Volume 44 • Issue 2

IMS Bulletin

March 2015

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New Researchers in Seattle

17th IMS New Researchers Conference
August 6–8, 2015
University of Washington, Seattle, WA

The 17th IMS New Researchers Conference is an annual meeting organized under the auspices of the IMS, and jointly sponsored this year by the National Science Foundation (NSF), Google, and other federal agencies and industry sponsors. The conference is hosted by the Department of Biostatistics at the University of Washington and will be held just prior to the 2015 Joint Statistical Meetings in Seattle (see below).

The purpose of the conference is to promote interaction and networking among new researchers in probability and statistics. If you received a PhD in or after 2010, or expect to defend your thesis by the end of 2015, you are eligible to apply to attend. Due to limited space, participation is by invitation only.

More information may be found at http://depts.washington.edu/imsnrc17/ including a link to the application information page. Application deadline is March 27, 2015.

Higher priority will be given to first-time applicants. Women and minorities are encouraged to apply. Contingent on the availability of funds, financial support for travel and accommodation may be provided. However, participants are strongly encouraged to seek partial funding from other sources.

Contact: imsnrc17@uw.edu

JSM 2015
August 8–13, 2015, Seattle, WA

The Joint Statistical Meetings in Seattle, WA, take place from August 8–13, 2015. JSM also includes the next IMS Annual Meeting. If you have never been to JSM it's a great experience but, since it's such a large meeting (typically over 5000 delegates) it can be a little overwhelming for the newcomers. Check out the advice on the First Time Attendees page: http://www.amstat.org/meetings/jsm/2015/firsttimeattendees.cfm. Registration and housing reservations open April 30, 2015.

Seattle is the largest city in the Pacific Northwest region of North America, and the the fastest-growing major city in the United States. Its population is set to (temporarily) expand by about 5000 people… during JSM from August 8–13, 2015. Will you be among them?

IMS Bulletin

Volume 44 • Issue 2
March 2015
ISSN 1544-1881

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Executive Committee

IMS Members' News

Emery N. Brown elected to US National Academy of Engineering


Emery Brown

On February 5, The National Academy of Engineering announced that IMS member Emery N. Brown, the Warren M. Zapol Professor of Anaesthesia at Harvard Medical School/Massachusetts General Hospital and the Edward Hood Taplin Professor of Medical Engineering and Computational Neuroscience at MIT, was elected to the National Academy of Engineering. Dr. Brown is now one of the few people who are members of all three branches of the National Academies (Institute of Medicine, National Academy of Sciences and the National Academy of Engineering). Dr. Brown is recognized "for development of neural signal processing algorithms for understanding memory encoding and modeling of brain states of anesthesia."

Also among those elected this year is Ingrid Daubechies, James B. Duke Professor of Mathematics at Duke University, "for contributions to the mathematics and applications of wavelets."

See the full list at http://www.nae.edu/Projects/MediaRoom/20095/130169/130172.aspx

Richard Samworth receives Leverhulme Prize

Philip Leverhulme Prizes recognize the achievement of outstanding researchers whose work has already attracted international recognition and whose future career is exceptionally promising. Among the 30 recipients of the 2014 Leverhulme Prize was Professor Richard Samworth, Department of Pure Mathematics and Mathematical Statistics, University of Cambridge. The prize is an award of £100,000 (approx US$150,000) a year, awarded across a range of academic disciplines (in 2014 Mathematics and Statistics was one of the six chosen areas).

Richard's Leverhulme Prize was for his "broad and influential foundational and methodological contributions to many areas of Statistics, including non-parametric maximum likelihood, classification; high-dimensional penalized regression and model selection; density estimation; and the bootstrap. His seminal contributions on nonparametric classification, one of the most important and rapidly growing areas on the interface between Statistics and Machine Learning, have had a profound impact on the development of the field. He has also demonstrated outstanding leadership qualities in his activities on behalf of many of the world's leading statistical societies and journals, and his work in building up Statistics within the University of Cambridge." Richard was elected an IMS Fellow last year.

David Spiegelhalter knighted

Professor David Spiegelhalter, OBE FRS, who is Winton Professor for the Public Understanding of Risk at the University of Cambridge, UK (and is occasionally known to the public as "Professor Risk") received a knighthood in last year's Queen's Birthday Honours list "for services to Statistics". Speaking of the award, Sir David said, "Work on statistics doesn't usually get much attention, and so it's a bit of a surprise to get such a great honour for doing things with numbers."

Although David actually was knighted last year, this news only reached us recently. If you hear about an IMS member receiving an award, don't forget to tell us: bulletin@imstat.org. *Thanks!*

Other news

ISI Director Bimal K Roy receives civilian award

Professor Bimal K. Roy, Director of the Indian Statistical Institute, was given the Padma Shri award, one of the highest civic honors in India, by the central government of India on January 26, 2015. Professor Roy was honored for his versatile and innovative contributions to numerous areas of theoretical computer science, cryptanalysis, statistical design, combinatorial mathematics, and applications of modern statistics to ecology and public health. He is primarily responsible for initiation of probabilistic cryptanalysis of ciphertexts driven by multiple feedback registers and complex unknown combining functions, and theoretical study of design and security analysis of wireless sensor networks. His research on cryptanalysis and sensor networks was rewardingly influenced by his foundations in statistical design, graph theory, and combinatorics. He took a leadership role in a difficult ecological study in the coastal rainforest areas in the state of West Bengal, and in a study of arsenic hazards in India. Professor Roy was previously honored with multiple prestigious awards by the IBM and Microsoft for being at the frontier of integrative multidisciplinary research, and was elected a member of the Indian National Science Academy. He has held faculty positions in numerous countries across the world. Interestingly, Professor Roy is a spectacularly gifted soccer star and it has been conjectured that he may be the best soccer player in the world with a PhD in mathematical statistics.

Jerome Sacks Award: nominations open

The NISS Board of Trustees established the Jerome Sacks Award for Cross-Disciplinary Research in 2000 to honor Sacks' service as the founding director of NISS. The annual prize of $1,000, to be presented this year at the NISS/SAMSI Joint Statistical Meetings Reception in Seattle, Washington, recognizes high- quality cross-disciplinary research involving the statistical sciences.

The 2015 award selection committee solicits nominations of researchers whose work is cross-disciplinary, sustained and encompasses innovation in the statistical sciences. Preference will be given to work that, in the spirit of NISS, creates new research relationships bridging the statistical sciences and other disciplines, or new bridges among academia, industry and government. Achievements such as patents and software creation will be considered.

Past winners (2014–2001) are Terry Speed, Kenneth Burnham, William Meeker, Emery Brown, Sallie Keller, Ramanathan Gnanadesikan, John Rice, Cliff Spiegelman, Adrian Raftery, Jeff Wu, Doug Nychka, Raymond Carroll, Max Morris and Elizabeth Thompson.

The nomination process is very straightforward. All that is needed is a nomination letter of no more than two pages, names of at least two other individuals who have consented to write letters of support and a CV. Nomination letters should be submitted by June 12, 2015 to sacksaward2015@niss.org.

New IMS Textbooks published

Two new books in the *IMS Textbooks* series have been published. They are: *The Surprising Mathematics of Longest Increasing Subsequences* by Dan Romik (IMS member price with 40% discount is $59.40 for the hardback [non-member price $99.00] or $23.99 paperback [$39.99]); and *Noise Sensitivity of Boolean Functions and Percolation* by Christophe Garban and Jeffrey E. Steif (discounted price $59.40 hardback, $20.99 paperback). As an IMS member you can order a discounted copy at http://www.cambridge.org/ims.

= 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/aoap

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

Journal of Computational and Graphical Statistics: Thomas Lee
http://www.amstat.org/publications/jcgs
log into members' area at 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/aihp
http://projecteuclid.org/aihp

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. Musiela, J. Rosiński, W. Szczotka, & W.A. Woyczyński
http://www.math.uni.wroc.pl/~pms

TOPOS: *Let's not make the same mistake twice*

Contributing Editor Robert Adler writes:

This is the fourth, and final, of my columns on the Topology, Probability, and Statistics triad. You might recall that the common thread was TDA, or Topological Data Analysis. I started by advertising TDA in a casual commercial for the IMS community, continued with some tendentious tutoring for topological tenderfeet, and proceeded to a pedagogical podium to preach to probabilists. Continuing to advance alliteratively, I want to conclude these columns with a seriously sinister statistical sermon on the theme of *Let's not make the same mistake twice!*

Of course, before sermonizing, it is traditional to recall vaguely relevant verses from a prophetic source to be bent to the preacher's needs. My source is a truly excellent article by John Tukey, published in the 1962 *Annals of Mathematical Statistics*. The rambling 61 page paper, entitled "The Future of Data Analysis", has the following lines, among many others expressing similar sentiments:

- "Statistics has contributed much to data analysis."
- "By and large, the great innovations in statistics have not had correspondingly great effects on data analysis."
- "We should seek out new questions to be answered."
- "We should seek out unfamiliar summaries of observational material, and establish their useful properties."

The first two points are seemingly contradictory, but are explained in the article along the lines of "when we are motivated by something outside of what we know, we can do great stuff, but when we self-motivate, looking mainly in a neighborhood of the familiar, then we end up with 'great innovations' which impress nobody but ourselves."

The second two points *suggest* the road to relevance, but...

Despite Tukey's timely warning, around about the same time parts of Statistics seemingly took a wrong turn, and instead of rolling along the road to relevance, pursued a path to purgatory.

Consider what was happening at the time of Tukey's article. Just four years earlier, Frank Rosenblatt had created the perceptron, an algorithm for pattern recognition based on a two-layer neural network using no more than simple addition and subtraction. Seven years later Minsky and Papert almost killed the fledging area of machine learning with some negative results about the ability of algorithms to actually achieve what it was hoped they could do. However, by the 1990s the not unrelated tool of Vapnik's support vector machines was making an enormous impact, and today, in the 2010s, neural nets are back with a vengeance following the general availability of powerful processors and the advent of deep learning.

It is of more than mere historical interest that, early in its development, Computer Science, as a discipline and as university departments, adopted machine learning as one of its own academic offspring. In doing so, the discipline found one of the highways to highbrow Heaven, gaining scientific and engineering recognition, while the departments reaped the reward of attracting excellent students.

On the other hand, back then, Statistics and statisticians reacted quite differently to the appearance of machine learning in all its forms. I am old enough to remember some of some of my colleagues' claims:

- *Nothing new there. It's just another form of regression.*
- *Estimating more parameters than there are data points? Ridiculous!*
- *No physical meaning to parameters, even when you know them. Who knows what the black box means?*
- *Totally inappropriate for hypothesis testing. Student would turn in his grave.*

And these are just the complaints that I remember.

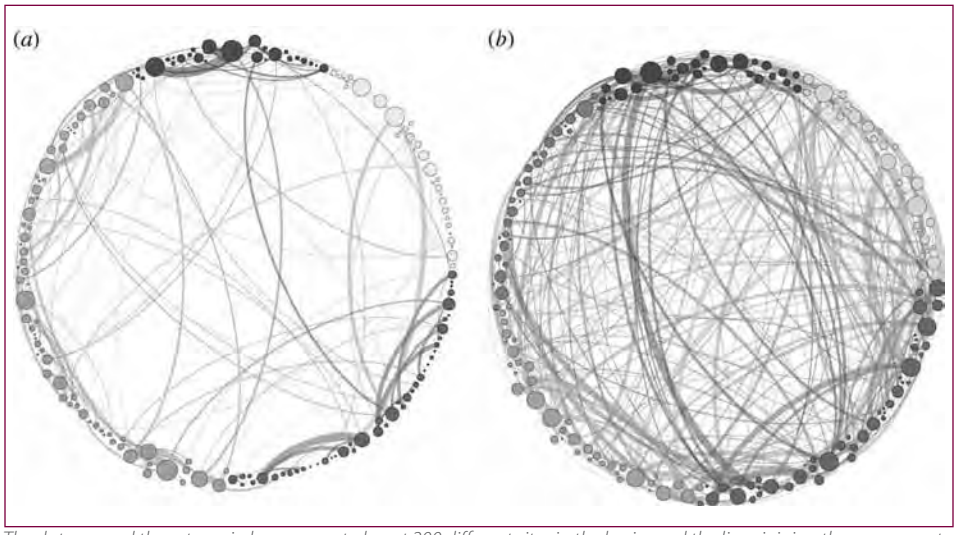
Of course, times have changed, and many statistics departments are now hiring machine learners (or teachers) and some of the best researchers out there in the machine learning world are semi-statisticians, often with joint appointments. But none of this changes the fact that thirty years ago *we made a mistake for the first time*, when a new set of questions, with new summaries of observational material (cf. Tukey), were at best ignored, at worst ridiculed, and Statistics lost a subject that might well have become its own. In doing so Statistics lost some important momentum, and, perhaps most importantly, it lost a generation of bright young graduate students who were attracted to the Computer Science world. To some extent Statistics departments are still suffering from this mistake today. I believe that the entire area of machine learning would have developed differently, been richer, and certainly with a stronger mathematical foundation, had statisticians developed an interest in it in its early days.

(In fairness, it should be noted that probabilists did a somewhat better job than statisticians in terms of jumping on the machine learning bandwagon. I doubt that this was because they were intrinsically wiser, but was probably due to the fact that it gave them an entire new class of models to which their tools were well suited. And there is nothing a probabilist likes better than a new model.)

So, now here we are in 2015, and there is another big challenge before us—and by 'us' I mean all IMS-ers, probabilists and statisticians alike. A new tool, TDA, has arisen, this time emerging from one of the most esoteric and abstract areas of Pure Mathematics—Algebraic Topology—and it is providing, in Tukey's words above,

most distinctly "unfamiliar summaries of observational material".

As I have argued in previous columns, TDA is having a significant and growing impact in the world of data analysis. Its most recent "killer app" is to be found in a paper studying the effect of the psychedelic drug psilocybin ("magic mushroom" to the streetwise) on networks in the brain. Using purely topological methods, an Anglo-Italian, multidisciplinary group, led by Francesco Vaccarino, and made up of mathematicians, physicists, a psychiatrist-cum-neuropsychopharmacologist, and a psychologist, produced the picture below. The dots around the circle represent 194 sites in the brain, and the lines joining them represent significant connections between these sites. The lines in the left hand diagram (a) represent these connectivities in normal brains, while the one on the right,(b), shows the situation after an injection of psilocybin, yielding a state of hyper-connectivity. The difference is striking, and explains the ability of the psychedelic brain to "smell the color yellow" and "taste the sound of a bell" (before it burns out forever).



The dots around these two circles represent almost 200 different sites in the brain, and the lines joining them represent significant connections between these sites. The lines in the left hand diagram (a) represent these connectivities in normal brains, while (b) shows the situation after an injection of the psychedelic drug psilocybin, found in "magic mushrooms", yielding a state of hyper-connectivity

The reason I called this a "killer app" is that it is putting TDA on the public map in a way it was never there before. While recent workshops in TDA have been extremely popular among (mainly) young mathematicians, this is a story that has reached the popular press, the evening news, etc. The paper, *Homological scaffolds of brain functional networks,* was published in the *Journal of the Royal Society Interface*, in late October 2014. At the time of writing, it had close to 40,000 downloads.

The tools of the paper are those of persistence homology for weighted networks. Statistics appears in the paper, in that there are a few Kolmogorov–Smirnov tests, always a great standby when you need something but don't know anything. However, apart from this, and despite the fact that the study raises many statistical issues, there is not even the slightest attempt to think statistically.

Naught. Nothing. Nada. Zero. Zilch. Zippo.

Until recently this was more or less true of TDA as a whole. Over the last couple of years this has started to change, and statisticians are beginning to draw novel new ideas from TDA while, at the same time, exporting to the TDA community the importance of basic concepts in Statistics. These are things that IMS-ers take for granted: the fact that almost all data is sampled from a population, and sample variation is crucial to understanding the reliability of one's data; almost all data is subject to error of some kind, another source of variability; models are just that—models, and not indisputable truth.

These are natural issues for us to raise, but they lead to problems that are not easy to solve. The tools of TDA, foremost among them persistent homology, are mathematical objects of a kind that neither probabilists nor statisticians have encountered in the past.

There are now teams of statisticians, involving people like Larry Wasserman at CMU, and Sayan Mukherjee at Duke, developing statistical tools appropriate for TDA. So far, most of the tools are from the post-Tukey period of Statistics, for, as Tukey hinted, the great theoretical innovations of our theories are not as easily or universally applicable as are data driven techniques such as resampling. Not being a statistician myself, I am not going to say more about what is being done here, in part since the probability of being caught out saying something stupid is just a little too high. However, going to the CMU and Duke websites will gently guide you into the slowly emerging literature of statistical TDA.

And so the sermon ends: *IMS-ers beware*. Look around you. There is something out there very close to us, and (whether TDA-ers admit it or not) needs us as much as we could benefit from it. We must grab the opportunity while we can, and *let's not make the same mistake twice*.

Medallion Lecture preview: Jiashun Jin

Jiashun Jin is Professor of Statistics at Carnegie Mellon University. He received his PhD in Statistics from Stanford University in 2003. He was a faculty member at Purdue University from 2003 to 2007, after which he joined the Department of Statistics at Carnegie Mellon University, where he remains a faculty member today. Dr. Jin's main research interest is in Large-Scale Inference, especially in the regime where the signals are both rare and weak. In such a regime, many conventional approaches fail, and it is desirable to find new methods and theory appropriate for such a situation.

Dr. Jin was a recipient of the NSF CAREER Award and in 2009 was given the IMS Tweedie New Researcher Award. He is also an elected IMS fellow. Dr. Jin has served as an Associate Editor for several journals, including *The Annals of Statistics* and *Journal of the American Statistical Association*. He also served as the organizational co-chair for the Second IMS-China International Conference in Statistics and Probability.

Jiashun Jin's Medallion Lecture will be delivered at JSM in Seattle, on Wednesday August 12, 2015 at 2:00pm.

New approaches to spectral clustering, with applications to gene microarrays and social network community detection

Pearson's PCA (principal component analysis) is a flexible and easy-to-use method, but faces challenges in modern settings. How to adapt PCA to problems of contemporary interest is a very active research topic, where new ideas, methods and theory, and applications are in urgent need.

This work is motivated by two application problems. In the first one, we have recently collected a network data set (co-authorship and citation) for statisticians, based on all published papers in *AoS, Biometrika, JASA,* and *JRSS-B*, 2003–2012. We are interested in network community detection (i.e., finding tight research groups). In the second one, we have microarray data measured for n different patients from K different classes. The class labels are unknown, and the goal is to estimate them (i.e., clustering).

For the first problem, the main challenge is that the information of the community labels is largely distorted by degree heterogeneity. We attack this using a new method: Spectral Clustering On Ratios of Eigenvectors (SCORE). In SCORE, we obtain the first few leading eigenvectors, "remove" the degree heterogeneity by taking entry-wise ratios between these vectors and the first one, and then clustering by applying the classical k-means. Applying SCORE to the networks aforementioned, we have identified a handful of meaningful communities, such as "Large-Scale Multiple Testing," "Objective Bayes," and "Variable Selection."

For the second problem, the main challenge is that only a small fraction of genes are related to the clustering decision, each contributes weakly. We also use a new method to attack this: Important-Features PCA (IF-PCA). In IF-PCA, we rank the features by the Kolmogorov–Smirnov statistic and then apply PCA to only the small fraction of the most significant features. Here, a difficult problem is how to set the threshold; we attack this by adapting the recent notion of Higher Criticism. We have applied IF-PCA to ten gene microarray data sets, where it consistently outperforms existing procedures, and significantly so in several data sets.

The nice real-data performances of SCORE and IF-PCA motivate careful theoretical studies on high-dimensional clustering. We focus on the most challenging regime where the signals are rare and weak. In the two-dimensional phase space calibrating the signal sparsity and signal strength, we identify the precise demarcations for the Region of Impossibility and the Region of Possibility. In the Region of Impossibility, signals are simply too rare and weak so that any post-selection PCA type of methods fail. In the Region of Possibility, signals are strong enough so some methods may succeed, and IF-PCA is one of such methods. In this sense, IF-PCA has optimal clustering behaviors.

We also study the fundamental limits and the computationally feasible fundamental limits associated with clustering problems. For the former, we consider all possible clustering procedures (maybe NP hard). For the latter, we only consider procedures that are computationally feasible. Similarly, we find the precise demarcations for the Region of Possibility and the Region of Impossibility, and identify optimal clustering procedures.

The study requires very delicate post-selection Random Matrix Theory, and many theoretical results presented are new. The work is connected to the literature on Higher Criticism, sparse PCA, and low-rank matrix recovery.

Hand writing: The Improbability Principle

Contributing Editor David Hand writes:

Reading my co-columnist Xiao-Li Meng's column *The XL-Files* in the January/February 2015 issue (http://bulletin.imstat.org/2014/12/xl-files-pray-with-me-statistically/) made me realise I hadn't written a column about *The Improbability Principle*, my book which appeared early in 2014. Xiao-Li wrote, "Winning the lottery or being struck by lightning are both events with extremely small probabilities, events any statistically sound mind should not expect." But the subtitle of my book (in the US) is *Why Coincidences, Miracles, and Rare Events Happen Every Day*, and the examples I give include both being struck by lightning and winning the lottery. So what's going on?

One of the characteristics of probability is that it can produce results which appear counterintuitive without careful thought (and formal mathematics). This has led to a collection of results termed paradoxes or fallacies, though they're not really paradoxes, and the fallacies lie not in probabilistic reasoning but in uninformed interpretations of probability. It has also led to a mini-genre of popular books on the subject. Think of Warren Weaver's *Lady Luck*, Brian Everitt's *Chance Rules*, Leonard Mlodinow's *The Drunkard's Walk*, John Haigh's *Taking Chances*, Jeffrey Rosenthal's *Struck by Lightning*, and Joseph Mazur's *What's Luck Got To Do With It?*. (My apologies if I have not listed your favourite – there are a *lot* of them.)

The particular aspect that I addressed in my book was that of highly improbable events, but events which nevertheless happened. These are things like people winning the lottery several times, or the same lottery numbers coming up in different weeks. Or people being struck by lightning multiple times (despite the old adage that "lightning never strikes twice"). Or financial crashes occurring when calculations show they shouldn't be expected in 20 billion years. Or more mundane things like people bumping into their neighbours when travelling overseas, or meeting someone with the same name (such as the other David Hand I once met at a conference). And so on.

Surely, intuition tells us, these things are incredibly unlikely, so we shouldn't expect to see them. Indeed, some very eminent philosophers and mathematicians have pointed this out. Jean D'Alembert questioned whether it's possible to observe a very long sequence of heads in a random series of events in which heads and tails are equally likely. Antoine-Augustin Cournot coined the principle that *an event with very small probability will not happen*. And the eminent mathematician Émile Borel coined what is now called Borel's law: *events with a sufficiently small probability never occur*. If an event is so improbable that we wouldn't expect to see it in the entire history of the universe, then it is only rational – in *practical* terms – to regard it as impossible.

But the painful truth is that, as my book illustrates with many true stories, events which appear to have extraordinarily low probability do keep happening. As the improbability principle has it: *highly improbable events are commonplace*.

In my book, I have tried to create a framework for the explanations. I've done this through the vehicle of five "laws", which will be recognised by professional statisticians.

The law of inevitability says that one of a complete list of outcomes must occur. It's a sort of converse of the law of total probability.

The law of truly large numbers (which already appears in the statistical literature) says that, given enough opportunities, the most extraordinarily unlikely things can occur. Any statistician who has grappled with multiple testing problems will appreciate this only too well.

One way of expressing *the law of selection* is that you can make things as probable as you want if you choose after the event. If this sounds banal, it can creep up in unexpected ways—and selection bias and the related phenomenon of regression to the mean are familiar concepts to statisticians.

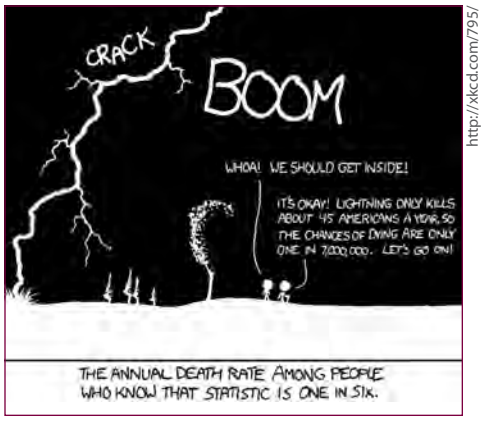
The law of near enough is concerned with how one defines the reference class. Make it broad enough and you can make the estimated probability as large as you like.

The law of the probability lever is to do with choosing models. With poor assumptions even highly likely events can seem very improbable. Classic examples of this concern the tails of distributions and independence assumptions.

Those five laws are not the end of the improbability principle. Sitting on top of them is the human mind, and the difficulty it often has in grasping the subtleties of probability: the base rate fallacy, the prosecutor's fallacy, the availability heuristic, …. The list is almost endless.

Put all these things together, and it is hardly surprising that *highly improbable events happen every day*.

Just because it's highly unlikely… doesn't mean you should stay outside in a thunderstorm! With thanks to xkcd.com for the joke.



http://xkcd.com/795/

The wavelet boom, and its statistical children

Guest columnist Dominique Picard considers the statistical legacy of wavelets. [*References appear on the Bulletin website*]

Once upon a time (around the nineties), wavelet analysis emerged as a major tool in various disciplines, including several branches of pure and applied mathematics and statistics. The primary intent at this time was to produce and exploit the properties of a basis which was concentrated at the same time in space and frequency.

This program has indeed been extensively conducted and many results have been achieved ever since, that were not even conceivable. Since then, many of the first objectives have changed and produced new orientations for research. Moreover and quite surprisingly, many of the recent developments in statistics find some of their roots in the wavelet theory.

Among them, obviously, the multiple results on functional estimation, inverse problems, minimax rates of estimation, nonparametric Bayesian estimation and adaptation of procedures have certainly be highly stimulated by the growing activities around wavelets. Even the notion of *sparsity,* which is nowadays extensively used in high dimensional problems, has many connections to this program.

Indeed one major concern in functional estimation at the beginning of the nineties was to investigate how to best express the standard functional regularity assumptions such as Lipschitz or Sobolev conditions. At this point, the Besov spaces $B^q_{s,p}$ have been essential tools since they proved to be the ideal framework in which regularity conditions exactly translated in *generalized* ℓ_p balls in the domain of wavelet coefficients. At this occasion, it appeared that for $p < 2$, $q = p$ and specified regularities (namely $s = 1/p - 1/2$), these Besov spaces were exactly ℓ_p spaces, the same ℓ_p spaces which are now widely used to express sparsity in many different frameworks.

Concerning the wavelet approach, many new directions of research have meanwhile emerged. Let us illustrate this with two basic aspects which have been recently extensively investigated: adapt the construction of wavelets to different problems and produce new ways of exploiting wavelets constructions.

1. Adapt the wavelet construction to the problem at hand

Very early, an increasingly important domain of activity has been to find new wavelets and extend their domain of application. Wavelet packets, simlets, curvelets, edgelets, bandelets, ..., were thereby produced to better analyse pictures, contours, discontinuities, surfaces and so on. Nowadays significant energy is still dedicated to produce wavelet constructions adapted to various statistical problems.

A seminal example is the spherical data case. This domain has obviously been motivated by a number of important applications. Let us only mention here the fascinating and multiple statistical challenges posed by the astrophysical data: denoising a signal, impainting the zones where it is covered by other radiations, testing stationarity (rotation invariance) or Gaussianity of the signal, investigating the fundamental properties of the cosmic microwave background (CMB), providing cosmological maps, investigating clusters of galaxies, point sources, exploring the true nature of ultra high energy cosmic rays, and more. See for instance the review by Starck[29] on the use of various wavelet tools in this domain.

To our knowledge, the first construction of wavelets on the sphere was introduced by Dahlke et al.[12] using a tensor product basis where one factor is an exponential spline. Schröder and Sweldens[28] used a "lifting scheme". Other well-known methods are obtained via a domain decomposition approach (see Dahmen and Schneider[13], Canuto et al.[6], Cohen and Masson[9] for related techniques). Other constructions (Antoine and Vandergheynst[1]) use a group theoretical approach. Others as Narcowich et al.[23,24], Petrushev and Xu[25] use a smooth Littlewood Paley decomposition associated to a discretization using a cubature formula.

Generalizing this aspect, an important effort has been put on the construction of wavelets on manifolds or more general domains, with the two especially challenging examples of the construction of wavelets on spaces of matrices or on spaces of graphs to contribute to the emerging field of signal processing on graphs and extending high-dimensional data analysis to networks and other irregular domains.

2. Wavelet construction starting from an operator

Although wavelets seem to be the ideal framework to study the high frequency phenomena, their use in this domain has been intensively developed only quite recently. There are important technical reasons to explain why the use of wavelets in a high frequency environment is considerably more challenging than in a traditional framework. Loosely speaking, high resolution analysis fundamentally requires the construction of wavelet bases which are specifically adapted to the problem at hand. For instance, in finance, cosmology or tomography, data either are observed on very particular domains, not necessarily well adapted to traditional wavelets (as the sphere in astrophysics) or they are observed after being blurred by a linear operator (Radon transform in the case of tomography, differential operators in finance). More frequently, a combination of these difficulties occur in the same problem.

In a regular manifold or in a linear inverse problem there is often an operator which is genuinely involved in the problem (the Laplacian operator in the manifold case, Radon or convolution operators in standard inverse problems). These operators usually have a basis of eigenvectors which is an important tool of the problem, but

very frequently these eigenvectors are poorly concentrated in space (as it is the case for instance, for the trigonometric basis on the interval, or the spherical harmonics in the sphere case).

More precisely, in lots of mathematical situations we have $\mathcal{Y}$, a compact metric space, μ, a finite Borelian measure and the following decomposition:

$$\mathbb{L}_2(\mathcal{Y},\mu) = \bigoplus_{k=0}^{\infty} \mathcal{H}_k,$$

where each $\mathcal{H}_k$ is a finite dimensional eigenspace associated to the spectral decomposition of a natural operator on $(\mathcal{Y},\mu)$ — say Δ-. Let L_k denote the orthogonal projection on $\mathcal{H}_k$ with the following kernel (if each e_i^k is forming an orthonormal basis of $\mathcal{H}_k$):

$$L_k(x,y) = \sum_{i=1}^{l_k} e_i^k(x)\, e_i^k(y).$$

In some of these situations, the 'mother' and 'father' needlet 'basis' can be expressed in the form: for $\xi \in X_j$,

$$\varphi_{j,\xi}(x)=\sqrt{\lambda_{j,\xi}} \sum_{2^{j-1}<k<2^{j+1}} \sqrt{a\left(\tfrac{k}{2^j}\right)}\, L_k(x,\xi),\quad \psi_{j,\xi}(x)=\sqrt{\lambda_{j,\xi}} \sum_{2^{j-1}<k<2^{j+1}} \sqrt{b\left(\tfrac{k}{2^j}\right)}\, L_k(x,\xi).$$

where a and b are regular compactly supported smoothing functions, X_j is a regular network in $\mathcal{Y}$ and the coefficients $\lambda_{j,\xi}$ are coming from a cubature formula. Such constructions have (under appropriate conditions) the beautiful property of producing localised frames. The localisation results can be found in Narcowitch et al.[23,24], Petrushev and Xu[25], or in Coulhon et al.[11] in a completely general framework.

In this direction we also mention the work of Hammond et al.[18] constructing wavelet frames defined on the vertices of an arbitrary finite weighted graph.

Constructions of such types have successfully been used in the case of high frequency astrophysical observations for testing the stationarity or the Gaussianity of the cosmological microwave background, as in Baldi et al.[2,3], Pietrobon et al.[26], Delabrouille et al[14], Faye et al.[16]. These applications fundamentally used the concentration in space and frequency of the wavelet bases, leading to wavelet coefficients being well estimated when the signal is present and decorrelated if the signal is stationary.

The same constructions have also been used in inverse problems where the coefficients on the eigenvector functions can easily been estimated, leading to the wavelet coefficients by a simple linear transformation (see, for example, Cohen et al.[8], for general inverse models; Kerkyacharian et al.[21], concerning the sphere deconvolution; Kerkyacharian et al.[19, 20] for the Radon transform).

3. New wavelet methods, learning and Bayesian methods

Massive learning: In 1997, Donoho[15] highlighted the connection between CART methods (Breiman et al.[5]) and the search for a best orthogonal basis among anisotropic Haar wavelet bases. This connection still makes sense for the more implementable procedures in high dimension such as random forests.

Moving to the frequency domain, in the recent years, methods based on graph Laplacians have become increasingly popular in machine learning. They have been used in unsupervised or semi-supervised learning (Belkin and Niyogi[4]; Zhou et al.[32]), spectral clustering (Spielman and Teng[27]; von Luxburg[31]) and dimensionality reduction (Belkin and Niyogi[4]). Their popularity is mainly due to the following properties of the Laplacian:

- the eigenvectors of the Laplacian translate the deep geometric structure which leads to a natural choice of a kernel in the spectral clustering, for instance
- the Laplacian induces a genuine regularization, adapting to the geometric structure of the data, which is fundamental in various situations: denoising, semi-supervised learning, classification...
- the Laplacian is the generator of a diffusion process whose properties are linked with clustering or label propagation in semi-supervised learning.

One generally assumes that the data (even though in a very high dimensional setting) has a hidden, low dimensional structure—for example, the data lies on a low dimensional manifold. The goal is to construct a mapping that parameterizes this low dimensional structure, revealing the intrinsic geometry of the data.

A major step in this direction was achieved by the work on diffusion maps by Coifman et al.[10,22]. This is a deep theory on diffusion processes for finding meaningful geometric descriptions of data sets. It shows in particular that eigenfunctions of Markov matrices can be used to construct coordinates called diffusion maps that generate efficient representations of complex geometric structures. The associated family of diffusion distances, obtained by iterating the Markov matrix, defines multiscale geometries that prove to be useful in the context of data parametrization and dimensionality reduction. This framework especially relates the spectral properties of Markov processes to their geometric counterparts and unifies ideas arising in a variety of contexts such as machine learning, spectral graph theory and eigenmap methods.

Bayesian methods: Works devoted to deeply understanding the behaviour of Bayesian nonparametric methods have recently experienced a considerable development in particular after the seminal works of A. W. van der Vaart et al.[17,30]. Especially, the class of Gaussian processes forms an important family of nonparametric prior distributions, for which precise rates have been obtained. Also, a vast class of priors have been produced using appropriate distributions directly on the collection of wavelet coefficients.

Moreover adaptation to diverse function classes has been obtained

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using for instance a randomized rescaling of the Gaussian processes. If the data is observed in a more intricate setting than $[0, 1]^d$ —a regular manifold, for instance—this rescaling is made possible by introducing a notion of time decoupled from the underlying space and issued from the semi-group property of a family of operators. Another important difference brought by the geometrical nature of the problem is the underlying Gaussian process, which now originates from an harmonic analysis of the data space, with the rescaling naturally acting on the frequency domain (see Castillo et al.[7]).

This construction of a prior is very much coupled with the general construction in Coulhon et al.[11] of wavelet bases initiated from an operator, and its application in spaces of matrices or graphs currently investigated in probability or learning theory seems promising. Moreover this construction is to be compared to priors obtained via distributions on the collection of wavelet coefficient for well suited wavelet bases.

[The references in this article are listed in the html version that appears at http://bulletin.imstat.org]

Obituary: Steve Arnold

1944–2014

Steven F. Arnold

Steven Ferris Arnold, age 70, of State College, PA, died December 6, 2014, at his residence. Steve was Professor Emeritus of Statistics at Penn State University. Steve was a 1966 graduate of Knox College in Galesburg, Ill., summa cum laude, and earned a MS (1967) and PhD in Statistics from Stanford University in 1970, with Professor Ingram Olkin as advisor. Before joining the Statistics Department at Penn State, he was an associate professor of mathematics at Lawrence University in Appleton, Wis. After coming to Penn State in 1976, Steve wrote two textbooks, *The Theory of Linear Models and Multivariate Analysis*, Wiley, 1981, and *Mathematical Statistics*, Prentice-Hall, 1990. He was also a co-author with A. Stuart and K. Ord of *Kendall's Advanced Theory of Statistics, Volume 2A, Classical Inference and the Linear Model*, Wiley 1998, a widely cited treatise in the field. Professor Arnold's publications made significant contributions to multivariate analysis, linear models, patterned covariance matrices, repeated measures, and invariance. He was active in campus life, serving on the Academic Standards Committee and the Undergraduate Education Committee of the Penn State Faculty Senate. In 1994 he proposed and served as the founding faculty member in charge of the new undergraduate major in Statistics, guided it through the Faculty Senate for approval, and directed the program for eight years. For many years he served as the Statistics Department representative to the Operations Research Program and to the Schreyer Honors College. He also served as a consultant on many projects, including the Diabetic Foot Clinic in State College, and the Center for Locomotion Studies at Penn State. He retired from Penn State University in June 2013.

Professor Arnold supervised 11 PhD students in statistics, many master's students, and served on multiple PhD committees in a wide variety of fields, including agriculture, engineering, mathematics and physiology.

Born March 8, 1944, in Milwaukee, Wis., he was the son of David Rudd and Jean Gebhart Arnold. He is survived by his wife of nearly fifty years, Rana (McMurray) Arnold; two sons, Timothy and his wife, Jules, of Frankfort, KY., and Christopher, of Quincy, Mass.; two sisters, Nancy Wilson and her husband, Grady, of Carrolton, TX, Judith Connor and her husband, Jerry, of Winnetka, IL.; and two grandchildren, Elizabeth and Vivian, of Frankfort KY; his paternal uncle and aunt, Hugh and Phyllis Arnold, of Greely, Colo.; and his maternal aunt, Ruth Belmour, of San Francisco, Calif.; and many other relations around the world.

Well-read, Steve had a remarkable breadth of knowledge and interests. He could speak intelligently on topics from Faulkner to Fidelio to foreign affairs. Steve's ready wit made such conversations not only illuminating, but enjoyable. His intelligence and sense of humor will be missed. Steve had a special love of basketball and tennis, playing each until he was no longer able to be competitive. He remained an avid fan, and never passed on an opportunity to take in a basketball game or a tennis match. One of the things he enjoyed most was watching a good, competitive game.

Written by James L Rosenberger, Professor of Statistics, and William L Harkness, Professor Emeritus of Statistics, both former department heads at Penn State

Obituary: Eugene Dynkin

1924–2014

Division of Rare and Manuscript Collections, Cornell University Library

Eugene Dynkin, the A.R. Bullis Professor of Mathematics Emeritus at Cornell University, died November 14, 2014, in Ithaca, NY. He was 90. He is survived by his wife, Irene; a daughter, Olga Barel; three grandchildren; and seven great-grandchildren.

Evgenii Borisovich Dynkin was born in Leningrad (now St. Petersburg) in 1924. When he was 11 his family was exiled to Kazakhstan and, two years later, his father disappeared in the gulag. On accepting the AMS Leroy P. Steele Prize, Dynkin said it was almost a miracle he was accepted at Moscow University at the age of 16 to study mathematics. There, he attended the seminars of I. Gel'fand and A. Kolmogorov.

Early in his career, Dynkin made outstanding contributions to Lie theory and introduced the diagrams now known as Dynkin or Coxeter–Dynkin diagrams. This work found applications in the study of elementary particle physics. He also discovered the explicit formula for the universal coefficients of the Baker–Campbell–Hausdorff series describing the logarithm of the product of two exponentials. He kept a keen interest in Lie theory throughout his career, which he described as "Seventy Years in Mathematics". Several of his Moscow former students became worldwide leaders in Lie theory and Algebra.

Dynkin made even more outstanding contributions to Probability Theory where he played a major role in the development of the theory of Markov Processes. His books, *Foundations of the theory of Markov processes* (1959) and *Markov processes* (1963), became highly influential. Among several important conceptual breakthroughs, Dynkin can be credited with the idea of looking at a Markov process as a single stochastic process under a collection of probability measures corresponding to the possible initial values, the introduction of the shift operators, and the rigorous formulation and proof of the strong Markov property.

At the 1962 International Congress of Mathematicians in Stockholm, Dynkin's plenary lecture "Markov Processes and Problems in Analysis" was read by Kolmogorov. On each of the three occasions Dynkin was invited to speak at the International Congress of Mathematicians (Stockholm, Nice and Vancouver), his lecture was delivered by a colleague as he was not authorized to leave the Soviet Union.

In 1968, Dynkin's work at the University of Moscow was interrupted and he became a senior scientist at the Central Economics and Mathematics Institute of the USSR Academy of Sciences. There, he attracted young researchers and developed results in mathematical economics regarding economic growth and economic equilibrium under uncertainty. It was for this work that he was invited to speak at the 1974 International Congress of Mathematicians in Vancouver.

At the end of 1976, Dynkin left the Soviet Union and immigrated to the United States. He found a new home in Ithaca, attracted by Cornell established tradition of excellence in Probability Theory and Mathematical Statistics. He was proud to have become part of this long tradition. At Cornell, he pursued his famous work on the relation between occupation times of a Markov process and Gaussian random fields, with striking applications to multiple points of Brownian motion, before turning to the development of the theory of superprocesses, a class of measure-valued Markov processes which gives probabilistic solutions to certain nonlinear PDE's. He remained active in mathematical research until his death.

Dynkin was a courageous, organized and determined human being who dedicated most of his life to the study of mathematics and to the mathematical community. Many of his ideas and contributions were foundational in nature and have gained a permanent place in mathematics, influencing the work of many others. The Dynkin Collection of mathematics interviews (available at http://dynkincollection.library.cornell.edu/) contains interviews which were recorded over the span of more than fifty years, starting with H. Cramér in 1955. It illustrates Dynkin's interest and faith in the mathematical community at large. He worked tirelessly to make sure this remarkable collection becomes available to all via the World Wide Web. Most important to him was his role as a mentor and supporter of young talents. Indeed, Dynkin has over five-hundred mathematical descendants. Through his unique work with talented high school students in Moscow mathematical circles, his Moscow seminar, and his outstanding lecturing and teaching, he touched and transformed the life of many an apprentice mathematician.

Dynkin's contributions were recognized by numerous distinctions. He received the Prize of the Moscow Mathematical Society in 1951 and the Leroy P. Steele Prize for life time achievement from the American Mathematical Society in 1993. He was a fellow of the Institute of Mathematical Statistics, of the American Mathematical Society and of the American Academy of Arts and Sciences. He was a member of the National Academy of Sciences of the United States.

Written by Laurent Saloff-Coste
Cornell University

Obituary: Henry Teicher

1922–2014

Henry Earl Teicher, husband, father, friend and colleague, passed away on November 12, 2014 at the age of 92.

Henry Teicher was born July 9, 1922, in Jersey City, NJ. Henry received his PhD in statistics from Columbia University in 1950, and served in professorial positions at Purdue until 1967. He then went to Columbia as a visiting professor, before coming to Rutgers as Professor in 1968. At Rutgers, Henry contributed to a strong presence in probability, while also being part of an outstanding group in the theory of statistics. He had been a pillar of the department before his retirement at 1993, and continued to be admired for his outstanding scholarship. His wide recognition led to visiting appointments at Stanford, Columbia, New York University and the University of Perugia.

Henry's research in mathematical statistics and probability includes major contributions to the theory of mixtures of distributions, U-Statistics, strong laws and laws of the iterated logarithm, exchangeable and interchangeable random variables, stopping sums and other topics in probability and mathematical statistics. We will discuss some of Henry's research that has had major impact.

Mixtures of Distributions: Henry's *Annals of Mathematical Statistics* papers on mixtures of distributions (1960) and identifiability of mixtures (1961, '63) had wide impact, with the 1963 paper having 407 citations.

Law of the Iterated Logarithm and strong laws: His 1974 *Annals of Probability* paper on sufficient conditions for random variable to follow the iterated logarithm law was also widely cited. A year later it was followed by a *Z. Wahrscheinlichkeit* article giving a necessary condition. The iterated logarithm law was a continuing research interest with a 1977 *Annals of Probability* paper with Klass, a 1979 *Z. Wahrscheinlichkeit* paper studying iterated logarithm, strong laws and exponential bounds, and a 1981 *Z. Wahrscheinlichkeit* paper with Chow, Wei, and Yu. Henry's research in strong laws first appeared in a 1968 *Proceedings of the National Academy of Science* paper. This interest continued even after retirement, resulting in a 1996 *Stud. Sci. Math. Hung.* paper with Deheuvel, and a 1998 *J. Theoretical Probability* paper on strong laws for martingales.

Stopping Rules and Times: Henry's 1965 *Annals of Mathematical Statistics* paper with Chow and Robbins on moments of stopping times had major impact, was widely cited, and was a continuing fascination for decades. This was followed by papers on optimal stopping with Dubins (*Annals of Mathematical Statistics* 1967), Wolfowitz (*Z. Wahrscheinlichkeit* 1968), as well as multiple papers on stopping sums. Thirty years after the 1965 paper with Chow and Robbins, Henry revisited randomly stopped sums in a *J. Theoretical Probability* paper, and in 1998, in a *London Math. Society Journal* paper with C. Zhang.

Henry was elected fellow of the Institute of Mathematical Statistics in recognition of his seminal research in mathematical statistics and probability. His classic book with Y.S. Chow on probability theory educated generations of graduate students. With editions in 1978, 1988, and 1998, and over a thousand citations just in the past four years, the book is listed among thirteen influential books in Columbia University department's history.

Henry was the cherished husband of 52 years to Anne Teicher, and beloved to daughter Rikke Cumberbatch, son-in-law Glen, grandson Duncan and granddaughter Taliah. He will be greatly missed by his family, colleagues, and friends.

Written by Joseph Naus
Rutgers, The State University of New Jersey

Recent papers: *Statistics Surveys* Volume 8, 2014

Statistics Surveys publishes survey articles in theoretical, computational, and applied statistics. The style of articles may range from reviews of recent research to graduate textbook exposition. Articles may be broad or narrow in scope. The essential requirements are a well specified topic and target audience, together with clear exposition. *Statistics Surveys* is sponsored by IMS< ASA< SSC and the Bernoulli Society. The Coordinating Editor is Wendy L. Martinez and the IMS Editor is Donald Richards. See http://imstat.org/ss/

Access papers at http://projecteuclid.org/ss

Recent papers

Electronic Journal of Statistics Vol 8, no. 2, 2014

The *Electronic Journal of Statistics* (*EJS*) publishes research articles and short notes on theoretical, computational and applied statistics. The journal is open access. Articles are refereed and are held to the same standard as articles in other IMS journals. Articles become publicly available shortly after they are accepted. *EJS* is sponsored by IMS and the Bernoulli Society.

Access papers at http://projecteuclid.org/ss

Special Section on Statistics of Time Warpings and Phase Variations

Articles

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Recent papers: *Electronic Journal of Statistics*

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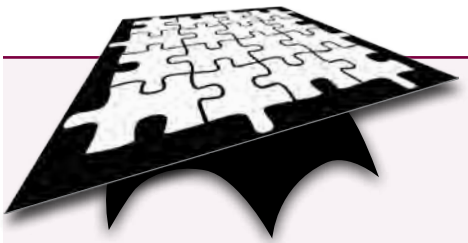


Student Puzzle Corner 8

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 with subject "Student Puzzle Corner"**). The deadline is **March 5, 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.

In the December 2014 issue, we considered a problem on random matrices. This time, we will look at a somewhat unconventional problem on **statistical inference**.

We want to experimentally measure a physical constant, say μ, that equals some positive integer k. We can repeat the experiment, but our measurements always have some experimental error. Suppose we model the sequence of experimental measurements $X_1, \ldots, X_n$ as $X_i = \mu + \epsilon_i$, $i = 1, \ldots, n$, where $\epsilon_i \overset{\text{iid}}{\sim} N(0, \sigma^2)$, $\sigma > 0$. The primary parameter μ as well as the nuisance parameter σ are unknown; we need to estimate them. The parameter space is $\Theta = \mathcal{Z}_+ \times (0, \infty)$. Here is this issue's exact problem:

(a) Prove that for all n and all sample data $(x_1, \ldots, x_n)$, there exist unique MLEs of μ, σ^2, and write them explicitly (that is, in completely closed form).

(b) The possible values of the primary parameter μ are separated; thus, intuitively, it is very hard for the MLE to get confused between the true value of μ and its illegitimate competitors. Heuristically, one would expect that the MLE $\hat{\mu}$ converges to the true μ very rapidly. To make it precise, calculate exactly $P_\mu(\hat{\mu} \neq \mu)$ and show that it converges to zero exponentially fast.

(c) Give a proof that $\hat{\sigma}^2$, the MLE of σ^2, is also consistent in this scenario.

And now, a little background and discussion. Once you work the problem out, you will appreciate and enjoy the intuitive appeal of maximum likelihood. What comes naturally will stare you at the eye. If you are curious, change the model from Gaussian to something else, and see what happens then. Also, this is a simply stated problem in which estimates of different components of the parameter vector converge at different rates; this also happens in problems which are partly regular and partly non-regular. The part that's regular will converge at the conventional $\sqrt{n}$ rate, while the part that's irregular, perhaps asymptotically exponential, will converge at a faster rate.

To some decimals, certain physical constants are indeed positive integers, perhaps on scaling. One instance is the reciprocal of the *fine structure constant* in cosmology; more common examples are the proton–neutron mass ratio and Avogadro's number. An interesting fact about Avogadro's number is that Einstein presented a novel statistical estimate of it in his PhD thesis, and it is the first well known use of moment estimates. Einstein was not the first person to estimate Avogadro's number; actually, in his thesis, he first made a calculation error and got an estimate inconsistent with estimates made by Jean Perrin. Einstein asked Ludwig Hopf to find the error, which he did in fact find, and corrected Einstein's estimate of the Avogadro number.

The solution to the previous problem is on **page 16**

Student Puzzle Corner 7: Solution

The problem asked was the following: what is an exact expression for the singularity probability $f(p)$ of a 3×3 random matrix with iid Rademacher entries having the distribution $P(1)=p$, $P(-1)=1-p$, to find its average over p, and to show that it is minimized at $p = \frac{1}{2}$.

Yixin Wang (above) and Tengyuan Liang (below) submitted correct answers

Yixin Wang (Columbia University) and Tengyuan Liang (Wharton School, University of Pennsylvania), provided correct solutions to the various parts of the problem.

This can actually be done by a brute force complete enumeration. Alternatively, condition on the first two rows and denote the third row by (x, y, z), and calculate the determinant. It is a linear function of x, y, z; find the probability that the determinant is zero. Now uncondition and obtain the unconditional probability that the determinant is zero. At first sight, the singularity probability $f(p)$ is a polynomial of degree 9. But cancellation occurs and it is actually the sixth degree polynomial

$$f(p) = 1 - 18p^2 + 84p^3 - 162p^4 + 144p^5 - 48p^6.$$

Immediately, the average singularity probability is $\int_0^1 f(p)\,dp = \frac{26}{35}$, and $f(\frac{1}{2}) = \frac{5}{8}$. Pictures can be deceiving, and this is an instance. A coarse scale picture would suggest that $f(p)$ is convex over the unit interval. It is not. It has the concave-convex-concave shape. $f''(p)$ is a polynomial of degree four and has a double zero at $p = \frac{1}{2}$ and two other distinct zeros in the unit interval. It has no other real or complex roots. The first derivative $f'(p)$ is a polynomial of degree five, has a zero at $p = 0$, 1, and $\frac{1}{2}$, and the zero at $\frac{1}{2}$ is a triple zero. The first derivative has no other roots. From the symmetry of $f(p)$ and the fact that it is strictly decreasing in a right neighborhood of zero and so, strictly increasing in a left neighborhood of $p = 1$, it now follows that the minimum must be at $p = \frac{1}{2}$.

We have here the function $f(p)$ written explicitly; an interesting question is whether the coefficients in the polynomial have some relations to a well known number theoretic function. The same question could be asked for other values of n.

Report: 13th Biennial ISOSS Conference

Shahjahan Khan reports: The 13th Islamic Countries Conference on Statistical Sciences (ICCS-13) was held in Bogor, Indonesia, 18–21 December 2014; it was jointly organised by Bogor Agricultural University (BAU) and Islamic Countries Society of Statistical Sciences (ISOSS). The theme was 'Statistics for Better Life'.

In the opening session of the conference, the Organising Committee Chair, Prof. Asep Saefuddin, Trilogi University, welcomed the participants. Dr Savas Alpay, Director General of the Statistical, Economic and Social Research and Training Centre for Islamic Countries (SESRIC) emphasised the importance of statistical capacity building and cooperation between national statistics offices and professional organisations such as ISOSS. Acting President of ISOSS, Prof Shahjahan Khan explained the role of ISOSS in bringing together practicing statisticians and researchers of diverse backgrounds on the same platform to improve the quality and development of statistics to serve humanity. Founding President Munir Ahmad gave a history of ISOSS.

Prof Illah Sailah, Indonesia's Ministry of Research, Technology and Higher Education emphasised the need of timely, good quality statistics for the formulation of government policies. The Deputy Chief Statistician for Production of Statistics in Indonesia, Dr Adi Lumaksono discussed the activities of the National Statistics Office and how they are engaging with government departments. The Vice Rector of BAU Prof Hermanto Siregar talked about BAU's significant scientific contributions.

Prof Haryono Suyono, a former Minister of Population of Indonesia presented the first keynote address focussing on the history of developing appropriate index to measure the fertility of Indonesia and how the program was successful in managing population growth. Prof M Ashraf Memon, University of Queensland, presented a panel session on medical meta-analysis covering different issues related to the current meta-analytic methods in the context of three different meta-analyses on surgical data.

There were two workshops in the conference: "Big Data Analysis" by Prof S Ejaz Ahmed and "Essentials of 21st Century Undergraduate Statistics Curriculum" by Shahjahan Khan. The focus of the second workshop was to use educational technologies and adopt appropriate changes in teaching statistics through data analysis and ensure graduates to know statistical computing including database management, multivariable calculus and statistical methods with the ability to communicate technical knowledge in the global context.

The conference dinner was hosted by the Mayor of Bogor, Dr Bima Arya Sugiarto. The conference tour was to Taman Mini Indonesia Indah, a miniature park containing history, culture and geographical aspects of all 34 states of Indonesia.

In the business session of the conference, Prof Abdul Ghapor Hussin of the National Defence University of Malaysia was elected as the fourth President of ISOSS for the next two years. The meeting announced the next ICCS-14 to be held at the Sultan Qaboos University, Oman, 17–20 December 2016.

A proposal to establish a Statistics Centre of Excellence in Kuala Lumpur, Malaysia was unanimously approved by the delegates, who agreed to work with other international statistical organisations for joint activities and cooperation. The launching of a new Journal of ISOSS was also approved.

The ISOSS Gold Medal was awarded to Asep Saefuddin for outstanding contributions in the development and promotion of statistics in Indonesia and beyond, and to M Hanif Mian for his promotion of ISOSS and development of numerous sample survey techniques.

The full report, and some photos, appear in the online version at **bulletin.imstat.org**

Terence's Stuff: Why do we do research?

A career in research requires, above all else, enough motivation—and a real passion for the subject—argues Terry Speed.

This sound like a question best answered via a survey conducted by a body such as *Vitae*, an international program "dedicated to realising the potential of researchers through transforming their professional and career development." But no, it is just based on my general experience.

I tell all who ask me about PhDs or a research career afterwards that I think their *motives* for wanting to do research are incredibly important. That they should only embark on a PhD, or on research later, if they really want to do it, after having thought hard. Talking to others is important, especially those who have gone before. Exactly what they should think or talk about varies, but relevant topics include their personality, values, skills and experience, learning style, and what they are good at, and like doing.

Why are motives so important? The PhD experience and later research will have lots of ups and downs. Over the years it will typically combine material poverty with intellectual wealth, depression with elation, fear with assurance, listlessness with industriousness, loneliness with collegiality, and much else. It will be a roller-coaster ride, with many challenges, and my point is this: motivation needs to be maintained throughout. Also needed are the *opportunity* and the *means*, but in my view these are secondary to motivation.

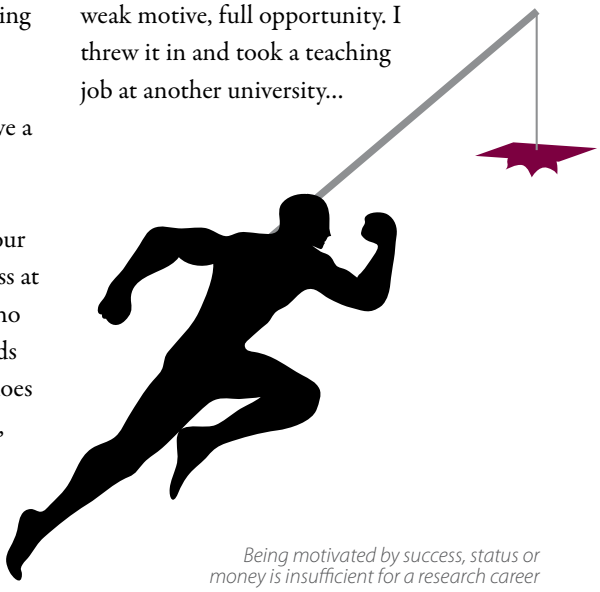
I try not to show it, but my heart sinks when people tell me they want to do a PhD or research afterwards in order that they can be a professor. I would much prefer that they began with something about their desire to make a difference by teaching statistics, or by contributing to another field of science through their statistical research. Barring that, I prefer to hear first that they love learning, that they want to learn more about our subject, or that they have a great curiosity about some aspect of it, a desire to get to the bottom of something, or that they get real pleasure from solving probability or statistics problems, or analyzing data. Terms I like to hear early on include *thirst for*, *passionate about*, *excited by*, *burning desire to*, or *love of*, though I'm willing to accept synonyms. Terms I am not so fond of hearing include secure, comfortable or respected, these usually being aspects of the life of a successful researcher, rather than of doing (or trying to do) research. Recently, someone told me she wanted to do research so that she could publish papers in top journals and become famous and respected.

Of course I'm not totally naïve. I've always liked the fable about the young person who set out to do good, and ended up not doing good but doing well. Good intentions don't always lead to good outcomes. Also, am I not being hypocritical? Here I am (or there I was) having a nice life at home, frequently travelling, seeing the world, meeting interesting people and occasionally collaborating with them: the modern academic life. If I have it, why does my heart sink when I meet someone else who would like to have a similar life? Why indeed?

This leads to my next question: Are there identifiable relationships between our motives for doing research and our success at research? For example, will the person who wants to do a PhD as the first step towards an academic career, and is qualified but does not admit any thirst, passion, excitement, desire or love for any aspect of statistics, do as well as one of my equally well-qualified, excited passionistas? I think probably not. I think that they will find it harder to maintain their motivation, but I confess to having no hard evidence on this, and I may be wrong. Perhaps the people at *Vitae* know the answer, but if so, a subscription seems necessary to learn it.

Most of what I have mentioned so far relates to people going directly to a PhD after a standard undergraduate experience. There are three other categories of beginning researchers who tend to have better than average prospects of success. There are people who (a) gained research experience as undergrads, liked it and did well at it; (b) have researchers in their family; and (c) finished first degrees, went out and worked for a while, and decided to come back to learn how to do research, so that they could be in charge. People in categories (a) and (b) have good direct or indirect knowledge of what research is, especially the ups and downs, while those in category (c) have made a big sacrifice: that alone makes them highly motivated.

How did I start research? My professor suggested it. I took his advice, asked no questions, got a scholarship and started research. Three months later I was depressed, frightened, lonely and listless. No means, weak motive, full opportunity. I threw it in and took a teaching job at another university...



Being motivated by success, status or money is insufficient for a research career

IMS meetings around the world

IMS sponsored meeting

2015 ENAR/IMS Spring Meeting
March 15–18, 2015
Hyatt Regency, Miami, Florida, USA
w http://www.enar.org/meetings/spring2015/index.cfm

ENAR program chair: Mithat Gönen, Memorial Sloan Kettering Cancer Center. ENAR associate program chair: Brisa Sánchez, University of Michigan. IMS program chair: Lurdes Y. T. Inoue, University of Washington.

The 2015 ENAR Spring Meeting will be held at the Hyatt Regency Miami, in Miami, FL, from March 15–18. The meeting brings together researchers and practitioners from academia, industry and government, connected through a common interest in Biometry. There are two workshops immediately before the meeting: for junior biostatistics researchers (http://www.enar.org/meetings/JuniorResearch/index.cfm) and "Fostering Diversity in Biostatistics" workshop (http://www.enar.org/meetings/diversity/index.cfm)

Tilmann Gneiting will present the IMS Medallion Lecture *"Uncertainty Quantification in Complex Simulation Models Using Ensemble Copula Coupling".* The ENAR President's Invited Address will be given by David L. DeMets on *"Big Data, Big Opportunities, Big Challenges."*

The online abstract submission deadline has passed.

See website for additional hotel and travel information.

ENAR: 2016–2018

IMS sponsored meeting

2016 ENAR/IMS Spring Meeting
March 6–9, 2016, Austin, Texas
w http://www.enar.org/meetings.cfm

IMS sponsored meeting

2017 ENAR/IMS Spring Meeting
March 12–15, 2017, Washington DC
w http://www.enar.org/meetings.cfm

IMS sponsored meeting

2018 ENAR/IMS Spring Meeting
March 25–28, 2018, Atlanta, GA
w http://www.enar.org/meetings.cfm

IMS co-sponsored meeting

Fifth International Workshop in Sequential Methodologies (IWSM)
June 22–24, 2015
Columbia University, New York, NY
w TBC

Joint Statistical Meetings: 2015–2020

JSM 2015
August 8–13, 2015, Seattle, WA
w http://amstat.org/meetings/jsm/2015 UPDATED

See http://bulletin.imstat.org/2014/12/ims-invited-sessions-at-jsm-2015/ for the list of 30 IMS invited sessions. These include three **Wald Lectures** by Susan A. Murphy (Michigan, USA), the **Le Cam Lecture** by Jon Wellner (Washington, USA), and four **Medallion Lectures**: Jiashun Jin (Carnegie Mellon U, USA), Michael Kosorok (UNC Chapel Hill, USA), John Lafferty (Chicago, USA) and Nicolai Meinshausen (ETH Zürich, Switzerland). And there's the **IMS Presidential Address** by Erwin Bolthausen.

IMS sponsored meeting
JSM 2016
July 30–Aug 4, 2016, Chicago, IL
w http://amstat.org/meetings/jsm/

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

IMS sponsored meeting
JSM 2018
July 28–August 2, 2018
Vancouver, Canada

IMS sponsored meeting
IMS Annual Meeting @ JSM 2019
July 27–August 1, 2019
Denver, CO

IMS sponsored meeting
JSM 2020
August 1–6, 2020
Philadelphia, PA

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**

IMS co-sponsored meeting

22nd ASA/IMS Spring Research Conference (SRC 2015)
May 20–22, 2015, Cincinnati, Ohio

w http://www.cvent.com/d/44qpkn

The 22nd ASA/IMS Spring Research Conference (SRC 2015) on Statistics in Industry and Technology will be hosted by Procter & Gamble and held in Cincinnati, Ohio, at the Hyatt Regency, May 20–22, 2015. The theme is *Bridging Statistics Research and Application to Foster Innovation*, with topics including the design and analysis of experiments, computer experiments, big data, quality improvement and control, measurement systems, consumer research, statistical computing and applications to consumer products, the Air Force, and industry and government. Keynote speakers include Vijay Nair (University of Michigan) and Sallie Keller (Virginia Tech). The SRC promotes cross-disciplinary research in statistical methods and collaboration between researchers and practitioners.

We encourage you to **submit a contributed talk** to the conference. To present a contributed talk, please submit a title and abstract via the SRC 2015 website (deadline **April 1, 2015**). A number of $600 scholarships will be available to selected student and early career presenters. Details on the website, or contact the Contributed Program Chair, Byran Smucker, at smuckerb@miamioh.edu.

IMS co-sponsored meeting

Probability Theory and Combinatorial Optimization
March 14–15, 2015, Duke University, Durham, NC

w http://sites.duke.edu/steele2015/

Specific areas of coverage include random structures and algorithms, random graphs, probabilistic combinatorial optimization, and concentration inequalities. The conference honors J. Michael Steele's contributions to probability theory and combinatorial optimization on his 65th birthday. Invited speakers: David Aldous, Sourav Chatterjee, Luc Devroye, James A. Fill, David Gamarnik, Gábor Lugosi, Alexander Sasha Rakhlin, Sneha Subramanian, Ruth Williams, Joseph E. Yukich, J. Michael Steele. Registration is free, but required.

IMS sponsored meeting

WNAR/IMS Annual Meeting
June 14–17, 2015 [PLEASE NOTE NEW DATES] UPDATED
Boise State University, Boise, Idaho

w http://wnar.org/meetings/

The 2015 Western North American Region of The International Biometric Society (WNAR)/IMS Annual Meeting is in Boise, Idaho this year. It features a short course on *Modern Methods to Estimate Propensity Score Weights*, with instructors, by Dan McCaffrey and Matt Cefalu, RAND Corporation.

The invited session proposal deadline is extended to February 28: http://wnar.org/2015/02/invited-session-proposal-deadline-extended-to-february-28/. Registration opens March 24. The abstract submission deadline for Contributed Talks and the Student Paper Competition is April 24. Posters should be submitted by May 11.

NEW

17th IMS New Researchers Conference
August 6–8, 2015
University of Washington, Seattle, WA

w http://depts.washington.edu/imsnrc17/
e imsnrc17@uw.edu

The 17th IMS New Researchers Conference is hosted by the Department of Biostatistics at the University of Washington and will be held just prior to the 2015 JSM. The purpose of the conference is to promote interaction and networking among new researchers in probability and statistics. If you received a PhD in or after 2010, or expect to defend your thesis by the end of 2015, you are eligible to apply to attend. Due to limited space, participation is by invitation only. More information may be found at http://depts.washington.edu/imsnrc17/ including a link to the application information page. Application deadline is March 27, 2015. Higher priority will be given to first-time applicants. Women and minorities are encouraged to apply. Contingent on the availability of funds, financial support for travel and accommodation may be provided. However, participants are strongly encouraged to seek partial funding from other sources.

IMS co-sponsored meeting

Statistics and Exoplanets
August 3–5, 2015
Honolulu, Hawaii

w http://exostats.org

Statistics and Exoplanets is a Focus Meeting of the XXIX General Assembly of the International Astronomical Union (IAU); you will need to register for the IAU GA meeting in order to attend this meeting: see http://www.astronomy2015.org/.

IMS co-sponsored meeting

9th International Conference on Extreme Value Analysis: EVA 2015
June 15–19, 2015, Ann Arbor, Michigan

w http://sites.lsa.umich.edu/eva2015

The ninth international conference on Extreme Value Analysis will take place at the University of Michigan, Ann Arbor. It will feature recent research on the probability and statistics of extreme value phenomena and its important applications to climate and weather, finance, insurance, engineering and computer science. All students, researchers, practitioners, and scientists with interests in statistics of extremes are welcome. Abstracts are due February 27, 2015: see http://sites.lsa.umich.edu/eva2015/abstract-submission. Decisions on accepted talks/posters announced (by e-mail) by March 16, 2015. Registration is open now.

More IMS meetings around the world

IMS co-sponsored meeting

10th Conference on Bayesian Nonparametrics (BNP) UPDATED

June 22–26, 2015

Raleigh, NC, USA

w https://stat.duke.edu/bnp10/

BNP is an official section meeting of the ISBA's Bayesian nonparametrics section. Abstract submission is open posters (deadline May 1, 2015 or until max capacity reached, whichever is earlier).

IMS members are eligible for a **discount on registration**: drop an email to Elyse Gustafson, erg@imstat.org, to ask for your discount code, which you can then enter when registering at http://bayesian.org/civicrm/event/info?reset=1&id=33. (Click "Register Now", then on the next screen "Enter Code:" and click "Apply" for the discount to appear. Note you cannot receive two discounts if you are both an IMS and ISBA member!)

IMS co-sponsored meeting

International Symposium in Statistics (ISS) 2015

July 6–8, 2015, Memorial University, St. John's, Canada

w http://www.iss-2015-stjohns.ca/

The ISS-2015, on *Parametric and Semi-parametric Inferences for Spatial-temporal, and Multi-dimensional Familial-longitudinal Data,* is planned to discuss the methodological advances and challenges in the analysis of continuous and discrete correlated data both in parametric and semi-parametric setup.

The main topics of interest of this symposium are:

- Multivariate analysis in a wider non-normal elliptical distribution setup;
- Multivariate analysis for longitudinal categorical data;
- Time series volatility models;
- Spatial-temporal data analysis;
- Familial longitudinal data analysis in semi-parametric setup.

It is also of interest to discuss further challenges in analysis when data may contain measurement errors, missing values, and/or outliers, for example. The scientific program will include keynote, special invited, invited, and contributed paper sessions.

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.

IMS co-sponsored meeting

2015 Workshop on Finance, Insurance, Probability and Statistics (FIPS 2015)

June 25–27, 2015

Rutgers Student Center, New Brunswick, New Jersey

w http://www.fsrm.rutgers.edu/fips2015

The primary purpose of the workshop is to bring together a global cast of leading academic experts, practitioners and junior researchers to share research that underscores the contributions of Probability and Statistics to the development of quantitative models, methods, techniques and technologies in the fields of Finance and Insurance.

IMS co-sponsored meeting

INFORMS Applied Probability Society Conference 2015

July 5–8, 2015, Istanbul, Turkey

w TBC

The next APS meeting will be held at the Koç University campus (Istanbul, Turkey) on July 5–8, 2015. Details to follow.

IMS sponsored meeting

2015 IMS-China Conference on Statistics and Probability

July 1–4, 2015

Kunming, Yunnan, P. R. China

w http://www.2015imschina.com

Contact: Qiwei Yao **e** q.yao@lse.ac.uk

The fifth IMS-China International Conference on Statistics and Probability will be held in Kunming, China, from July 1–4, 2015. Its scientific program will cover a wide range of topics in probability, statistics and their related areas. The conference will also provide an excellent forum for scientific exchanges and for forging new research collaborations.

IMS co-sponsored meeting

2015 European Meeting of Statisticians

July 6–10, 2015

Amsterdam, The Netherlands

w http://ems2015.nl/

The European Meeting of Statisticians (EMS) is the main conference in statistics and probability in Europe. It is organized in a roughly two-yearly schedule and is sponsored by the European Regional Committee of the Bernoulli Society. The program consists of invited and contributed lectures, and posters, addressing a full range of subjects in statistics and its many applications.

The conference will be held at the campus of the VU University Amsterdam, from Monday, July 6 to Friday, July 10, 2015.

IMS co-sponsored meeting

UPDATED

38th Conference on Stochastic Processes and their Applications
July 13–17, 2015
Oxford, UK

w http://spa2015.oxford-man.ox.ac.uk

Call for papers

Submit papers for consideration using the online form: http://spa2015.oxford-man.ox.ac.uk/spa2015-registration. Submission deadline: February 28, 2015

The 38th Conference on Stochastic Processes and their Applications (SPA) will take place in Oxford, UK, from July 13–17, 2015. The conference is hosted by the Oxford-Man Institute of Quantitative Finance, the Mathematical Institute and the Department of Statistics, and is co-sponsored by IMS and the Bernoulli Society.

Plenary speakers

The plenary speakers include two **Medallion lectures**, from Grégory Miermont and Scott Sheffield; a **Schramm Lecture** from Michel Ledoux; and a **Doob Lecture** from Terence Tao. The full list is: Alan Hammond (UC Berkeley); Grégory Miermont (École Normale Supérieure de Lyon) IMS Medallion Lecture; Alexei Borodin (Massachusetts Institute of Technology); Michael Cranston (UCI) Itô Prize Lecture; Bénédicte Haas (Université Paris–Dauphine); Haya Kaspi (Technion–Israel Institute of Technology); Michel Ledoux (Université de Toulouse) Schramm Lecture; Régine Marchand (Université de Lorraine); Jason Miller (Massachusetts Institute of Technology); Sandrine Péché (Université Paris Diderot) Scott Sheffield (Massachusetts Institute of Technology) IMS Medallion Lecture; Christophe Sabot (Université Lyon 1); Andrew Stuart (University of Warwick); Terence Tao (UCLA) Doob Lecture; Augusto Teixeira (IMPA); Boris Tsirelson (Tel Aviv University) Lévy Lecture.

Discount for IMS members

Registration is open, and IMS members get a **discounted** rate. To obtain the preferential delegate rate for IMS Academic Members (£284.00) and IMS Student Members (£210.00), please use the code **SPAIMS** when registering.

IMS co-sponsored meeting

NEW

ISNPS Meeting
Biosciences, Medicine, and novel Non-Parametric Methods
July 12–15, 2015, Graz, Austria

w http://www.medunigraz.at/imi/isnps2015/index.php

The ISNPS (International Society of Non-Parametric Statistics) conferences take place biennially. After the very successful Second ISNPS Conference 2014 in Cádiz, Spain, it was decided to have a meeting every other year dedicated to a special topic. For 2015 this topic is "Biosciences, Medicine and novel Non-Parametric Methods". The ISNPS Meeting will take place immediately after the European Meeting of Statisticians in Amsterdam. It is hosted by the Institute for Medical Informatics, Statistics and Documentation of the Medical University of Graz in the city of Graz, Austria. The scientific meeting will be reminiscent of a workshop because of many plenary activities and opportunities to informally discuss novel, controversial or educational topics with respect to new methodologies and applications. Each day there will be one keynote (confirmed speakers are Peter Hall and Steve Marron) introducing a special non-parametric or data problem followed by shorter related presentations and discussion.

IMS co-sponsored meeting

NEW

The 4th Workshop on Biostatistics and Bioinformatics
May 8–10, 2015, Atlanta, GA

http://www2.gsu.edu/~matyiz/2015workshop/

IMS Representative(s) on Program Committees: Yichuan Zhao

Biostatistics and Bioinformatics have been playing key and important roles in statistics and other scientific research fields in recent years. The goal of this workshop is to stimulate research and to foster the interaction of researchers in Biostatistics & Bioinformatics research areas. The workshop will provide the opportunity for faculty and graduate students to meet the top researchers, identify important directions for future research, facilitate research collaborations.

The keynote speaker is Xiao-Li Meng, Harvard University. Invited Speakers: Jianwen Cai, University of North Carolina; Michael Epstein, Emory University; Liang Liu, University of Georgia; Robert Lyles, Emory University; Chris McMahan, Clemson University; Bin Nan, University of Michigan; Annie Qu, University of Illinois; Yiyuan She, Florida State University; Yu Shyr, Vanderbilt University; Dylan Small, University of Pennsylvania; Wei Wu, Florida State University; Ying Xu, University of Georgia; Daowen Zhang, North Carolina State University; Jiajia Zhang, University of South Carolina.

Partial travel support for young researchers and under-represented groups is available: see the website for details of how to apply.

Registration, invited talks and poster presentations will be accepted up to April 30, 2015. See the website for instructions.

The workshop is sponsored by IMS, the National Science Foundation, International Chinese Statistical Association (ICSA), and the Department of Mathematics and Statistics in the GSU.

Other meetings around the world

IXth International Multiple Comparisons Procedures (MCP) Conference

September 2–5, 2015 [NOTE NEW DATES]

Hyderabad, India

w http://www.mcp-conference.org/hp/2015/

The IXth International Multiple Comparisons Procedures (MCP) Conference will now be held from September 2–5, 2015 (postponed from earlier dates).

The conference will cover the latest methodological and applied developments in the areas of multiple comparisons and adaptive designs in clinical trials. There will be pre-conference workshops on September 2 and the main conference will be from September 3–5. Keynote speech will be by Dr. Jason Hsu on *"Errors in Multiple Testing Big and Small, Now and Then, More or Less"*. There will also be a panel discussion on FDA Multiplicity Guidance Document led by Dr. John Scott and Dr. Mohammad Huque of FDA and prominent industry statisticians.

For further details and submission of abstracts visit the website above, or write to Dr. Vishwanath (Mahesh) Iyer **e** vishwanath.iyer@novartis.com.

The 29th New England Statistics Symposium

NEW

April 24–25, 2015

Storrs, Connecticut, USA

w http://merlot.stat.uconn.edu/ness15

The Department of Statistics of the University of Connecticut will host the 29th New England Statistics Symposium on Saturday, April 25, 2015, to bring together statisticians from all over New England at a central location.

Invited keynote speakers are Yaakov BarShalom of University of Connecticut and Adrian E. Raftery of University of Washington. There will be three full day short courses, entitled *"Bayesian Biostatistics: Design of Clinical Trials and Subgroup Analysis"* presented by Professor Peter Müller of University of Texas Austin, *"Modern Multivariate Statistical Learning: Methods and Applications"* presented by Professors Kun Chen and Jun Yan of University of Connecticut, and *"Boosting R Skills and Automating Statistical Reports"* presented by Dr. Yihui Xie of RStudio, Inc, on Friday, April 24, 2015.

We invite talks and posters on all aspects of statistics and probability. Students are encouraged to submit papers for consideration of one of three IBM Student Awards. Students must submit an application for consideration of award no later than Monday, April 6, 2015. Visit merlot.stat.uconn.edu/ness15 for more information.

Methodological advances in Statistics related to BIG DATA

NEW

June 8–12, 2015

Castro Urdiales, Spain

w http://www.imuva.uva.es/workshopbigdata/

Scope: The workshop "Methodological advances in Statistics related to BIG DATA" will be an international scientific meeting organized by the IMUVA, the Mathematical Institute of the University of Valladolid, Spain on behalf of REDIUM, the network of Spanish mathematical research institutes. The meeting will be held at CIEM (International Center for Mathematical Meetings) in Castro-Urdiales, Cantabria, Spain. The workshop will include two short courses (6 hours each) to be given by leading research experts on the field. A second scientific activity will consist of plenary conferences covering the main methodological challenges from the point of view of mathematical statistics in the Big Data setting. The workshop will include, as well, oral contributions to be selected from proposals by young researchers interested in the topic. The number of participants is limited to 70.

Plenary speakers: Ery Arias-Castro, Gérard Biau, Peter Bühlmann, Olivier Cappé, Po-Ling Loh, Guillaume Obozinski, Nicolas Vayatis.

Leeds Annual Statistical Research Workshop

NEW

June 30–July 2, 2015

Hinsley Hall, Leeds, UK

w http://www1.maths.leeds.ac.uk/statistics/workshop/lasr2015/

Contact Leeds.LASR@gmail.com

We are celebrating four decades of the Leeds Workshops in the forthcoming 2015 Leeds Annual Statistical Research (LASR) Workshop. It was 1975 when Leeds hosted a research symposium where distinguished and prominent figures in statistics attended. The research symposium later became our annual LASR Workshops.

Our research workshops have facilitated interdisciplinary discussion between participants that have resulted in important research collaborations and cutting edge applications. The 2015 LASR Workshop will focus on geometry-driven statistics, which include advanced methods in the analysis of manifolds, directional data analysis and shape analysis, and their cutting edge applications, especially in large data or high-dimensional data.

We are pleased to announce that the following leading scientists are expected to speak at LASR 2015: Fred Bookstein, Clive Bowman, Charlotte Deane, Ian Dryden, Walter Gilks, Peter Green, Thomas Hamelryck, Stephan Huckemann, Peter Jupp, John Kent, Arnab Laha, Kanti Mardia, Steve Marron, Eulogio Pardo-Iguzquiza, Sheena Radford and Cristina Rueda.

AMISTAT 2015 (Analytical Methods in Statistics) NEW
November 10–13, 2015
Prague, Czech Republic
http://www.karlin.mff.cuni.cz/~amistat2015/
Contact amistat2015@karlin.mff.cuni.cz

Workshop on Flexible Models for Longitudinal and Survival Data with Applications in Biostatistics NEW
July 27–29, 2015
Coventry, UK
w http://www2.warwick.ac.uk/fac/sci/statistics/crism/workshops/fmlsjd
Contact Francisco Javier Rubio
e francisco.rubio@warwick.ac.uk
The goals of this workshop are to bring together senior and young researchers as well as practitioners from around the world who are working in the areas of longitudinal data analysis, survival analysis, and joint models with a special focus on the impact of the use of flexible distributional assumptions.

Offering 10 scholarships for young researchers: see the website.

36th Annual Conference of the International Society for Clinical Biostatistics NEW
August 23–27, 2015
Utrecht, The Netherlands
w http://www.iscb2015.info/
Contact Natasja van Schaik
e iscb2015@congressbydesign.com
The ISCB 2015 conference is a scientific forum for international exchange of theory, methods and applications of biostatistics in medical research and practice. The conference is intended for statisticians, clinicians and members of other disciplines, such as epidemiologists, clinical chemists and clinical pharmacologists interested in the field of clinical biostatistics.

Statistical and Computational Challenges in Networks and Cybersecurity NEW
May 4–8, 2015
Montreal, Quebec, Canada
w http://www.crm.umontreal.ca/2015/Challenges15/index_e.php
Contact Hugh Chipman hugh.chipman@gmail.com
Two-day short course and three-day workshop. Networks and cybersecurity are producing varied, rich, complex and BIG data. Great research opportunities are opening up in the statistical, computational and mathematical sciences. Mon-Tue: short course by Eric Kolaczyk of Boston University on "Statistical Analysis of Network Data", based on his book, and its companion volume on R implementations of network models. Wed-Fri: research workshop.

Financial support available for students. Poster session. Deadlines: April 1, 2015.

Details online.

MBI workshop for PhD and post-doctoral students: NEW
Spatially-varying stochastic differential equations, with application to the biological sciences
July 6–10, 2015
Columbus, OH, USA
w http://mbi.osu.edu/event/?id=904
In this workshop, participants will learn about the use of stochastic differential equations (SDEs) to model physical phenomena in the biological sciences. Students will learn how to define and manipulate SDEs, and will understand the difficulties in performing statistical inference on the parameters of SDEs using data. They will relate the modeling of SDEs to the theory of spatial and temporal data analysis, and will carry out a small group project to discover and investigate how to model data from various disciplines within the biological sciences.

The Dynamical Systems, Ergodic Theory, and Probability Conference: Dedicated to the Memory of Nikolai Chernov NEW
May 18–20, 2015
Birmingham, Alabama
w http://people.cas.uab.edu/~ablokh/c-c-2015/
The Department of Mathematics of University of Alabama would like to announce The Dynamical Systems, Ergodic Theory, and Probability Conference, dedicated to the memory of Nikolai Chernov, which will be held on May 18–20, 2015. The conference will include three parallel sessions (Dynamical Systems, Ergodic Theory, Probability) and plenary talks by Leonid Bunimovich (Georgia Tech), Dmitry Dolgopyat (University of Maryland), Anatole Katok (Penn State), Konstantin Khanin (Toronto), Joel Lebowitz (Rutgers), Russell Lyons (Indiana University, Bloomngton), Roberto Markarian (Uruguay), Yakov Pesin (Penn State), Nandor Simanyi (UAB), Domokos Szasz (Hungary).

2015 New England Symposium on Statistics in Sports NEW
September 26, 2015
Harvard University, Cambridge, Mass., USA
w http://www.nessis.org/
This is a meeting of statisticians and quantitative analysts connected with sports teams, sports media, and academia to discuss common problems of interest in statistical modeling and analysis of sports data.

The symposium format will be a mixture of invited talks, a poster session, and a panel discussion.

Please consult the conference website for more information, including abstract submission instructions.

Columbia-Princeton Probability Day 2015

NEW

March 6, 2015
Princeton, NJ, USA

w http://orfe.princeton.edu/conferences/cp15/
Contact Ramon Van Handel **e** rvan@princeton.edu
The main speakers are Davar Khoshnevisan (Utah), Fraydoun Rezakhanlou (Berkeley), Prasad Tetali (Georgia Tech), and Balint Virag (Toronto). Junior Speakers: Alex Drewitz (Columbia), Leonid Petrov (Virginia).

Registration is free and will be open until February 26, 2015. The registration form can be found on the Probability Day website above.

Topics in renormalisation group theory and regularity structures

NEW

May 11–15, 2015
Coventry, UK

w http://www2.warwick.ac.uk/fac/sci/maths/research/events/2014-15/nonsymposium/trgtrs
The mathematics department at Warwick University is organising a summer school on 'Renormalisation group theory and regularity structures' with lectures by David Brydges, Martin Hairer, Antii Kupiainen, and Gordon Slade at the University of Warwick.

The principal aim is to deliver the basic ideas and connections of renormalisation group and regularity structures. There are funds to cover accommodation for PhD students wishing to participate. Please contact Stefan Adams at: S.Adams@warwick.ac.uk

Summer school: The recently developed theory of regularity structures by Martin Hairer has many relevant connections to the theory of the renormalisation group (RG) and stochastic PDE's. The renormalisation group goes back to Wilson (Nobel prize 1982) and is a dominant calculational and conceptual tool of theoretical physics and probability. RG is a map that replaces a model by a simpler model having the same macroscopic predictions. By iteration to a fixed point one obtains a simple model having the macroscopic predictions of a whole class of more detailed models. The aim of the school is to give an elementary introduction to both RG and regularity structures, as well to their connection. The lecturer series will be complemented by exercise/discussion hours in the afternoons. This will allow students to deepen their understanding and to raise questions. The second main objective is to highlight open problems in both fields and their connection to enable the student to gain insight in a currently important and active field in probability, applied probability, analysis, and mathematical physics.

Lecturers: David Brydges and Antii Kupianinen are internationally very well-known experts in RG and related subjects since the 1980s. David Brydges has developed a mathematical approach to RG which is specially designed for students with interest in probability (and related subjects as mathematical physics). Antii Kupiainen has done pioneer work on 'block-spin' calculations and studies PDE's using techniques from RG. Martin Hairer has developed the powerful theory of regularity structures. Gordon Slade is famous for his fundamental contributions to the self-avoiding random walk and corresponding RG techniques.

Atlantic Causal Inference Conference

NEW

May 20–21, 2015, Philadelphia, PA

w http://www.cceb.upenn.edu/biostat/conferences/ACIC15/index_acic15.php
The Atlantic Causal Inference Conference is a gathering of statisticians, biostatisticians, epidemiologists, economists, social science and policy researchers to discuss methodologic issues with drawing causal inferences from experimental and non-experimental data.

MAA MathFest

NEW

August 5–8, 2015
Washington DC

Founded in 1915, the Mathematical Association of America will celebrate its 100th birthday with activities throughout the coming year. The MAA is now the largest professional society that focuses on mathematics accessible at the undergraduate level.

The centerpiece of the centennial celebration will be the MAA MathFest in Washington, D.C., August 5–8, 2015. The meeting program promises prominent speakers, thought-provoking lectures, wide-ranging sessions, and special events and exhibits.

The MAA Centennial Lectures at MathFest will feature a distinguished roster of invited speakers: 2014 Fields Medalist Manjul Bhargava (Princeton University), Carlos Castillo-Chavez (Arizona State University), Jennifer Chayes (Microsoft Research), Ingrid Daubechies (Duke University), Erik Demaine (Massachusetts Institute of Technology), and Karen Parshall (University of Virginia). Beyond MathFest, sections of the MAA plan to celebrate the centennial throughout the year in a variety of ways in their own parts of the country.

In addition, the spring of 2015 will see publication of a commemorative volume, *A Century of Advancing Mathematics*. The book will contain about 30 original articles covering a wide range of topics, from reviews of mathematical developments to pedagogy and aspects of mathematical culture and history. The authors include Bob Devaney, Andrew Granville, Robin Wilson, Joe Silverman, Frank Morgan, Michael Starbird, Rhonda Hughes, Gil Strang, Joe Gallian, Alan Tucker, Phil Davis, Jon Borwein, Dan Zelinsky, Bud Brown, Ken Ross, Jerry Alexanderson, Bonnie Gold, Bill Dunham, Leonard Klosinski, and Karen Parshall.

Go to http://www.maa.org/100 to learn more about MAA's 100 years of history in advancing the mathematical sciences and promoting mathematical education in America.

NIMBioS Investigative Workshop: Evolution and Warfare
NEW

September 16–18, 2015
Knoxville, Tennessee

w http://www.nimbios.org/workshops/WS_warfare

Warfare is a widespread and arguably universal practice of human societies. While war's origins continue to be debated, warfare has occurred in most historically documented societies, from hunter-gatherers to nation-states. Its prehistoric traces can be found in fortifications, weapons, mass graves, and skeletal trauma. Given that it is a major source of mortality, warfare has potentially acted as a powerful source of selection for both biological and cultural evolution. In a reprise of the past—and in contrast to force-on-force, hierarchically organized wars among great powers—conflict today takes a number of decentralized forms, from urban gang fights to livestock raids, and from clan warfare to leaderless resistance and terrorism.

In this workshop, we will begin working toward an integrated approach to the study of warfare under decentralized or only loosely controlled conditions, combining empirical data, evolutionary theory, and mathematical models. We envision developing working hypotheses to answer several key questions about between-group conflict in general, and the nature of 'decentralized warfare' in particular. These hypotheses will be informed by evolutionary theory using data from diverse conflict settings. Our hypotheses will be articulated in a framework amenable to formal modeling that will point the way toward a multi-level predictive understanding of warfare.

Participation in the workshop is by application only. Individuals with a strong interest in the topic are encouraged to apply, and successful applicants will be notified within two weeks of the application deadline. If needed, financial support for travel, meals, and lodging is available for workshop attendees. Application deadline: May 17, 2015

Seventh international workshop on Statistical Analysis of Neural Data (SAND7)
NEW

May 27–29, 2015
Pittsburgh, PA

w http://sand.stat.cmu.edu

Partial travel support is available. Requests for financial support should be made by March 15. There will be talks by senior investigators and junior investigators. The talks by young investigators (graduate student or postdoc/faculty within 5 years of Ph.D.) will be selected on a competitive basis. Any young investigator interested in presenting their work as a talk should submit an abstract by MARCH 1. There will also be a poster session, to which all participants are invited to contribute. Talks and posters may involve new methodology, investigation of existing methods, or application of state-of-the-art analytical techniques.

Here are the confirmed keynote speakers: Gyorgy Buzsaki (NYU), Marlene Cohen (University of Pittsburgh), Adrienne Fairhall (University of Washington), Bruce Rosen (Harvard, MGH), Mark Schnitzer (Stanford), Sebastian Seung (Princeton).

This workshop series is concerned with analysis of neural signals from various sources, including EEG, fMRI, MEG, 2-Photon, and extracellular recordings. It aims to define important problems in neuronal data analysis and useful strategies for attacking them; foster communication between experimental neuroscientists and those trained in statistical and computational methods encourage young researchers, including graduate students, to present their work; and expose young researchers to important challenges and opportunities in this interdisciplinary domain, while providing a small meeting atmosphere to facilitate the interaction of young researchers with senior colleagues.

The organizers are Emery Brown, Elizabeth Buffalo, Rob Kass, Liam Paninski, Sri Sarma and Jonathan Victor.

United States: Storrs, CT

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Canada: Toronto, ON
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Lecturer/Senior Lecturer in Statistics (equivalent to Assistant / Associate Professor in the North American academic system)
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Contra Costa Community College District
Mathematics Assistant Professor (Brentwood Center)
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United States: Grinnell, IA
Grinnell College
Assistant Professor, Statistics
http://jobs.imstat.org/c/job.cfm?site_id=1847&jb=21638702

United States: Lincoln, NE
University of Nebraska-Lincoln
Tenure-track assistant professor (9-month) in Bayes (and some non-Bayes) spatial and spatio-temporal analysis with applications in agriculture and natural resources
http://jobs.imstat.org/c/job.cfm?site_id=1847&jb=21788998

United States: Lincoln, NE
University of Nebraska Lincoln
Tenure track assistant professor
http://jobs.imstat.org/c/job.cfm?site_id=1847&jb=21872187

United States: Lincoln, NE
University of Nebraska Lincoln
Tenure track assistant professor in statistics
http://jobs.imstat.org/c/job.cfm?site_id=1847&jb=21984646

United States: Ithaca, NY
Cornell University
Applied Mathematics-Cornell University, College of Engineering
http://jobs.imstat.org/c/job.cfm?site_id=1847&jb=21942156

United States: Columbus, OH
College of Public Health, The Ohio State University
Chair, Division of Biostatistics
http://jobs.imstat.org/c/job.cfm?site_id=1847&jb=21599787

United States: Corvallis, OR
Oregon State University
Assistant Professor
http://jobs.imstat.org/c/job.cfm?site_id=1847&jb=21762915

International Calendar of Statistical Events

IMS meetings are highlighted in maroon with the IMS logo, and new or updated entries have the NEW or UPDATED 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

March 2015

NEW March 6: Princeton, NJ, USA. **Columbia-Princeton Probability Day 2015 w** http://orfe.princeton.edu/conferences/cp15/

March 11–13: Knoxville, Tennessee. NIMBioS Investigative Workshop: Neurobiology of Expertise **w** http://www.nimbios.org/workshops/WS_expertise

IMS March 14–15: Duke University, Durham, NC. Probability Theory and Combinatorial Optimization **w** http://sites.duke.edu/steele2015/

IMS March 15–18: Miami, Florida. **2015 ENAR/IMS Spring Meeting. w** http://www.enar.org/meetings.cfm

March 16–18: Islamia College University, Peshawar, Pakistan. 13th International Conference on Statistical Sciences **w** http://www.isoss.net/conferences

March 23–26: London, UK. Limit Theorems in Probability **w** http://wwwf.imperial.ac.uk/~amijatov/IP/LimitTheorems/LTP.html

March 23–27: Toronto, Canada. Workshop on Big Data in Health Policy [*Fields Big Data program*] **w** www.fields.utoronto.ca/programs/scientific/14-15/bigdata

April 2015

April 8–10: NIMBioS, Knoxville, Tennessee, USA. **Information and Entropy w** http://www.nimbios.org/workshops/WS_entropy

April 13–17: Toronto, Canada. Workshop on Big Data for Social Policy [*Fields Big Data program*] **w** www.fields.utoronto.ca/programs/scientific/14-15/bigdata

NEW April 24–25: Storrs, CT, USA. **The 29th New England Statistics Symposium w** http://merlot.stat.uconn.edu/ness15

May 2015

NEW May 4–8: Montreal, Quebec, Canada **Statistical and Computational Challenges in Networks and Cybersecurity w** http://www.crm.umontreal.ca/2015/Challenges15/index_e.php

NEW IMS May 8–10: Atlanta, GA. **The 4th Workshop on Biostatistics and Bioinformatics w** http://www2.gsu.edu/~matyiz/2015workshop/

NEW May 11–15: Coventry, UK **Topics in renormalisation group theory and regularity structures w** http://www2.warwick.ac.uk/fac/sci/maths/research/events/2014-15/nonsymposium/trgtrs

May 15–17: Bloomington, Indiana. Seymour Sherman Lecture and Conference **w** http://pages.iu.edu/~rdlyons/sherman/2015.html

NEW May 18–20: Birmingham, AL, USA **The Dynamical Systems, Ergodic Theory, and Probability Conference: Dedicated to the Memory of Nikolai Chernov w** http://people.cas.uab.edu/~ablokh/c-c-2015/

May 18–29: Singapore. **Workshop on New Directions in Stein's Method w** http://www2.ims.nus.edu.sg/Programs/015wstein/

IMS May 20–22: Cincinnati, Ohio. **22nd ASA/IMS Spring Research Conference (SRC 2015) w** http://www.cvent.com/d/44qpkn

May 21–22: Athens, Greece. 4th International Conference on Quantitative and Qualitative Methodologies in the Economic and Administrative Sciences **w** https://sites.google.com/site/icqqmeas2015/

May 26–28: Haikou, Hainan, China. **24th International Workshop on Matrices and Statistics (IWMS-2015) w** http://iwms2015.csp.escience.cn/dct/page/1

May 26–29: Varna, Bulgaria. HiPMoS 2015: High Performance Modelling and Simulation 2015 (special session on ProbStat) **w** https://www.dem.unina2.it/hipmos/

International Calendar *continued*

May 2015 *continued*

May 31–June 5: Ascona, Switzerland. **Workshop on Statistical Learning of Biological Systems from Perturbations** **w** http://www.cbg.ethz.ch/news/ascona2015

June 2015

June 7–10: Oslo, Norway. **Colloquium of the International Actuarial Association** **w** http://www.actuaries.org/oslo2015

NEW June 8–12: Castro Urdiales, Spain **Methodological advances in Statistics related to BIG DATA** **w** http://www.imuva.uva.es/workshopbigdata/

June 13–14: Toronto, Canada. Closing Conference [*Fields Big Data program*] at AARMS of Dalhousie University. **w** www.fields.utoronto.ca/programs/scientific/14-15/bigdata

IMS June 14–17 [NOTE NEW DATES]: Boise State University, ID, USA. **2015 WNAR/IMS Annual Meeting** **w** http://wnar.org/meetings

June 15–19: Aarhus, Denmark. Aarhus Conference on Probability, Statistics and Their Applications **w** http://thiele.au.dk/events/conferences/2015/aarhus/

June 15–19: Ann Arbor, Michigan. **9th International Conference on Extreme Value Analysis: EVA 2015** **w** http://sites.lsa.umich.edu/eva2015

IMS June 22–24: Columbia University, New York, NY. Fifth International Workshop in Sequential Methodologies (IWSM) **w** TBC

June 22–25: NIMBioS, Knoxville, TN. Research Collaboration Workshop for Women in Mathematical Biology **w** http://www.nimbios.org/education/WS_wwmb.html

IMS June 22–26: Raleigh, NC, USA. **10th Conference on Bayesian Nonparametrics** **w** https://stat.duke.edu/bnp10/

IMS June 25–27: Rutgers Student Center, New Brunswick, NJ. 2015 Workshop on Finance, Insurance, Probability and Statistics (FIPS 2015) **w** http://www.fsrm.rutgers.edu/fips2015

June 29–July 2: Athens, Greece. **9th Annual International Conference on Statistics** **w** http://www.atiner.gr/statistics.htm

June 29–July 2: Athens, Greece. 1st Annual International Conference on Formal Sciences **w** http://athensformal.com

NEW June 30–July 2: Leeds, UK **Leeds Annual Statistical Research Workshop** **w** http://www1.maths.leeds.ac.uk/statistics/workshop/lasr2015/

June 30–July 4: Piraeus, Greece. **16th Applied Stochastic Models and Data Analysis International Conference** (ASMDA) **w** http://www.asmda2015.com

July 2015

July 1–4: Kunming, Yunnan, P. R. China. **2015 IMS-China International Conference on Statistics and Probability w** http://www.2015imschina.com

July 5–8: Istanbul, Turkey. **INFORMS Applied Probability Society Conference 2015 w** TBC

July 6–8: Memorial University, St John's, Canada. **International Symposium in Statistics (ISS 2015)** *Parametric and Semi-parametric Inferences for Spatial-temporal, and Multi-dimensional Familial-longitudinal Data.* **w** http://www.iss-2015-stjohns.ca

July 6–10: Amsterdam, The Netherlands. **2015 European Meeting of Statisticians w** http://ems2015.nl/

NEW July 6–10: Columbus, OH, USA **Spatially-varying stochastic differential equations, with application to the biological sciences w** http://mbi.osu.edu/event/?id=904

July 13–17: Oxford, UK. **38th Conference on Stochastic Processes and Applications w [please note new website address]** http://spa2015.oxford-man.ox.ac.uk

July 20–24: Pescara, Italy. ISIPTA'15 **w** http://www.sipta.org/isipta15

July 26–31: Rio de Janeiro, Brazil. **2015 ISI World Statistics Congress w** http://www.isi2015.ibge.gov.br/

August 2015

August 3–5: Honolulu, HI. **Statistics and Exoplanets w** http://exostats.org

NEW August 5–8: Washington DC **MAA MathFest w** http://www.maa.org/100

NEW August 6–8: Seattle, WA. **17th IMS New Researchers Meeting w** http://depts.washington.edu/imsnrc17/

August 8–13: Seattle, WA. **IMS Annual Meeting at JSM 2015. w** http://amstat.org/meetings/jsm/2015

See bulletin.imstat.org/2014/12/ims-invited-sessions-at-jsm-2015/ for the complete list of 30 IMS Invited Sessions, including the Wald, Le Cam and Medallion Lectures, and the IMS Presidential Address. Join us in Seattle!

August 10–14: Beijing, China. **8th International Congress of Industrial and Applied Mathematics w** http://www.iciam2015.cn/

NEW August 23–27: Utrecht, The Netherlands **36th Annual Conference of the International Society for Clinical Biostatistics w** http://www.iscb2015.info/

September 2015

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

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

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

March 2016

March 6–9: Austin, Texas. **2016 ENAR/IMS Spring Meeting w** http://www.enar.org/meetings.cfm

International Calendar *continued*

Benson Kua / Wikimedia Commons

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/

June 2016

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

June 20–24: University of California at San Diego. **Stochastic Networks Conference w** TBD

July 2016

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/

July 2017

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

July 2018

July 28 – August 2: Vancouver, Canada. **JSM 2018 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/

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, 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

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IMS Bulletin

The *IMS Bulletin* publishes articles and news of interest to IMS members and to statisticians and probabilists in general, as well as details of IMS meetings and an international calendar of statistical events. Views and opinions in editorials and articles are not to be understood as official expressions of the Institute's policy unless so stated; publication does not necessarily imply endorsement in any way of the opinions expressed therein, and the *IMS Bulletin* and its publisher do not accept any responsibility for them. The *IMS Bulletin* is copyrighted and authors of individual articles may be asked to sign a copyright transfer to the IMS before publication.

The *IMS Bulletin* (ISSN 1544-1881) is published eight times per year in January/February, March, April/May, June/July, August, September, October/November and December, by the Institute of Mathematical Statistics, 3163 Somerset Dr, Cleveland, Ohio 44122, USA. Periodicals postage paid at Cleveland, Ohio, and at additional mailing offices. Postmaster: Send address changes to Institute of Mathematical Statistics, 9650 Rockville Pike, Suite L3503A, Bethesda, MD 20814-3998.

Printed by The Sheridan Press, 450 Fame Avenue, Hanover, PA 17331, USA.

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Issue	Deadline	Online by	Mailed
1: January/February	**December 1**	December 15	January 1
2: March	**February 1**	February 15	March 1
3: April/May	**March 15**	April 1	April 15
4: June/July	**May 1**	May 15	June 1
5: August	**July 1**	July 15	August 1
6: September	**August 15**	September 1	September 15
7: Oct/Nov	**September 15**	October 1	October 15
8: December	**November 1**	November 15	December 1

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the next issue is **April/May 2015**

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March 15, then **May 1**

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Articles

Vol. 43, No. 2—March 2015