to four leading scientists working in the Netherlands, including statistician **Aad van der Vaart**. NWO Spinoza Laureates perform outstanding and ground-breaking research, which has a large impact, inspiring young researchers. NWO awards 2.5 million Euros to each laureate for scientific research. More information at <http://www.nwo.nl/en/research-and-results/programmes/spinoza+prize>

## Michael Waterman wins Dan David Award in Bioinformatics:

The Dan David Prize, managed by Tel Aviv University, annually awards three prizes of US\$1 million for outstanding achievement in past, present and future time dimensions. The Dan David Prize awards prizes to individuals or institutions with proven exceptional, distinct excellence in the sciences, arts and humanities that have made an outstanding contribution to humankind. Among the three laureates for the *Future Time Dimension in the field of Bioinformatics* is Professor **Michael Waterman**, who “made seminal and influential contributions to biological sequence analysis. He developed an algorithm that is the basis for the database of DNA, RNA and protein sequences and developed the fundamental algorithms used for the mapping of sequence information in the Human Genome Project.” <http://www.timesofisrael.com/past-present-and-future-achievers-feted-at-tel-aviv-event/>

## Stephen Fienberg receives NISS 2015 Jerome Sacks Award for Cross Disciplinary Research

The National Institute of Statistical Sciences (NISS) has selected **Stephen E. Fienberg** to receive its 2015 Jerome Sacks Award for Cross-Disciplinary Research. The announcement was made by Dr. Nell Sedransk, Acting Director of NISS, during a reception at JSM. She said Fienberg received this award for “a remarkable career devoted to the development and application of statistical methodology to solve problems for the benefit of society, including aspects of human rights, privacy and confidentiality, forensics, survey and census-taking, and more; and for exceptional leadership in a variety of professional and governmental organizations, including in the founding of NISS.” Fienberg is Maurice Falk University Professor of Statistics and Social Science in the Department of Statistics, the Machine Learning Department, and Cylab, and co-Director of the Living Analytics Research Center at Carnegie Mellon University. He has authored more than 20 books and 500 papers and related publications. Fienberg’s interest in confidentiality and disclosure limitation ties both to surveys and censuses and also to categorical data analysis. It also led him to work on the “NISS Digital Government Project.”

## Jiming Jiang NISS Former Postdoc Achievement Award

Celebrating its 25th anniversary, NISS created a new award to recognize the extraordinary achievements of some of its former postdocs—more than 70 since 1993. IMS Fellow **Jiming Jiang**, University of California, Davis, received this award together with Laura J. Steinberg, Syracuse University. Jiang’s award honored “his distinguished career and excellence in leadership through research, through education and through example as a role model for the profession of statistics.” Jiang has published over 80 peer-reviewed papers and three books. He is known for his work on generalized linear mixed models, the subject of his first book. Other interests include small area estimation with applications to survey data, asymptotics and large sample statistics, and model selection. See [www.niss.org/news/](http://www.niss.org/news/)

# IMS Members' News

## Janet L. Norwood Award for Judith Goldberg

**Judith Goldberg**, ScD, Professor of Biostatistics at NYU Langone Medical Center in the Department of Population Health, has been honored with the Janet L. Norwood Award. The award is presented annually by the School of Public Health at The University of Alabama at Birmingham to an internationally recognized woman statistician for outstanding achievement in the statistical sciences. Janet Norwood was the first woman commissioner of the US Bureau of Labor Statistics.

Judith Goldberg is the director of the PhD program in biostatistics in the environmental health sciences at NYU's Graduate School of Arts and Science; director of the Biostatistics Shared Resource of the NYU Perlmutter Cancer Center; director of the study design, biostatistics and clinical research ethics core of the NYU-HHC Clinical Translational Science Institute; and director of the environmental health statistics and bioinformatics facility of the National Institute of Environmental Health Sciences Center at NYU. She is also the principal investigator of the statistics and data management core of the NCI-funded Myeloproliferative Disorders Research Consortium and a co-investigator on numerous other collaborative research grants in clinical and translational research in oncology and other areas. She has over 125 publications in statistics and substantive journals. Dr. Goldberg was founding director (1999–2013) of the Division of Biostatistics at NYU Langone Medical Center.

Prior to joining NYU, Judith was vice president of biostatistics and data management at Bristol Myers Squibb, executive director of statistics and data management at Lederle Laboratories, associate professor of biostatistics at Mount Sinai School of Medicine, and a research statistician for the Health Insurance Plan of Greater New York.

Judith is a fellow of the ASA and of the American Association for the Advancement of Science (AAAS). She has held numerous offices including President of the Biometric Society, chair of the ASA Fellows Committee, and chair of the Statistics Section U of the AAAS. Her research interests include survival analysis, clinical trials, methods for the analysis of screening and diagnostic tests, misclassification, methods for the analysis of observational data, statistical methods in epidemiology, and statistical genomics.

The Janet L. Norwood Award, “wishes not only to recognize Dr. Norwood's achievements, but also to recognize the contribution of all women to the statistical sciences. It is noteworthy that women have been traditionally under-represented many fields of science, with the degree of under-representation greater for the quantitative sciences. This denies the field the benefit of

the great contributions women are obviously capable of making to the statistical sciences.”

## NISS Distinguished Service Awards

NISS has selected Dr. **John Eltinge** and **Jamie Nunnally** to receive its 2015 Distinguished Service Awards. Read the full report on page 18.

Dr. Goldberg will accept the award on September 9 at the University of Alabama at Birmingham School of Public Health, where she will deliver a special lecture.

## Xuming He and Danyu Lin receive ICSA Distinguished Achievement Award

**Xuming He** (Professor of Statistics at the University of Michigan) and **Danyu Lin** (Professor of Biostatistics at the University of North Carolina at Chapel Hill) have received the 2015 Distinguished Achievement Award from the International Chinese Statistical Association (ICSA). The award honors individuals for their distinguished achievements and leadership in statistics research, education, or applications. See <http://icsa.org/awards/distinguish/index.html>

 = access published papers online

## IMS Journals and Publications

*Annals of Statistics*: Peter Hall and Runze Li

<http://imstat.org/aos>

 <http://projecteuclid.org/aos>

*Annals of Applied Statistics*: Stephen Fienberg

<http://imstat.org/aoas>

 <http://projecteuclid.org/aoas>

*Annals of Probability*: Maria Eulalia Vares

<http://imstat.org/aop>

 <http://projecteuclid.org/aop>

*Annals of Applied Probability*: Timo Seppäläinen

<http://imstat.org/aap>

 <http://projecteuclid.org/aop>

*Statistical Science*: Peter Green

<http://imstat.org/sts>

 <http://projecteuclid.org/ss>

## IMS Collections

<http://imstat.org/publications/imscollections.htm>

 <http://projecteuclid.org/imsc>

*IMS Monographs and IMS Textbooks*: David Cox

<http://imstat.org/cup/>

## IMS Co-sponsored Journals and Publications

*Electronic Journal of Statistics*: George Michailidis

<http://imstat.org/ejs>

 <http://projecteuclid.org/ejs>

*Electronic Journal of Probability*: Brian Rider

<http://ejp.ejpecp.org>

*Electronic Communications in Probability*:

Sandrine Péché

 <http://ecp.ejpecp.org>

*Current Index to Statistics*: George Styan

<http://www.statindex.org>

 log into members' area at [imstat.org](http://imstat.org)

*Journal of Computational and Graphical Statistics*:

Thomas Lee

<http://www.amstat.org/publications/jcgs>

 log into members' area at [imstat.org](http://imstat.org)

*Statistics Surveys*: Donald Richards

<http://imstat.org/ss>

 <http://projecteuclid.org/ssu>

*Probability Surveys*: Ben Hambly

<http://imstat.org/ps>

 <http://www.i-journals.org/ps/>

## IMS-Supported Journals

*Annales de l'Institut Henri Poincaré (B)*: Thierry

Bodineau & Lorenzo Zambotti <http://imstat.org/aihpc>

 <http://projecteuclid.org/aihpc>

*Bayesian Analysis*: Marina Vannucci

<http://ba.stat.cmu.edu>

*Bernoulli*: Eric Moulines

<http://www.bernoulli-society.org/>

 <http://projecteuclid.org/bj>

*Brazilian Journal of Probability and Statistics*:

Nancy Lopes Garcia <http://imstat.org/bjps>

 <http://projecteuclid.org/bjps>

*Stochastic Systems*: Peter W Glynn

 <http://www.i-journals.org/ssy/>

## IMS-Affiliated Journals

*ALEA: Latin American Journal of Probability and*

*Statistics*: Servet Martinez

 <http://alea.impa.br/english>

*Probability and Mathematical Statistics*: K. Bogdan,

M. Musiel, J. Rosiński, W. Szczotka, & W.A. Woyczyński

 <http://www.math.uni.wroc.pl/~pms>



Le Cam lecturer Jon Wellner receives his plaque from Aad van der Vaart



Marie Davidian presents Wald lecturer Susan Murphy

# JSM Seattle in pictures



Medallion lecturer Jiashun Jin with Jon Wellner



Medallion lecturer Michael Kosorok with Mouli Banerjee



Medallion lecturer John Lafferty



A packed audience for Jon Wellner's Le Cam lecture



New IMS Fellows, left-right: Sudipto Banerjee, Douglas Nychka, Peter Guttorp, Igor Prünster, Axel Munk, Judith Rousseau, Laurent Younes, Ji Zhu, Ming Yuan, with IMS President Erwin Bolthausen



Editors' luncheon



Nicolai Meinshausen's Medallion lecture



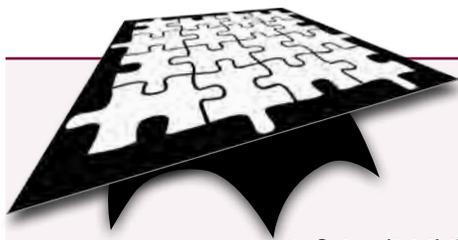
Erwin Bolthausen presented Patrick Kelly with this year's Carver Medal



Travel Award winners who came to JSM:  
Lijie Gu, Yong Chen, Thilaksha Tharanganie, Chuan Hong



The Presidents past, present and future: Erwin Bolthausen, Richard Davis, Jon Wellner



## Student Puzzle Corner 11

The *Student Puzzle Corner* contains one or two problems in statistics or probability. Sometimes, solving the problems may require a literature search.

Current student members of the IMS are invited to submit solutions electronically (to [bulletin@imstat.org](mailto:bulletin@imstat.org) with subject "Student Puzzle Corner"). The deadline is **October 20, 2015**.

The names and affiliations of (up to) the first 10 student members to submit correct solutions, and the answer to the problem, will be published in the next issue of the *Bulletin*.

The Editor's decision is final.

Infinite divisibility of Euclidean random variables and vectors has been a core theme in the theory of probability for at least sixty years. The question asked is: when can a random variable be decomposed into small independent components. Precisely, a random variable (vector)  $X$  is called infinitely divisible if for each  $n \geq 1$ ,  $X$  is equal in law to a sum of  $n$  iid variables  $X_{n1}, \dots, X_{nn}$ , with some common distribution  $F_n$ . So, obviously any Gaussian or any Poisson or any Gamma or any Cauchy random variable is infinitely divisible. An attractive characterization of infinitely divisible distributions is that the set of all possible weak limits of triangular array partial sums  $S_n = X_{n1} + \dots + X_{nn}$ , where  $X_{n1}, \dots, X_{nn}$  are iid with some common distribution  $F_n$ , coincides with the set of all infinitely divisible distributions. For example, if  $F_n$  is a Bernoulli distribution with parameter  $\frac{\lambda}{n}$ , then the partial sums  $S_n$  converge in distribution to a Poisson with mean  $\lambda$ . So all Poissons arise as weak limits of triangular array partial sums, and hence must be infinitely divisible.

What is not infinitely divisible? Although many special examples are known, what can one say generally? Random variables with a bounded support cannot be infinitely divisible; random variables whose characteristic function  $\psi(t)$  ever takes the value zero cannot be infinitely divisible. Thus, Betas cannot be infinitely divisible; interestingly, logarithms of Betas are. On the other hand, although all Gaussians, and in particular the standard normal, are infinitely divisible, fold the standard normal to  $(0, \infty)$ , and that's not infinitely divisible. Any non-normal distribution with a normal tail cannot be infinitely divisible. Normal stands at the edge of infinite divisibility in thinness of the tail.

The concept of infinite divisibility has long been extended to non-Euclidean random variables, for example, to groups with some structures, and to random sets. Primary authoritative references include work of Bondesson, Ibragimov, Steutel, Zolotarev, and the all time classic book of Feller. Infinite divisibility is an enigma; something may be infinitely divisible, and something very very similar may fail to be so.

Here is the exact problem of this issue:

**Fix  $\epsilon > 0$ . Give an example of two real valued random variables  $X, Y$ , respectively with densities  $f(x), g(x)$ , such that  $f(x), g(x) > 0$  for all real  $x$ ,  $|g(x) - f(x)| \leq \epsilon$  for all real  $x$ , and  $X$  is infinitely divisible, yet  $Y$  is not.**

## Solution to Student Puzzle Corner 10

*Bulletin* Editor Anirban DasGupta writes:

The problem asked was to settle the possibility of consistent estimation with incomplete data in three examples, and to provide a concrete one when consistent estimation is possible. Intuitively, in case (a), you can only infer about  $|\mu|$ , but not the sign of  $\mu$ .

Denote  $Y_i = |X_i|$ ; the distribution of each  $Y_i$  and hence the joint distribution of  $(Y_1, \dots, Y_n)$  depends only on  $|\mu|$ . Suppose

$c(Y_1, \dots, Y_n)$  is a consistent estimate (tor) of  $\mu$ . Fix  $\mu > 0$ . Then,  $P_\mu(c(Y_1, \dots, Y_n) < \mu/2) = P_{-\mu}(c(Y_1, \dots, Y_n) < \mu/2) \rightarrow 1$ , as  $n \rightarrow \infty$ , which would contradict  $c(Y_1, \dots, Y_n) \xrightarrow{P} \mu$  under every  $\mu$ .

In case (b), consistent estimation of  $\lambda$  is possible. This is because the family of Poisson distributions is strictly MLR in  $X$  and hence, for any  $k$ ,  $\bar{F}_k(\lambda) = P_\lambda(X > k)$  is strictly increasing in  $\lambda$ ; it is also

*The solution continues on page 7*

# New IMS Group for Junior Researchers

We are happy to announce the formation of a new committee within the IMS to create a forum for early career statisticians and probabilists. Tentatively called “j-IMS”, the group aims to bring together statisticians and probabilists in the early stages of their careers. The group’s organizers say, “Having an international forum to interact with individuals within our cohort—those who will likely be our colleagues in years to come—can greatly increase collaboration within our field. Our future plans include invited sessions for junior researchers with senior discussants, the formation of junior researchers focus groups and establishing a web presence that will facilitate interaction and collaboration.”

The fledgling group organized a mixer at JSM on Wednesday, August 12, for early-stage statisticians and probabilists who received their PhDs in the past seven years. It provided the first opportunity for an exchange of ideas and it was attended by over 50 junior researchers, along with some members of the IMS Executive Committee, who are pleased to support this group.

The Ad Hoc j-IMS committee is:

- Alexander Volfovsky (event organizer)
- Edo Airoldi (co-chair)
- Ali Shojaie (co-chair)
- Sharmodeep Bhattacharyya
- Charles Doss
- Simon Lunagomez
- Elizabeth Ogburn
- Molly Roberts
- Arman Sabbaghi
- Daniel Sussman

We’ll bring you more news of the group as plans develop, including how you can get involved. Stay tuned!



The newly-formed group organized a reception at the JSM in Seattle, which was attended by over 50 people. Alex Volfovsky addressed the group and outlined some of their intentions.



The atmosphere in the room was lively

continuous. Denote  $Y_i = I_{X_i > k}$ . Then,  $\bar{Y}$  is a consistent estimate of  $\bar{F}_k(\lambda)$ , and by the continuous mapping theorem,  $\bar{F}_k^{-1}(\bar{Y})$  is a consistent estimate of  $\lambda$ ; the estimate may be defined arbitrarily (for example, as 1), if  $\bar{Y} = 0$  or  $n$ .

Finally in case (c), perhaps a little surprisingly, consistent estimation of the exponential mean  $\lambda$  is possible as well. By a direct calculation, the fractional part  $Y = \{X\}$  has the density

$$g(y|\lambda) = \frac{1}{\lambda(1-e^{-1/\lambda})} e^{-y/\lambda}, 0 < y < 1.$$

This is a regular one parameter Exponential family and therefore the natural parameter  $-\frac{1}{\lambda}$  is consistently estimable, and so,  $\lambda$  is also consistently estimable. For example, a concrete consistent estimate can be constructed by estimating  $E_{\lambda}(Y)$ , necessarily a strictly increasing function of the natural parameter, by  $\bar{Y}$ , and then by using the inverse function.

# Meeting report: ISS in St John's, Canada

Brajendra C. Sutradhar, Memorial University, was the General Chair of the recent International Symposium in Statistics (ISS) 2015 On Advances in Parametric and Semi-parametric Analysis of Multivariate, Time Series, Spatial-temporal, and Familial-longitudinal Data. He reports:

The International Symposium in Statistics (ISS) 2015 was hosted by the Department of Mathematics and Statistics at Memorial University, and it took place in Holiday Inn, St. John's, Canada from July 6 to 8, 2015. The Institute of Mathematical Statistics (IMS) was a co-sponsor of the symposium among others. This meeting covering five specialized research themes: Multi-dimensional data analysis in continuous setup; Multivariate analysis for longitudinal categorical data; Time series with financial and environmental applications; Spatial-temporal data analysis; and Familial longitudinal data analysis in semi-parametric setup, was attended by 46 delegates from many countries such as Brazil, France, India, Switzerland, USA and Canada, covering a large part of the globe. The meeting was a grand success with an excellent academic program complemented by two social events: the symposium banquet, and a whale- and puffin-watching tour.

The symposium welcome address was given by Dr. Charmaine Dean, former President of the SSC (Statistical Society of Canada) and the current Dean of Science of the University of Western Ontario. Dr. Alwell Oyet, Deputy Head, welcomed the delegates on behalf of the host department. Dr. Brajendra Sutradhar, General Chair of the symposium welcomed all guests and provided a brief history of the past two symposiums (ISS-2009, ISS-2012) and their connection to the present symposium (ISS-2015). He thanked all sponsors, in particular to Memorial University, CANSSI (Canadian Statistical Sciences Institute), and AARMS (Atlantic Association for Research in the Mathematical Sciences) for their support in organizing this meeting.

There were four keynote speeches in four different areas given by three speakers. Professor Anthony C. Davison from EPFL, Switzerland gave his keynote address on Max-stable processes on river networks, under the theme of spatial-temporal data analysis. Professor Brajendra C. Sutradhar from Memorial University, Canada gave part 1 of his keynote presentation on Advances and challenges in correlated data analysis in non-Gaussian multivariate setup; and part 2 of the presentation on Advances and challenges in analyzing ordinal



*Alwell Oyet from Memorial University (left, with Brajendra Sutradhar) presented greetings from the department*

categorical data in semi-parametric setup. The third keynote address was given by Professor Andrew Harvey from Cambridge University, UK, on New developments in modeling dynamic volatility. Nine special invited talks over three days of the symposium were given by professors Paul D. Sampson, University of Washington; Grace Y. Yi, University of Waterloo; Nairanjana Dasgupta, Washington State University; Roman Viveros-Aguilera, McMaster University; Julio M. Singer, Universidade de Sao Paulo; David E. Tyler, Rutgers–The State University of New Jersey; Refiq Soyer, The George Washington University, Charmaine Dean, The University of Western Ontario; and Richard J. Cook, University of Waterloo.

The symposium had another two invited speakers, Drs. Alwell Oyet from Memorial University, and Ashis SenGupta from Indian Statistical Institute. Also contributed papers were presented by seven speakers including four graduate students. Thus, the goal of the symposium was well reached. Furthermore, it is planned that a selected number of papers presented in the symposium will be published in the near future as lecture notes in Springer's lecture notes series.



*Delegates at the International Symposium on Statistics*

# Putnam Mathematics Competition

Paul Shaman delves into the history of the Putnam Mathematics Competition, and some of its notable laureates. He writes:

The William Lowell Putnam Mathematics Competition is held annually. Undergraduates at schools in the US and Canada are eligible, and many of those who do well go on to have distinguished careers in the mathematical sciences and other fields. In addition to the competition between individuals, there is a team contest among schools, with three people on a team. Since 1962, the examination has involved a three-hour morning session and a three-hour afternoon session, each with six questions. The top five individual performers are designated Putnam Fellows and receive monetary awards. The top teams are also awarded monetary prizes. Originally three teams received the prizes, and later the awards were expanded to four teams, and then to the current five. Several of the Putnam Fellows went on to become Fields Medalists, and two received the Nobel Prize in Physics.

Over the history of the competition, many entrants who achieved strong performances and were on winning teams went on to become prominent statisticians and probabilists. For statisticians and probabilists, two Putnam outcomes are notable. In the February 1958 competition, three of the five Putnam Fellows subsequently became leading researchers in statistics and probability. They were David Brillinger, University of Toronto; Richard Dudley, Harvard; and Lawrence Shepp, Polytechnic Institute of Brooklyn. In addition, Edward L. Kaplan was a Putnam Fellow for three consecutive years, 1939–1941, while a student at Carnegie Institute of Technology.

Currently Putnam Fellows are awarded \$2,500; lesser amounts to other top finishers. The department of the top team is awarded \$25,000, and each team member receives \$1,000. In the February 1958 competition, these awards were \$50, \$400, and \$40, respectively.

The Putnam Competition is underwritten by a trust established by Elizabeth Lowell Putnam in her will, written in 1927, to honor her late husband, William Lowell Putnam, a member of the Harvard class of 1882 and a prominent lawyer and banker. Mrs. Putnam's intent was to sponsor intellectual competition among schools as had been advocated by her husband. After Mrs. Putnam died in 1935, her sons consulted with George David Birkhoff and Garrett Birkhoff of the Harvard Mathematics Department, both friends of the Putnam family, as to the use of her bequest. The structure of the Competition was formulated, with the Mathematical Association of America in charge of administration, and the first examination took place in 1938. With several exceptions, the examination has been given annually. There was a three-year hiatus during World War II, and two examinations were held in 1958. Now the Competition is staged on the first Saturday in December. Birkhoff (1965) and Bush (1965) describe the history of events leading to the Competition and the early years.



David Brillinger (Putnam Fellow, 1958) kindly shared this image of a special bookmark he received along with a monetary prize.

In the first eight years of the Competition, Toronto fielded the top-ranked team four times and Brooklyn College three times. Over the history of the Competition, Harvard has had the greatest number of first place team finishes, with Caltech second and MIT third. See Gallian (2004, 2014) for a detailed accounting of the Putnam results. Additional information is given in the Wikipedia article.

## Read more in the online Bulletin

Because of the restrictions on space, we have listed the tables and references in the online version of this article, at <http://bulletin.imstat.org/2015/08/putnam-mathematics-competition/>

There is information on the Putnam Fellows who became active in statistics and probability, with their undergraduate institutions and doctoral degree. (J. Arthur Greenwood earned the first doctorate awarded by Harvard's Department of Statistics.)

For each Putnam Competition, the results, including the questions and their solutions, are reported subsequently in *The American Mathematical Monthly*. In addition to the Putnam Fellows, top team performances, and those individuals receiving honorable mention and above are cited. This is also listed in the online article linked above.

# OBITUARY: Gopinath Kallianpur

## 1925–2015

GOPINATH KALLIANPUR, distinguished probabilist, passed away on February 19, 2015. He was Alumni Distinguished Professor at University of North Carolina, Chapel Hill for nearly 25 years; Professor Emeritus since retirement. He is survived by his wife Krishna, daughters Asha and Kalpana, and granddaughters Yashwina and Kashmir.

Born in Mangalore, Karnataka on April 16, 1925, Kallianpur's college education was in Trichy, Madras (now Tamilnadu). After teaching briefly in Mumbai at Wilson College, he moved to Chapel Hill for his PhD. Working in the field of stochastic processes with H. Robbins, he obtained his doctoral degree from Chapel Hill in 1951 for his work on the asymptotic behaviour of the occupation times of two dimensional Brownian paths, known as Kallianpur–Robbins law. His was one of the early theses in the then-emerging field of stochastic processes. He spent a year each at the University of California, Berkeley and the Institute of Advanced Studies, Princeton. Subsequently he was a faculty member at the Indian Statistical Institute (ISI) during 1953–56. Norbert Wiener visited ISI during this period and Kallianpur interacted with him extensively on prediction theory. This manifested later in fundamental work on non-linear filtering theory. In the 1960s, while at the University of Minnesota, Minneapolis, the Kallianpur–Striebel formula was obtained. This provides the solution to a class of important filtering problems in the form of an integral on a suitable function space, and plays a key role in the further development of the theory. This work used, for the first time, Itô's theory of stochastic integration and the Girsanov formula.

He showed, along with M. Fujisaki and H. Kunita, that under suitable conditions,

the non-linear filter satisfies an appropriate stochastic differential equation (SDE). An important special case was also derived independently by H. Kushner. These equations have come to be known as the Fujisaki–Kallianpur–Kunita (FKK) equations. The SDE of the non-linear filter is one of the first naturally arising examples of an SDE governing an infinite dimensional process.

The problem of characterizing the filter as the unique solution to the FKK (or other) equations was open for about 20 years. Kallianpur (with Abhay Bhatt and R. L. Karandikar) obtained the characterization in a very general framework using the formulation of Martingale problems. They also used the Kallianpur–Striebel formula to prove that the nonlinear filter is robust.

The classical theory of filtering that uses stochastic calculus is elegant, mathematically appealing and has provided enormous stimulus to the theory of SDE's. Using the concept of a Gaussian cylindrical measure on Hilbert spaces, Kallianpur, with R. L. Karandikar, developed a theory of white noise, rich enough to incorporate filtering theory and derived analogues of various results of the classical theory which culminated in the book *White Noise Theory of Prediction, Filtering and Smoothing*.

Inspired by R.A. Fisher's lectures at the ISI, Kallianpur and C.R. Rao introduced the concept of Fisher Consistency in the theory of statistical estimation. Kallianpur considered several other aspects of statistical estimation, like optimality properties of regular Bayes estimators, limiting distributions of Von Mises statistical functionals, asymptotic distributions of V-statistics, and estimating a two-dimensional area using line grid method. This latter work actually goes back to his stay at the ISI in the early 1950s and has its origins in ISI's crop-cutting experiments.



Gopinath Kallianpur

He returned to ISI as its Director during 1976–78 and worked relentlessly, making significant contributions to the academic and administrative functioning of the Institute. He founded the Bangalore centre of ISI.

In 1979 he was appointed Alumni Distinguished Professor at the University of North Carolina at Chapel Hill. Assisted by M.R. Leadbetter and S. Cambanis, he set up a Center for Stochastic Processes at Chapel Hill. This center provided an important avenue for significant interaction among faculty, students and a large number of distinguished visitors from all over the world, which contributed towards substantial research in the general area of stochastic processes.

Throughout his career, Kallianpur was very active in serving the scientific profession in various capacities. He served on the editorial boards of several international journals and on committees of professional societies. He was a Fellow of the IMS and the Indian National Science Academy (INSA); a member of the International Statistical Institute; he was Kolmogorov Professor (1996) of Moscow State University.

Kallianpur was a man with a sharp wit and a passion for research and learning. He was knowledgeable on world history, politics, Indian archaeology, Buddhism, Hinduism, and the western literary classics, and he was interested in music—Indian as well as western classical.

*B.V. Rao, Adjunct Professor,  
and Rajeeva L. Karandikar, Director,  
both from Chennai Mathematical Institute*

# OBITUARY: Gunnar Kulldorff

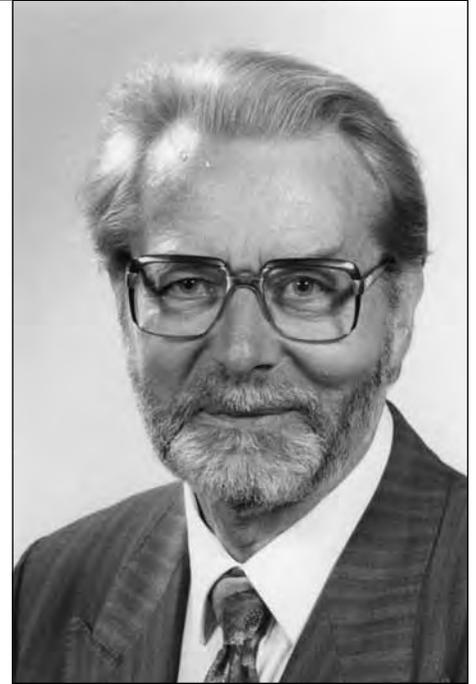
## 1928–2015

GUNNAR KULLDORFF, a Fellow and long time member of IMS, passed away in Umeå, Sweden, on June 25, 2015. Gunnar was born in Malmö, Sweden, in 1928. He studied at Lund University and obtained his PhD in 1961. His dissertation, on the topic *Contributions to the Theory of Estimation from Grouped and Partially Grouped Samples*, under the supervision of Professor Carl-Erik Quensel, was a fine piece of scholarly work.

In 1965 Gunnar became one of the first professors at the newly established University of Umeå, and soon thereafter he was elected the Dean of the School of Science. Later—twice—he became the President of the Swedish Statistical Association, and in 1989–91, he was the President of the International Statistical Institute. After the

fall of the Soviet Union, Gunnar worked tirelessly to establish Statistical Science in the Baltic States, and in 2006 Gunnar was bestowed an honorary doctorate from Vilnius University.

Gunnar's numerous papers on optimum combinations of selected order statistics from various well known parametric distributions to draw inference on population parameters will long be remembered for their novelty and usefulness. Gunnar's last article, 'Statistical Science is International—And Survey Statistics is Cool and Hot', published in *Lithuanian Journal of Statistics* in 2014, presents a very interesting history of international cooperation in statistics, the formation of statistical associations and their activities in the world and in the Nordic countries.



Gunnar Kulldorff

*Written by Peter Jagers, Chalmers and the University of Gothenburg, and Bimal Sinha, UMBC*

## Wolfgang Doeblin Prize

### *for Outstanding Research in Probability*

The Bernoulli Society for Mathematical Statistics and Probability welcomes nominations for the third *Wolfgang Doeblin Prize* to be awarded at the 9<sup>th</sup> World Congress of Probability and Statistics, Toronto, in July 2016 (<http://www.fields.utoronto.ca/programs/scientific/16-17/WC2016/index.html>).

The Wolfgang Doeblin Prize was founded in 2011. It is awarded bi-annually to a single individual for outstanding research in the field of probability theory, and who is at the beginning of his or her mathematical career.

The Wolfgang Doeblin Prize is generously sponsored by Springer. The awardee will be invited to submit to the journal *Probability Theory and Related Fields* (<http://www.springer.com/mathematics/probability/journal/440>) a paper for publication as the Wolfgang Doeblin Prize Article, and will also be invited to present the Doeblin Prize Lecture at the Ninth Bernoulli World Congress (Toronto, July 11–15, 2016) [*which is also the next IMS Annual Meeting—Ed*], or at a later Conference on Stochastic Processes and their Applications.

Detailed information about the *Wolfgang Doeblin Prize*, the Prize Committee and earlier awardees can be found at the Bernoulli Society website, <http://www.bernoulli-society.org/index.php/prizes?id=158>.

Each nomination should offer a brief case in support and should be sent to the chair of the prize committee, Bálint Tóth, at [balint.toth@bristol.ac.uk](mailto:balint.toth@bristol.ac.uk) by **30 November 2015**.



**Bernoulli Society**  
for Mathematical Statistics  
and Probability

# Recent papers

## *Annals of Probability* Volume 43, number 4: July 2015

The *Annals of Probability* publishes research papers in modern probability theory, its relations to other areas of mathematics, and its applications in the physical and biological sciences. Emphasis is on importance, interest, and originality—formal novelty and correctness are not sufficient for publication. The *Annals* will also publish authoritative review papers and surveys of areas in vigorous development. The editor is Maria Eulalia Vares (from 2015–2017).

Access papers at <http://projecteuclid.org/aop>

Multiple points of the Brownian sheet in critical dimensions . . . . .	ROBERT C. DALANG AND CARL MUELLER; 1577 - 1593
Quenched invariance principles for random walks and elliptic diffusions in random media with boundary . . . . .	ZHEN-QING CHEN, DAVID A. CROYDON, AND TAKASHI KUMAGAI; 1594 - 1642
The shape of a random affine Weyl group element and random core partitions . . . . .	THOMAS LAM; 1643 - 1662
Spectral gap for stochastic energy exchange model with nonuniformly positive rate function . . . . .	MAKIKO SASADA; 1663 - 1711
Integral identity and measure estimates for stationary Fokker–Planck equations . . . . .	WEN HUANG, MIN JI, ZHENXIN LIU, AND YINGFEI YI; 1712 - 1730
Percolation and disorder-resistance in cellular automata . . . . .	JANKO GRAVNER AND ALEXANDER E. HOLROYD; 1731 - 1776
On a functional contraction method . . . . .	RALPH NEININGER AND HENNING SULZBACH; 1777 - 1822
Feynman–Kac representation for Hamilton–Jacobi–Bellman IPDE . . . . .	IDRIS KHARROUBI AND HUỖN PHAM; 1823 - 1865
Invariance principle for the random conductance model in a degenerate ergodic environment . . . . .	SEBASTIAN ANDRES, JEAN-DOMINIQUE DEUSCHEL, AND MARTIN SLOWIK; 1866 - 1891
Branching random tessellations with interaction: A thermodynamic view . . . . .	HANS-OTTO GEORGII, TOMASZ SCHREIBER, AND CHRISTOPH THÄLE; 1892 - 1943
Nonlinear noise excitation of intermittent stochastic PDEs and the topology of LCA groups . . . . .	DAVAR KHOSHNEVISAN AND KUNWOO KIM; 1944 - 1991
A Hsu–Robbins–Erdős strong law in first-passage percolation . . . . .	DANIEL AHLBERG; 1992 - 2025
2D Coulomb gases and the renormalized energy . . . . .	ETIENNE SANDIER AND SYLVIA SERFATY; 2026 - 2083
Diffusion-limited aggregation on the hyperbolic plane . . . . .	RONEN ELDAN; 2084 - 2118
Subordination for the sum of two random matrices . . . . .	V. KARGIN; 2119 - 2150
Zero-temperature limit of the Kawasaki dynamics for the Ising lattice gas in a large two-dimensional torus . . . . .	B. GOIS AND C. LANDIM; 2151 - 2203

## *Annals of Applied Probability* Volume 25, no 5: October 2015

The *Annals of Applied Probability* aims to publish research of the highest quality reflecting the varied facets of contemporary Applied Probability. Primary emphasis is placed on importance and originality. The editor (2013 to 2015) is Timo Seppäläinen.

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# Presidential Address: Erwin Bolthausen

## *Some thoughts about the relations between statistics and probability theory*

Erwin Bolthausen, University of Zürich and Kyoto University

If one opens any scientific work about a topic where statistics plays a role, there are usually probabilistic concepts behind. How does it then come that probability theory and statistics, in research, have become more and more separated? The answer is to some extent evident:

- Probability theory has nowadays many relations with other mathematical fields, and also with applied fields outside statistics.
- For modern statistics, probability is just *one* crucial basis, but there are many more, often also non-mathematical ones. For instance, one has to decide which probabilistic models lead to computational feasible procedures, and still mirror the reality close enough. This cannot be answered by probability theory.

Nonetheless, I would argue that the separation of the fields has become deeper than healthy, and furthermore, IMS should be more active to bridge the gap.

When I started as IMS President-elect two years ago, I became fully aware how far statistics and probability had moved apart in research, and that the scientific communication between the groups—also within IMS—is reduced to a trickle. Of course, I already knew that this interaction had become weaker over the years. For instance, until about 30 years ago, there was every year a joint statistics-probability meeting in Oberwolfach, on a theme of common interest, and I attended them for many years. That was going on till the mid eighties, and then Oberwolfach stopped them. Such type of conferences still exist, but at least in Oberwolfach or in Banff, they have become very rare. The Joint Statistical Meetings which are the main meetings for the IMS in odd years have no longer any probability sections.

I am far from blaming just the statisticians. There is also a declining interest of probabilists in statistics. The big majority of them, at least in Europe, knows nothing about statistics, except perhaps least squares which they might have learned in the basic linear algebra course.

I think that in the modern development of probability, the relations with pure mathematics and with mathematical physics have become stronger than those with statistics. Many probabilists, including me, have found the problems from mathematical physics very appealing. Parallel to it developed also closer connections with other mathematical fields, like algebra, matrix theory, representation theory, complex analysis, differential geometry, to name only a few. The relations with differential equations had always been very close. Probability theory is now much more present than 20 years ago in pure mathematical institutions, like the Ecole Normale Supérieure,

the elite school in France, where some of the scientific directors of the mathematics school in the last decades were probabilists. It is also much more present at the International Congresses of Mathematics.

The lack of communication will create problems for IMS. For instance, we certainly don't want to have fixed quota in the form: So many IMS fellows selected have to be probabilists, and so many statisticians. If we don't want that, there has to be a rational discussion inside the committee, and a mutual basis of understanding. This would mean that the committee members should ideally have some view of the whole field, but it has become fairly difficult to find such people. Also, if young probabilists are not joining IMS, then we have on the long run a problem with handling the probability journals, like filling committees for choosing the editors.

I would now like to present and shortly discuss some of the most interesting recent developments in probability theory, with a personal bias of course, and give comments about their (possible) relations with statistics. But to put up the historic perspective, first a view back in time.

It is actually not so well known that Bernoulli's law of large numbers, was motivated by thoughts of a statistical nature. This is only marginally present in the posthumously published "Ars conjectandi" but it is revealed in an exchange of letters, Bernoulli had with Leibniz in 1703, two years before he died, and which I found extraordinary interesting. Bernoulli thought of using the LLN as a foundation to obtain through repeated measurements better and better approximations for unknown probabilities, and compares the problem with the possibility to approximate  $\pi$ . Although he was very proud of his mathematical proof of the LLN, he writes to Leibniz that every fool would anyway know the truth of it, and that his *main* aim is to apply it to real world problems like estimating "true" survival probabilities. He probably didn't have a precise concept of confidence intervals, but it is also clear from his letter that he was thinking intensively about this. He however died before he could further develop his ideas. Leibniz was actually not at all convinced of the concept.

A century later, much of probability theory was still motivated by statistical considerations. The method of least squares, invented independently by Gauss and Legendre, entered the scientific world with a spectacular success, namely the prediction of Gauss of the position of Ceres.

Some of the 20th century probability theory has of course very close connections with statistics, for instance branching processes,

*Continues on page 14*

# Presidential Address continued

measure valued processes, and coalescent processes, which are still very much alive today, and which play a fundamental role in biostatistics. Then Markov processes with many applications in statistics and computer science, and empirical process theory with its motivation from goodness-of-fit and other statistical problems.

The most recent and perhaps most spectacular, developments in probability theory are however only very loosely connected with statistics, if at all, and were barely motivated by statistical questions. I discuss shortly some of the main themes in modern probability theory: a personally biased selection, with a view towards applications.

## Stochastic analysis and martingale theory:

This had many applied sources, finance mathematics (Bachelier), games and insurance. There are close relations with other mathematical fields, mainly harmonic analysis, partial differential equations, differential geometry, and others. Today, it plays a huge role in finance mathematics.

A recent and most powerful progress came through the **rough path theory** initiated by Terry Lyons. It is basically a deterministic theory. One of the main achievements is that one can write solutions of SDEs as continuous deterministic functionals of the Brownian path on an enlarged path space. The key point is an extension of the path space by the “signature” which comes from iterated integrals. On the enlarged space, with an appropriate topology, the solutions of the SDE are smooth functionals. This has now found wide applications, also in statistics, and machine learning, with some quite spectacular successes. For instance, Benjamin Graham did win a competition about automatic Chinese character identification with a method based on rough paths. Rough paths are now also heavily used in finance mathematics.

This was very recently pushed much further by the **regularity structures** of Martin Hairer for which he obtained the Fields Medal 2014, which make sense of ill posed stochastic PDEs that have solutions only after renormalization by infinite “counterterms”. An example is the KPZ equation:

$$\delta_t h = \delta_x^2 h + (\delta_x h)^2 + \text{white noise.}$$

The white noise is in space–time. This equation does not make sense as it stands because  $h$  has to be a distribution, and one cannot square a distribution. The basic idea for the renormalization is coming from quantum field theory. There is presently a lot of interest in the so called KPZ-universality class which encompasses models, some from experimental physics, for which the scaling limits are described by the KPZ equation.

## Random media and spin glasses.

This is mainly motivated by mathematical physics. Spin glasses are interacting systems like the Ising model with “disordered” meaning random interactions. There are many fields in random media outside spin glasses, for instance percolation, random walk in random environments and others.

The non-rigorous physicists picture of mean-field spin glasses like the SK model predicts a spectacular mathematical structure with an infinite-dimensional hierarchical “symmetry breaking” going back to Giorgio Parisi. There are important recent advances in a mathematical understanding, by Talagrand, Guerra, Panchenko, and others, but many of the aspects are still poorly understood. The theory has found many applications, for instance in:

- Theoretical computer science where some ideas were leading to very efficient algorithms.
- Combinatorial optimization, like the Traveling Salesperson Problem, assignment problems and others.
- Coding theory
- Most recently: Statistics. More on that a bit later.

## Spectral properties of large random matrices.

The motivation came from quantum mechanics. Eugene Wigner had the idea that spectra of large atoms could be modeled by random Hamiltonian matrices. This is a very active field connected with some of the most challenging open problems in mathematical physics and in pure mathematics.

A spectacular achievement was the proof of the Tracy–Widom limit distributions for the law of the largest eigenvalues. This is closely connected with the KPZ equation, and I believe that it must be of interest in statistics.

Random matrices are strongly related to algebra (free probability), representation theory and number theory. Some of the results on random matrices (proved by John Keating and coauthors) lead to conjectures about the Riemann Zeta function which go beyond the Riemann Hypothesis.

## Schramm–Löwner-evolution equations and two-dimensional random geometry problems.

This is about two-dimensional models from statistical physics at criticality, like percolation, self-avoiding random walks, the Ising model, and others. The basic mathematical construction to attack these problems was invented by Oded Schramm, who tragically died in an mountain accident near Seattle.

The topic led to the first two Fields Medals for probabilists:

Wendelin Werner and Stas Smirnov. It is one of the most active fields in probability theory presently.

Let me now briefly discuss a particular example which I found very striking and which reveals a close connection of modern (21st-century) regression analysis and compressed sensing with problems which arose from spin glass theory and neural nets. I like it, as I was marginally involved in it.

The statistical side I learned from a survey article by Donoho and Tanner and a recent article by Bayati, Lelarge and Montanari which appeared in 2015 in the *Annals of Applied Probability*.

Take a linear regression:

$$Y_i = \sum_{j=1}^p X_{ij} \beta_j + Z_i, \quad i=1, \dots, n$$

$\beta_j$  being the regression parameters, and  $Z$  the noise, in the situation which Donoho calls the 21st century setting, namely when  $n < p$ , which is opposite to the classical Gauss–Legendre setup.

However, only a part of the parameters are relevant that is, one has a sparsity assumption:

$$k := \#\{j : \beta_j \neq 0\} < n, \quad (1)$$

but one does not know which ones, of course.

The first question is about **identification**: Given a matrix  $(X_{ij})$ , and  $(\beta_j)$  sparse, satisfying the equation

$$y_i = \sum_{j=1}^p X_{ij} \beta_j, \quad i=1, \dots, n,$$

is it possible to identify the  $\beta_j$  from  $(y_i)$  and  $(X_{ij})$  by

$$\beta = \arg \min \left\{ \sum_j |\beta_j| : y = X\beta \right\}.$$

That depends, of course, very much on the matrix  $X$ , and therefore one chooses a probabilistic formulation: Given a “typical” matrix  $(X_{ij})$ , where “typical” has to be specified, is it true that for most  $(\beta_j)$  with satisfying (1) the answer is “yes”?

It can then be phrased as a problem on **random convex polytopes**. Given the  $\ell_1$  unit ball  $C$  in  $\mathbb{R}^p$ , map it with a random matrix  $X$  to the random convex polytope  $XC \subset \mathbb{R}^n$ : Has this convex polytope with high probability the property that the convex hull of  $k$  nodes, with no antipodal pairs, is a  $k-1$ -dimensional face of the polytope, for *most choices* of the set of  $k$  nodes? Donoho proved that if  $X$  has i.i.d. standard Gaussian entries, then the answer is “yes”, for large  $k, n, p$ , provided  $\delta := k/n$  is below a critical value  $\delta^*(n/p) \in (0,1)$  given by a semi-explicit formula. Donoho and Tanner showed by extensive computer simulations that there is universality in the sense that the distribution of  $X$  is not important, and they conjectured that such universality holds as  $k, n, p \rightarrow \infty$  with quotients fixed. Bayati et al finally proved this conjecture in somewhat restricted cases in a difficult 70-page paper.

In the geometric formulation, the problem fairly evidently has



**close connections with spin glass theory.** There is a first random object, namely the random polytope, and then one asks probabilistic questions about this random object. It turns out, that there are close similarities with problems around the Thouless–Anderson–Palmer equations in spin glass theory. Bayati et al use a (complicated) variant of an iterative procedure for the TAP equation used by me for the Sherrington–Kirkpatrick model in a paper which appeared last year in *CMP*.

One may question whether this is a good example. After all, the fact that there is universality had been checked by Donoho and Tanner on the basis of extensive simulations, and the Bayati et al result still has restrictions on the choice of the  $X_{ij}$ . This after a complicated and compact proof of 70 pages. Still, in my view, it opens an understanding which would be impossible to gain just by computer simulations, but that’s of course the view of a mathematician which may not be shared by many applied statisticians.

This is just a very special example, and I presented it only because my special interest in it. In my view, however, it however shows how much both sides can learn from each other if we take the time to pay attention to what the others are doing, and if there are opportunities for both sides to meet.

Overall, I think IMS would be the society to support interactions and communications, and I think it is important for us in the long run, unless IMS wants to chip off the probability side. To a large extent, the interactions have to come bottom-up, through scientists organizing workshops and meetings, and asking for support. That is happening to some extent. On the other hand, I think it would good to become more active from the side of the society, in order to keep some coherence.

# What is the core of Data Science?

David Dunson, Arts and Sciences Professor of Statistical Science at Duke University, writes:

*What is the core of data science?* To address this, I think it is necessary to first touch on the question of what *is* data science? Certainly there is not one agreed upon definition of what data science is, exactly. At Duke we had a recent search for an open rank data science faculty position, and we received extremely disparate applicants, ranging from theoretically focused researchers studying properties of machine learning algorithms to optimization experts to image processors to applied mathematicians interested in large scale applications in neurosciences and power grid optimization. The field of the PhD degree for these applicants varied extremely widely, including, but not limited to, statistics, computer science, mathematics, electrical engineering and physics. I received candidates with similarly varied backgrounds when I recently advertised for a “Bayesian data science” postdoctoral fellow.

The consensus that we came up with in our search and my own view is that a data scientist is an individual who is driven primarily by the application and uses whatever statistical, computational and algorithmic tools they can come up to develop new knowledge and insights in that application area. If the field of study is an area of science (eg., neuroscience, genomics) then the data scientist is a full-fledged scientist in their corresponding area, but instead of collecting new data in their labs they exploit existing large, complex and disparate data sources to obtain new scientific insights.

Given this view of data science, it is not at all surprising that the rise of data science has ended up blurring disciplines and attracting individuals with highly disparate backgrounds in the mathematical sciences (broadly defined). Many view this as a threat to statistics as a discipline. Increasingly, the caricature of a statistician is a reserved, conservatively thinking stickler for foundations

and theoretical support, who is so slowed down by their own principles that they study toy algorithms that aren’t useful in real world large scale applications. Meanwhile the hip and cool machine learning types charge ahead in creatively developing wild new algorithms and approaches and diving right into big exciting applications. Then, not surprisingly, the lion’s share of the increasing research dollars associated with data science topics goes to the latter group. These stereotypes, which have a seed of underlying truth to them, should serve as a wake up call to statisticians to make their work more relevant to modern applications.

The over-arching motivation for organizing this conference [*the IMS-Microsoft Research workshop on Foundations of Data Science—see the interview with the other organizers on the following pages*], and for hopefully kick-starting an IMS group focused on this topic, is to bring together leaders in different aspects of data science to move towards establishing the foundations of data science. Classical statistical theory, methods and principles are increasingly not relevant in modern data science problems and new foundations need to be established, going well beyond statistical theory for large  $p$ , small  $n$  problems.

There are several directions to take in closing the gulf between statistical foundations and data science practice. One is to have mathematical statisticians become more seriously engaged in understanding why highly successful algorithms, such as deep learning, have such good behavior. This is a type of top-down approach. The other is to become more cognizant and seriously engaged in what successful data scientists are actually doing in terms of the process of obtaining the data to analyze, reducing dimension, doing many analyses, reporting and summarizing the results, etc. Then, attempt to develop a

realistic statistical formalism for establishing optimality and other properties, taking into account more of the pipeline including computational time, storage, etc.

My own view is that the data science revolution has been extremely intellectually stimulating and exciting. In a very short time, it has had the impact of dramatically reducing siloing of data scientists based on their PhD field and department affiliation. For many years, different communities proceeded independently working on essentially identical problems, but with different notation, publication outlets and perspectives. Mostly these communities were unaware of each other even when working on exactly the same problems. This has shifted dramatically, partly due to the growing tendency to establish interdisciplinary big data and data science centers or institutes. For example, at Duke we have the “Information Initiative at Duke” (IID), which has wonderful dedicated space, a core faculty having PhDs and primary department affiliations in many different fields, vibrant seminar series, and great cross-talk between research groups at all levels including undergraduates. I have grown to enjoy the “data seminar” organized by a topologist and focusing on cool math-y stuff people do with data more than our regular statistics seminars. I’m more likely to see new intellectually stimulating ideas that will deeply impact my work, while there isn’t as much surprising to me in a usual statistics seminar after 20+ years in the field. This has definitely improved the quality of my work, and I’m hoping efforts, such as the Foundations of Data Science conference, will similarly stimulate others.

Got something to say?

Post a comment on the Bulletin website:  
<http://bulletin.imstat.org>



# Data Science Conference: an interview

On June 11–12, 2015, the IMS-Microsoft Research workshop Foundations of Data Science brought together parallel communities of statisticians and machine learning researchers to discuss various problems that have both statistical and computational aspects. The organizers **Jennifer Chayes** from Microsoft Research, former IMS president **Bin Yu** from UC Berkeley Statistics Department, **Sham Kakade** from Microsoft Research, and **Rafael Irizarry** from Dana-Farber Cancer Institute were interviewed by **Karl Rohe** from UW-Madison Statistics Department via teleconference on July 24. This transcript has been edited for clarification and brevity.

David Dunson also helped organize the conference, but he was unable to join the teleconference. His essay (on page 16) was written before this interview.

**Karl Rohe:** Why did you organize this conference?

**Jennifer Chayes:** One of the reasons for setting up this conference is that we felt machine learning people should be more involved in statistics, and statistics people should be more involved in machine learning.

**Bin Yu:** We wanted to show the younger generation of statisticians that a lot of work is being done at the intersection of these areas.

**Chayes:** Data science covers a wide breadth of challenges. These challenges have both statistical and computation aspects. These two fields provide complementary approaches to these problems.

**Yu:** We want to integrate these two fields.

**Chayes:** Right! You need both of them to address all of these data science questions.

**Yu:** IMS wants to facilitate this foundational work. The next step is to organize a data science group to host the next conference.

**Chayes:** That would be great!

**Rohe:** To give a flavor of the conference, what were some of the talks about?

**Sham Kakade:** Axel Munk's session on super-resolution imaging had some really cool stuff. For example, Victor Panaretos spoke about functional data analysis of DNA molecular dynamics. There was also a lot of cool computational social science stuff. Sharad Goel analyzed over three million stops by New York City police officers to investigate racial disparities.

There were also numerous talks from physicists.

**Rohe:** Do you have any advice for people who are interested in data science?

**Yu:** They have to be quantitative already...

**Chayes:** And people can be quantitative in many ways. Expose yourself to the richness of the kinds of problems that are addressed in data science and the breadth of techniques that can be brought to bear. Whatever a researcher is doing, there are things that they can do to contribute to data science. Expose yourself to the breadth of this so that you can say to yourself, "Wow, I can do this."

**Yu:** Also, research is always human-centered. You need to make the right connections. You can go to conferences, you can organize webinar meetings, you can have blogs, there are many ways, but it is people coming together. We are forging data science together. It is not like it is already made and you should learn it. This is really an invitation, *let's do data science!* Let's invent data science together! Whatever you can bring to the table.

**Chayes:** You need to get out there and meet people!

**Yu:** Yeah! For me, research is always social.

**Chayes:** This is true in all areas of research. I do think that one of the nice things about data science, and one of the things that was inherent in the workshop, is the breadth of the communities. If you've been doing statistical biology, it doesn't

mean that you can't be doing statistical environmental science. A lot of the techniques apply across multiple application areas.

**Yu:** That is the essence of statistics. Statistics is always the hub of ideas and you can transport and learn. That is why you have a field. Data science is playing that role too. I don't think we need to worry too much about "Statistics vs Data Science"—the important thing is to get real problems solved, alone or together.

**Chayes:** Data science does have computational aspects that were not at the fore in statistics. As the data sets have gotten larger, the computational questions have entered more profoundly than they did in the past.

**Yu:** Computation has always been essential to statistics. The motivation for the Hollerith Tabulating Machine arose from the 1890 US Census. It was developed by a statistician and inventor. In 1911, his company merged with three others to form a company that we now call IBM. I discussed in my [2014] IMS Presidential Address (<http://bulletin.imstat.org/2014/10/ims-presidential-address-let-us-own-data-science/>). For me, the role of computation is a key part of statistics. Statistics has to address computational challenges.

**Chayes:** Statistics is not going to be useful if it is computationally inefficient.

*Continues on page 18*

# Data Science Conference interview continued

**Rohe:** Do you think there is a difference between data science and statistics?

**Yu:** Defining the difference between data science and statistics will make things really difficult right now since we are defining data science as we engage and solve data problems.

**Chayes:** A key point is that the people from machine learning and people from statistics are already starting to form a vibrant and joint community. Right?

**Yu:** Yes. Yes. Intellectually, statistics and machine learning have much overlap as academic fields and some (like me) think machine learning represents recent development in statistics, but individual people are more clearly defined. I'm in a statistics department and you [Jennifer] are in a machine learning department, but we do many similar things.

**Chayes:** What we had hoped was to encourage statisticians and machine learning

people to start reaching out beyond the boundaries of their departments, their fields, their journals, and collaborating more extensively with each other on this wide breadth of application areas.

**Yu:** The conference took steps in this direction. Statisticians need to continue reaching out.

**Chayes:** The conference was just the beginning for both communities. What we really want is for people to be reaching out between these two communities because the questions that arise in data science are being addressed simultaneously by these two communities with complementary skill sets of techniques. They should be working with each other more.

**Yu:** I agree. We have a lot to learn from each other and we have a lot to be gained from working together to forge the next frontier.

**Rohe:** Rafael, is there anything that you would like to add?

**Rafael Irizarry:** I agree with what has been said in this previous discussion. One point that has been missing is that there is often a disconnect between theory and applications. Sometimes the theory that is being developed is not necessarily targeting, as specifically as it could, the problems that are currently being faced by people who have data problems.

**Yu:** That is an excellent point. We need more of a dialogue between the theoretical and applied communities. Working with domain experts is a key part as well.

**Irizarry:** One of the things that is also missing of people who claim to do data science is an understanding of theory! So, I think it goes both ways.

**Rohe:** Thanks to Jennifer, Bin, Sham and Rafael for sharing your thoughts.

## NISS Distinguished Service Awards

Dr. John Eltinge and Jamie Nunnally were the recipients of the 2015 Distinguished Service Awards from the National Institute of Statistical Sciences (NISS). Nell Sedransk, Acting Director of NISS, announced the awards on August 10, 2015 at the NISS/SAMSI (Statistical and Applied Mathematical Sciences Institute) reception held at the 2015 Joint Statistical Meetings in Seattle Washington. The NISS Distinguished Service Awards were established by the Board of Trustees in 2005 to recognize individuals who have given extraordinary service that significantly advances NISS and its mission.

Eltinge, who is Associate Commissioner for Office of Survey Methods Research for the United States Bureau of Labor Statistics, received the award for bringing insight and implementing the vision for NISS as a multi-sector institute, especially through his leadership in the Affiliates Program. Before joining the Bureau of Labor Statistics, Eltinge served as an Associate Professor with tenure in the Department of Statistics at Texas A&M University, specializing in sample design, survey nonresponse, measurement error, small domain estimation, quantile estimation and time series analysis. From June, 1999 to January, 2004, he served as the Senior Mathematical Statistician in the BLS Office of Survey Methods Research. He is a Fellow of the American Statistical Association; a member of the Federal Committee on Statistical Methodology; an Associate Editor for Survey Methodology and Journal of Official Statistics; and a former Associate Editor for Journal of the American Statistical Association and The American Statistician. He received a PhD in Statistics from Iowa State University; an M.S. in Statistics from Purdue University; and a B.S. in Mathematics from Vanderbilt University.

Nunnally, who is Communications Director for NISS and the Statistical and Applied Mathematical Sciences Institute (SAMSI), received the award for her role in dramatically increasing the visibility of NISS, for engaging the next generation of statisticians in NISS and for modernizing NISS communications, especially through design of the new website.

# IMS meetings around the world

## Joint Statistical Meetings: 2016–2020

IMS co-sponsored meeting

**JSM 2016**

**July 30–August 4, 2016**

**Chicago, IL**

[w http://amstat.org/meetings/jsm/2016](http://amstat.org/meetings/jsm/2016)

This is a final call for high quality invited session proposals sponsored by the IMS for the 2016 Joint Statistical Meetings (JSM) to be held July 30–August 4, 2016 in Chicago. Keep in mind that the selection of invited session proposals is a competitive process due to the limited amount of invited sessions.

The theme of JSM 2016 is “The Extraordinary Power of Statistics” but sessions need not necessarily adhere to this theme. Sessions are 110 minutes in length and can take a variety of formats. Please reference the article “JSM 2016 Invited Session Proposals Sought” for details (<http://magazine.amstat.org/blog/2015/07/01/jsm-2016-invited-session-proposals-sought/>). Traditionally, IMS has favored invited sessions with four speakers, or three speakers and discussant. The ideal session involves fresh, important work that many JSM attendees will find interesting. Many of the most stimulating sessions present diverse viewpoints and strategies on a common topic, with speakers coming from different institutions and taking different approaches toward similar problems.

The deadline for submitting invited session proposals is 11:59pm EST on **Thursday, September 3, 2015**. All proposals must be submitted via the online system (<http://www.amstat.org/meetings/jsm/2016/invitedsessions/>) by the due date.

We look forward to your proposals!

*Final call: invited  
session proposals*



IMS sponsored meetings: JSM dates for 2017–2021

<b>IMS Annual Meeting</b> <b>@ JSM 2017:</b> <b>July 29–August 3,</b> <b>2017, Baltimore, MD</b>	<b>JSM 2018</b> <b>July 28–August 2,</b> <b>2018</b> <b>Vancouver, Canada</b>	<b>IMS Annual Meeting</b> <b>@ JSM 2019</b> <b>July 27–August 1,</b> <b>2019, Denver, CO</b>	<b>JSM 2020</b> <b>August 1–6, 2020</b> <b>Philadelphia, PA</b>	<b>IMS Annual Meeting</b> <b>@ JSM 2021</b> <b>August 7–12, 2021,</b> <b>Seattle, WA</b>
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IMS co-sponsored meeting

**The 10th ICSA International Conference**

**December 19–22, 2016**

**Shanghai Jiao Tong University, Shanghai, China**

IMS Rep: Ming Yuan, University of Wisconsin–Madison

[w http://www.math.sjtu.edu.cn/conference/2016icsa/](http://www.math.sjtu.edu.cn/conference/2016icsa/)

The tenth ICSA international conference will be held at Xuhui campus of Shanghai Jiao Tong University in China. The theme is

*Global Growth of Modern Statistics in the 21st Century*. The International Chinese Statistical Association (ICSA) is a non-profit organization, established in 1987, with the aim of promoting the theory and applications of statistical disciplines through scholarly activities, including publication of journals in statistics and probability, scientific meetings, and other educational programs. The plenary speakers are: Jim Berger, Tony Cai, Kai-Tai Fang, Zhiming Ma, Marc A. Suchard, Lee-Jen Wei and C.F. Jeff Wu.



### At a glance:

*forthcoming  
IMS Annual  
Meeting and  
JSM dates*

### 2015

**IMS Annual Meeting**  
**@ JSM: Seattle, WA,**  
**August 8–13, 2015**

### 2016

**IMS Annual Meeting/  
9th World Congress:**  
Toronto, Canada,  
July 11–15, 2016

**JSM: Chicago, IL,**  
**July 30 – August 4,**  
**2016**

### 2017

**IMS Annual Meeting**  
**@ JSM: Baltimore,**  
MD, July 29 –  
August 3, 2017

### 2018

**IMS Annual Meeting:**  
TBD  
**JSM: Vancouver,**  
Canada, July 28–  
August 2, 2018

### 2019

**IMS Annual Meeting**  
**@ JSM: Denver, CO,**  
July 27–August 1,  
2019

# More IMS meetings around the world

IMS co-sponsored meeting

## WNAR Annual Meeting in conjunction with the XXVIII International Biometric Conference

July 10–15, 2016

Victoria, BC, Canada

<http://biometricconference.org/conference-information/>

The next WNAR Annual Meeting, in conjunction with the XXVIII International Biometric Conference (IBC2016), will be held July 10–15, 2016 at the Victoria Conference Centre in Victoria, British Columbia, Canada.

A list of invited sessions is at <http://biometricconference.org/invited-sessions/>. There will also be four full day short courses: *Analysis of life history data with multistate models* (Richard Cook and Jerry Lawless); *An introduction to the joint modelling of longitudinal and survival data* (Dimitris Rizopoulos); *A statistical approach to machine learning* (Andreas Ziegler and Marvin Wright); and *Design of complex experiments* (Andrew Mead and Steven Gilmour).

Registration will open later this year.

NEW

IMS co-sponsored meeting

## UK Easter Probability Meeting 2016: Random Structures Arising in Physics and Analysis

April 4–8, 2016

Lancaster University, UK

<http://www.lancaster.ac.uk/math/easter-probability-meeting/>

Lancaster University, UK, is hosting the UK Easter Probability Meeting 2016, on “Random Structures Arising in Physics and Analysis”. The meeting will take place from April 4–8, 2016. The UK Easter Probability Meeting is a long-standing tradition that brings together the UK probability community. The aim is to discuss recent developments, to speak about future research and also to give PhD students an opportunity to become part of the UK probability community. The 2016 meeting in Lancaster consists of four mini-courses of three lectures each, given by leading international researchers on current topics in probability theory. The remaining time is reserved for 45 minute talks by invited speakers, shorter talks by PhD students, a poster session and time for discussions.

NEW

### IMS Textbook:

## Noise Sensitivity of Boolean Functions and Percolation

Christophe Garban (ENS Lyon) and Jeffrey E. Steif (Chalmers)

Hardback ~~\$99.00~~ IMS member price **\$59.40** Paperback ~~\$34.99~~ IMS member price **\$20.99**

This is a graduate-level introduction to the theory of Boolean functions, an exciting area lying on the border of probability theory, discrete mathematics, analysis, and theoretical computer science. Certain functions are highly sensitive to noise; this can be seen via Fourier analysis on the hypercube. The key model analyzed in depth is critical percolation on the hexagonal lattice. For this model, the critical exponents, previously determined using the now-famous Schramm–Loewner evolution, appear here in the study of sensitivity behavior. Even for this relatively simple model, beyond the Fourier-analytic set-up, there are three crucially important but distinct approaches: hypercontractivity of operators, connections to randomized algorithms, and viewing the spectrum as a random Cantor set. This book assumes a basic background in probability theory and integration theory. Each chapter ends with exercises, some straightforward, some challenging.

*“Presented in an orderly, accessible manner, this book elegantly integrates the general theory of noise sensitivity into a concrete study, allowing for a new understanding of the percolation process. It provides an excellent and clear exposition of the general theory of noise sensitivity and its manifestation in two-dimensional critical percolation.”* Itai Benjamini

Order at [www.cambridge.org/ims](http://www.cambridge.org/ims)  
with your 40% members' discount

### Seminar on Stochastic Processes (SSP) 2016 March 16–19, 2016

University of Maryland, College Park, MD

[http://depts.washington.edu/ssproc/ssp\\_nextssp.php](http://depts.washington.edu/ssproc/ssp_nextssp.php)

The Seminar on Stochastic Processes (SSP) in 2016 will be held from Wednesday, March 16, through Saturday, March 19. It will be hosted by the University of Maryland.

The local organizers will be Sandra Cerrai, Dmitry Dolgopyat, Mark Freidlin and Leonid Korolov. The invited speakers will be

- Claudio Landim (*Kai Lai Chung Lecturer*)
- Louigi Addario-Berry
- Yuri Bakhtin
- Yimin Xiao
- Thaleia Zariphopoulou

The tutorial lectures will be delivered on March 16 by Konstantin Khanin.

The first Seminar on Stochastic Processes was organized in 1981 by Kai Lai Chung, Erhan Çinlar and Ronald Gettoor.

NEW

## IMS co-sponsored meeting

**Stochastic Networks Conference 2016****June 20–24, 2016****San Diego, CA****NEW WEBSITE:** <http://stochasticnetworks2016.ucsd.edu/>

The aim of the conference is to bring together researchers who share an interest in stochastic network models, to survey recent developments, and to identify future research directions. As in the past, the 2016 meeting will be structured in a workshop format, with approximately 20 hour-long invited talks, allowing ample unscheduled time to maximize interactions between speakers and participants and to facilitate a fruitful exchange of ideas. In addition, there will be a poster session for contributed papers.

Stochastic networks is a multifaceted area of research dealing with the modeling, stability, control, performance, approximation, and design of stochastic networks. It gives rise to challenging and subtle mathematical problems, whose solution often requires a combination of ideas and techniques from several branches of mathematics, including probability theory, stochastic processes, analysis, optimization, algorithms, combinatorics, and graph theory. Research in this area is strongly motivated by applications in diverse domains, ranging from the traditional areas of telecommunications and manufacturing to service operations, biological and social networks, revenue management, and health care.

Like its predecessors, the 2016 Stochastic Networks Conference will emphasize new model structures and new mathematical problems that are motivated by contemporary developments in various application domains, as well as new mathematical methods for stochastic network analysis.

## IMS co-sponsored meeting

**39th Conference on Stochastic Processes and their Applications (SPA)****July 24–28, 2017. Moscow, Russia****w** TBC**ENAR dates: 2016–2018**

## IMS sponsored meetings

**March 6–9, 2016: in Austin, Texas****March 12–15, 2017: in Washington DC****March 25–28, 2018: in Atlanta, GA****w** <http://www.enar.org/meetings.cfm>

## IMS co-sponsored meeting

**Fourth IMS Asia Pacific Rim Meeting****June 27–30, 2016****Hong Kong, China****w** <http://ims-aprm2016.sta.cuhk.edu.hk/>

The Institute of Mathematical Statistics Asia Pacific Rim Meeting series promotes interaction and networking among statisticians and probabilists from Asia, the Pacific Rim, and other parts of the world. The previous three meetings were successfully held in Seoul, Tsukuba, and Taipei. We are pleased to announce that the fourth meeting will take place on the beautiful campus of The Chinese University of Hong Kong, during the period June 27–30, 2016. The program covers recent developments and the state-of-the-art in a variety of modern research topics in statistics and probability. For more information, you may contact the program chairs: Ming-Yen Cheng ([cheng@math.ntu.edu.tw](mailto:cheng@math.ntu.edu.tw)) and Xuming He ([xmhe@umich.edu](mailto:xmhe@umich.edu)).

## IMS co-sponsored meeting

**9th World Congress on Probability and Statistics****July 11–15, 2016. Toronto, Canada****w** <http://www.fields.utoronto.ca/programs/scientific/16-17/WC2016/>

This meeting is jointly sponsored by the Bernoulli Society and the IMS. The Scientific Programme Chair is Alison Etheridge. The Local Chair is Tom Salisbury.

The 9th World Congress on Probability and Statistics will be hosted by the Fields Institute. Previous congresses have been held in Istanbul (2012), Singapore (2008), Barcelona (2004), Guanajuato (2000), Vienna (1996), Chapel Hill (1994), Uppsala (1990), and Tashkent (1986).

## IMS co-sponsored meeting

**Sixth IMS–ISBA joint meeting: BayesComp at MCMSki****January 5–7, 2016. Lenzerheide, Switzerland****w** <http://www.pages.drexel.edu/~mw125/mcmskiV/program.html>

The next joint IMS–ISBA meeting, also known among participants as “MCMSki V”, will be held in Lenzerheide, Switzerland, from Tuesday, January 5 to Thursday, January 7, 2016. This year the meeting will be the first meeting of the newly created BayesComp section of ISBA. The InterDisciplinary Institute of Data Science at USI (Università della Svizzera Italiana) will co-sponsor the meeting and help with the organization. Other sponsors for MCMSki V include Springer, Google, the journal *Statistics and Computing*, Blossom Skis and Deviation Skis. MCMSki V will see the return of the Richard Tweedie ski race, on the afternoon of Wednesday January 6th. The fastest man and woman will be rewarded with a pair of skis (one pair each of Blossom skis and Deviation skis).

The plenary speakers are Stephen Fienberg, Steve Scott, David Dunson, Krys Latuszynski, Tony Lelièvre.



# Other meetings around the world

## **Ninth International Triennial Calcutta Symposium on Probability and Statistics December 28–31, 2015 Kolkata, India**

**w** <http://triennial.calcuttastatisticalassociation.org>

Contact: Manisha Pal [caltri9@gmail.com](mailto:caltri9@gmail.com)

Organisers: Department of Statistics, University of Calcutta & Calcutta Statistical Association

Features: Special Sessions; invited and contributory sessions on theoretical and applied statistics and probability; and poster sessions for students and young researchers; awards for best posters. Sponsored posters from industries will also be entertained.

Keynote speaker: Prof. Sheldon M. Ross. S. K. Chakravarti Memorial speaker: Prof. Sabina Alkire

Early registration deadline October 31.

## **2015 Lloyd Roeling UL Lafayette Mathematics Conference: Statistics November 20–21, 2015 Lafayette, Louisiana, USA**

**w** <http://math.louisiana.edu/node/182>

Contact: Calvin Berry [cberry@louisiana.edu](mailto:cberry@louisiana.edu)

The conference topic this year is statistics.

The conference will also serve as the Fall meeting of the Louisiana Chapter of the American Statistical Association. The conference will provide an opportunity for researchers and students in statistics and related fields to come together, present their research, and learn from each other. Cross-disciplinary and applied paper submissions are especially welcome. The conference will begin on Friday afternoon and continue through Saturday.

## **6th CEQURA Conference October 1–2, 2015 Munich, Germany**

**w** <http://www.cequra.uni-muenchen.de/conference2015/index.html>

Contact: Martina Brunner [riskconference@cequra.lmu.de](mailto:riskconference@cequra.lmu.de)

The 6th CEQURA Conference on Advances in Financial and Insurance Risk Management, organized by the Society for Financial and Insurance Econometrics in collaboration with the Montreal Institute of Structured Products and Derivatives and Bayerisches Finanz Zentrum, will take place on October 1–2, 2015 in Munich.

## **IEEE International Conference on Information Processing December 16–19, 2015 Vishwakarma Institute of Technology Pune, Maharashtra, India**

**w** [www.icip.in](http://www.icip.in)

The conference provides an opportunity for participants to discuss the recent developments in the fields of information processing related to electronics, communication and computer science. It also provides a platform to review the challenges faced by the community in the 21st century.

Vishwakarma Institute of Technology, Pune, occupies a place of pride amongst the premier technical institutes of the western region of India. Established in 1983, financed and run by the Bansilal Ramnath Agrawal Charitable Trust, Pune. The institute is affiliated to the University of Pune. Within two decades, the institute marched towards the pinnacle of glory through its remarkable achievements and laurels in the field of engineering education of high caliber.

For further details and updated information, please visit the website.

## **6th Annual High Frequency Finance and Data Analytics Conference October 29–31, 2015 Stevens Institute of Technology, Hoboken, NJ, USA**

**w** [http://hfsl.stevens.edu/hff\\_conference](http://hfsl.stevens.edu/hff_conference)

The 6th Annual Stevens Conference on High Frequency Finance and Analytics (HF2015) is sponsored by the CME Group Foundation and Stevens Financial Systems Center with a focus on sharing the latest research and applications of models for data sampled with high frequency. This three-day conference will gather key thought leaders from academia, industry and government from across the globe in the areas of mathematical finance, financial engineering, quantitative finance, stochastic processes and applications and more. The conference will feature graduate students research, and for the first time a recruiting event and data provider talks about the utility and availability of financial datasets. A dinner cruise on the Hudson will provide ample opportunity for networking.

Confirmed Speakers to date:

Peter Carr, Morgan Stanley and NYU

Robert Almgren, Quantitative Brokers and NYU

Alvaro Cartea, University College London, UK

John Schwall, IEX Group

Sylvain Corlay, Bloomberg Research

Xin Guo, University of California Berkeley

Sebastian Jaimungal, University of Toronto, Canada



# IEEE International Conference on **INFORMATION PROCESSING**



December 16-19, 2015

## CALL FOR PAPERS

**Original research, review and survey papers are invited (IEEE format)  
in the following research areas but not limited to**

- Digital Signal Processing
- Image Processing
- Speech Processing
- Biomedical Signal Processing
- VLSI Signal Processing
- Audio Video Processing
- Information Retrieval
- Wireless Communication
- Wireless Sensor Networks
- Digital Communication
- Mobile Computing
- Computer Networks
- Embedded Systems
- Fault Tolerant Systems
- Computer Vision
- Pattern Recognition
- Data Mining
- Machine Vision
- Remote Sensing
- Cloud Computing
- Optimization Techniques

## About the Conference

The conference provides an opportunity for the participants to discuss recent developments in the field of information processing related to Electronics, Communication and Computer Science. It also provides a platform to review the challenges faced by the community in 21<sup>st</sup> century.

## Technical Program

- Insightful Keynote Speeches
- Technical Exhibitions
- Tutorials and Workshop
- Posters of Emerging Ideas
- Oral Presentations in Multiple Tracks

## Important Dates

Last date for full paper submission : 30<sup>th</sup> July 2015

Acceptance notification : 15<sup>th</sup> September 2015

Camera ready paper submission : 30<sup>th</sup> September 2015

Last date of registration : 10<sup>th</sup> October 2015

## Registration Details

Registration Categories	India (Rs.)	Out of India (USD)
Industry	7500	400
Academics (Faculty, Students)	6000	300
IEEE Members	4500	200
General Participants	5000	250

All accepted & presented papers in conference will appear in IEEE Xplore.

Organized By

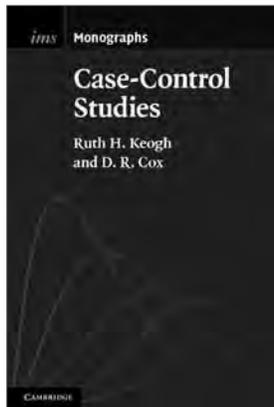
**Department of Electronics Engineering,  
BRACT's Vishwakarma Institute of Technology,  
Pune - 411037, Maharashtra, India.**

Contact No: +91 20 24202202 | Mobile: +91 9970174958 / 9623551946 | Fax: +91 20 24280926  
Email: contact\_icip@vit.edu Conference Website: www.icip.in Institute Website: www.vit.edu



*The Institute of Mathematical Statistics presents*

# IMS MONOGRAPHS



## **Case-Control Studies**

Ruth H. Keogh  
and D. R. Cox

The case-control approach is a powerful method for investigating factors that may explain a particular event. It is extensively used in epidemiology to study disease incidence, one of the best-known examples being Bradford Hill and Doll's investigation of the possible connection between cigarette smoking and lung cancer. More recently, case-control studies have been increasingly used in other fields, including sociology and econometrics.

With a particular focus on statistical analysis, this book is ideal for applied and theoretical statisticians wanting an up-to-date introduction to the field. It covers the fundamentals of case-control study design and analysis as well as more recent developments, including two-stage studies, case-only studies and methods for case-control sampling in time. The latter have important applications in large prospective cohorts which require case-control sampling designs to make efficient use of resources. More theoretical background is provided in an appendix for those new to the field.

IMS member? Claim  
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Hardback price  
US\$48.00  
(non-member price  
\$80.00)

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Cambridge University Press, in conjunction with the Institute of Mathematical Statistics, established the IMS Monographs and IMS Textbooks series of high-quality books. The Series Editors are Xiao-Li Meng, Susan Holmes, Ben Hambly, D. R. Cox and Alan Agresti.

# Employment Opportunities around the world

## Australia: Canberra, ACT

### Australian National University

Lecturer in Statistics

[http://jobs.imstat.org/c/job.cfm?site\\_id=1847&jb=24698006](http://jobs.imstat.org/c/job.cfm?site_id=1847&jb=24698006)

## Australia: Melbourne, Victoria

### RMIT University

Lecturer/Senior Lecturer, Statistics

[http://jobs.imstat.org/c/job.cfm?site\\_id=1847&jb=24664357](http://jobs.imstat.org/c/job.cfm?site_id=1847&jb=24664357)

## Canada: Waterloo, ON

### University of Waterloo

Actuarial Science: Tenure track or Tenured

[http://jobs.imstat.org/c/job.cfm?site\\_id=1847&jb=24881707](http://jobs.imstat.org/c/job.cfm?site_id=1847&jb=24881707)

## Canada: Waterloo, ON

### University of Waterloo

Statistics or Biostatistics: Tenure track or Tenured

[http://jobs.imstat.org/c/job.cfm?site\\_id=1847&jb=24881683](http://jobs.imstat.org/c/job.cfm?site_id=1847&jb=24881683)

## Chile: Santiago

### Universidad Catolica de Chile

Assistant Professor

[http://jobs.imstat.org/c/job.cfm?site\\_id=1847&jb=24740242](http://jobs.imstat.org/c/job.cfm?site_id=1847&jb=24740242)

## Hong Kong

### The University of Hong Kong

Tenure-Track Associate Professor/Assistant Professor in the Department of Statistics and Actuarial Science (2 posts)

[http://jobs.imstat.org/c/job.cfm?site\\_id=1847&jb=24803482](http://jobs.imstat.org/c/job.cfm?site_id=1847&jb=24803482)

## Singapore

### Division of Mathematical Sciences, Nanyang Technological University, Singapore

Faculty Positions at all Ranks

[http://jobs.imstat.org/c/job.cfm?site\\_id=1847&jb=24631078](http://jobs.imstat.org/c/job.cfm?site_id=1847&jb=24631078)

## United Kingdom: London

### Imperial College London

Non-Clinical Reader/Professor in Biostatistics

[http://jobs.imstat.org/c/job.cfm?site\\_id=1847&jb=24631195](http://jobs.imstat.org/c/job.cfm?site_id=1847&jb=24631195)

## United Kingdom: Anywhere in UK

### Biometrika

Research Fellowships

[http://jobs.imstat.org/c/job.cfm?site\\_id=1847&jb=24598866](http://jobs.imstat.org/c/job.cfm?site_id=1847&jb=24598866)

## United States: Hayward, CA

### California State University, East Bay

Full-Time Tenure-Track

[http://jobs.imstat.org/c/job.cfm?site\\_id=1847&jb=24704459](http://jobs.imstat.org/c/job.cfm?site_id=1847&jb=24704459)

## United States: Los Angeles, CA

### UCLA

UCLA Department of Mathematics Faculty Positions 2016-17

[http://jobs.imstat.org/c/job.cfm?site\\_id=1847&jb=24631622](http://jobs.imstat.org/c/job.cfm?site_id=1847&jb=24631622)

## United States: Los Angeles, CA

### UCLA Fielding School of Public Health

Open-Rank Tenure-Track or Tenured Faculty Position

[http://jobs.imstat.org/c/job.cfm?site\\_id=1847&jb=24276452](http://jobs.imstat.org/c/job.cfm?site_id=1847&jb=24276452)

## United States: Davis, CA

### University of California, Department of Statistics

Assistant Professor

[http://jobs.imstat.org/c/job.cfm?site\\_id=1847&jb=24875281](http://jobs.imstat.org/c/job.cfm?site_id=1847&jb=24875281)

## United States: Fort Collins, CO

### Numerica Corporation

Research Scientist

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- 3) Applications of optimization.

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- 2) Exoplanets,
- 3) Gravitational wave astrophysics,
- 4) High-performance computing,
- 5) Lightcurve analysis in astronomy.

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Assistant Professor of Statistics

[http://jobs.imstat.org/c/job.cfm?site\\_id=1847&jb=24778963](http://jobs.imstat.org/c/job.cfm?site_id=1847&jb=24778963)**United States: Research Triangle Park, NC****SAMSI**

Postdoctoral Fellowships 2016–17

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The Department of Biostatistics, University at Buffalo, seeks to hire an outstanding scientist with research interests in computational statistics, algorithms, visualization, machine learning, analysis and inference for digital image processing, neural computation, predictive modeling and other areas of statistical informatics. This is a 12-month, tenure-track, appointment at the Assistant Professor rank, and it is part of the university-wide initiative on developing expertise in Data Science and analysis of "Big Data".

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[http://jobs.imstat.org/c/job.cfm?site\\_id=1847&jb=24777063](http://jobs.imstat.org/c/job.cfm?site_id=1847&jb=24777063)**United States: Richmond, VA****University of Richmond**

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# International Calendar of Statistical Events

IMS meetings are highlighted in maroon with the  logo, and new or updated entries have the  or  symbol. **t** means telephone, **f** fax, **e** email and **w** website. Please submit your meeting details and any corrections to Elyse Gustafson at [erg@imstat.org](mailto:erg@imstat.org)

## September 2015

September 2–5: Hyderabad, India IXth International Multiple Comparisons Procedures (MCP) Conference  
**w** <http://www.mcp-conference.org/hp/2015/>

September 14–16: University of Warwick, UK. CRiSM Workshop: Models and Inference in Population Genetics **w** <http://www2.warwick.ac.uk/fac/sci/statistics/crism/workshops/populationgenetics>

September 20–23: Ribno (Bled), Slovenia. Applied Statistics 2015 (AS2015) **w** <http://conferences.nib.si/AS2015/>

September 21–25: Vienna, Austria. 8th International Workshop on Simulation **w** <http://iws.boku.ac.at/index.php>

September 24–25: NCAR Mesa lab, Boulder, CO. 5th International Workshop on Climate Informatics  
**w** <https://www2.cisl.ucar.edu/events/CI2015>

September 26: Harvard University, Cambridge, MA, USA 2015 New England Symposium on Statistics in Sports  
**w** <http://www.nessis.org/>

September 30–October 2: NIMBioS, Knoxville, TN. Mathematics of Planet Earth 2013+ Workshop on Education for the Planet Earth of Tomorrow  
**w** [http://www.nimbios.org/education/WS\\_mpe2015](http://www.nimbios.org/education/WS_mpe2015)

## October 2015

 October 1–2: Munich, Germany. 6th CEQURA Conference  
**w** <http://www.cequra.uni-muenchen.de/conference2015/index.html>

October 5–7: Dubai, UAE. Seventh Global Summit on Cancer Therapy **w** <http://cancer.global-summit.com/middleeast/>

October 28–29: Washington DC. 2015 Modern Math Workshop  
**w** <http://www.msri.org/workshops/789>

October 28–November 1: Antalya, Turkey. Ninth International Statistics Congress **w** <http://www.istkon.net/istkon09/en>

 October 29–31: Stevens Institute of Technology, Hoboken, NJ, USA. 6th Annual High Frequency Finance and Data Analytics Conference **w** [http://hfsi.stevens.edu/hff\\_conference](http://hfsi.stevens.edu/hff_conference)

## November 2015

November 10–13: Prague, Czech Republic. AMISTAT 2015 (Analytical Methods in Statistics)  
**w** <http://www.karlin.mff.cuni.cz/~amistat2015/>

 November 20–21: Lafayette, Louisiana, USA. 2015 Lloyd Roeling UL Lafayette Mathematics Conference: Statistics **w** <http://math.louisiana.edu/node/182>

## December 2015

December 4–5: London, UK. Complex Systems in Time Series **w** <http://www.lse.ac.uk/statistics/events/SpecialEventsandConferences/Complex-Systems-in-Time-Series>

December 6–11: Atlantic City, NJ, USA. 71st Annual Deming Conference on Applied Statistics **w** [www.demingconference.com](http://www.demingconference.com)

 December 16–19: Vishwakarma Institute of Technology Pune, Maharashtra, India. IEEE International Conference on Information Processing **w** [www.icip.in](http://www.icip.in)

 December 28–31: Kolkata, India. Ninth International Triennial Calcutta Symposium on Probability and Statistics **w** <http://triennial.calcuttastatisticalassociation.org>

## January 2016

 January 5–7: Lenzerheide, Switzerland. Sixth IMS-ISBA joint meeting: BayesComp at MCMSki.  
**w** <http://www.pages.drexel.edu/~mw125/mcmskiV/program.html>

January 25–27: Lunteren, The Netherlands. 15th Winter school on Mathematical Finance **w** <https://staff.fnwi.uva.nl/p.j.c.spreij/winterschool/winterschool.html>

## March 2016

March 1–4: Bochum, Germany. **12th German Probability and Statistics Days 2016: Bochumer Stochastik-Tage**

**w** <http://www.gpsd-2016.de/>

 March 6–9: Austin, Texas. **2016 ENAR/IMS Spring Meeting**

**w** <http://www.enar.org/meetings.cfm>

  March 16–19: University of Maryland, College Park, MD, USA. **Seminar on Stochastic Processes (SSP) 2016** **w** [http://depts.washington.edu/ssproc/ssp\\_nextssp.php](http://depts.washington.edu/ssproc/ssp_nextssp.php)

## April 2016

  April 4–8: Lancaster University, UK. **UK Easter Probability Meeting 2016: Random Structures Arising in Physics and Analysis** **w** <http://www.lancaster.ac.uk/math/easter-probability-meeting/>

## May 2016

May 18–21: Cappadocia, Turkey. **International Conference on Information Complexity and Statistical Modeling in High Dimensions with Applications (IC-SMHD-2016)**

**w** <http://www.ic-smhd2016.com/>

## June 2016

June 15–18: Cartagena, Colombia. **Second International Congress on Actuarial Science and Quantitative Finance**

**w** <http://icasqf.org>

June 20–23: Geneva, Switzerland. **ICES-V, the 5th International Conference on Establishment Statistics** **w** TBC

 June 20–24: San Diego, CA. **Stochastic Networks Conference 2016** **NEW WEBSITE** <http://stochasticnetworks2016.ucsd.edu/>

 June 27–30: Hong Kong, China. **Fourth IMS Asia Pacific Rim Meeting** **w** <http://ims-aprm2016.sta.cuhk.edu.hk/>

June 27–July 1: Barcelona, Spain. **3rd Barcelona Summer School on Stochastic Analysis** **w** [http://www.crm.cat/en/Activities/Curs\\_2015-2016/Pages/3rd-BCN-Summer-School-on-Stochastic-Analysis.aspx](http://www.crm.cat/en/Activities/Curs_2015-2016/Pages/3rd-BCN-Summer-School-on-Stochastic-Analysis.aspx)

## July 2016

  July 10–15: Victoria, BC, Canada. **WNAR Annual Meeting in conjunction with the XXVIII International Biometric Conference** **w** <http://biometricconference.org/conference-information/>

 July 11–15: Toronto, ON, Canada. **IMS Annual Meeting at 9th World Congress in Probability and Statistics** **w** <http://www.fields.utoronto.ca/programs/scientific/16-17/WC2016/>

 July 30 – August 4: Chicago, USA. **JSM 2016** **w** <http://amstat.org/meetings/jsm/>

## December 2016

 December 19–22: Shanghai, China. **10th ICSA International Conference** **w** <http://www.math.sjtu.edu.cn/conference/2016icsa/>

## July 2017

 July 24–28: Moscow, Russia. **39th Conference on Stochastic Processes and their Applications (SPA)** **w** TBC

 July 29 – August 3: Baltimore, USA. **IMS Annual Meeting at JSM 2017** **w** <http://amstat.org/meetings/jsm/>

# International Calendar *continued*

**Toronto, Canada: location for the Ninth World Congress in Probability and Statistics, and the 2016 IMS Annual Meeting**

<http://www.fields.utoronto.ca/programs/scientific/16-17/WC2016/>



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## July 2018

 July 28 – August 2: Vancouver, Canada. JSM 2018  
w <http://amstat.org/meetings/jsm/>

## August 2021

  August 7–12: Seattle, WA, USA. JSM 2021  
w <http://amstat.org/meetings/jsm/>

## July 2019

 July 27–August 1: Denver, CO, USA. IMS Annual Meeting at JSM 2019 w <http://amstat.org/meetings/jsm/>

## August 2020

 August 1–6: Philadelphia, PA, USA. JSM 2020  
w <http://amstat.org/meetings/jsm/>

Are we missing something? If you know of any statistics or probability meetings which aren't listed here, please let us know. You can email the details to Elyse Gustafson at [erg@imstat.org](mailto:erg@imstat.org), or you can submit the details yourself at <http://www.imstat.org/submit-meeting.html>. We'll list them here in the Bulletin, and on the IMS website too, at [www.imstat.org/meetings](http://www.imstat.org/meetings)



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