



# Bernoulli News

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† Bernoulli News is the official newsletter of the Bernoulli Society, publishing news, calendars of events, and opinion pieces of interest to Bernoulli Society members, as well as to the Mathematical Statistics and Probability community at large. The views and opinions expressed in editorials and opinion pieces do not necessarily reflect the official views of the Bernoulli Society, unless explicitly stated, and their publication in Bernoulli News in no way implies their endorsement by the Bernoulli Society. Consequently, the Bernoulli Society does not bear any responsibility for the views expressed in such pieces.

## A VIEW FROM THE PRESIDENT

### SPC Gothenburg 2018

Dear Members of the Bernoulli Society, In this letter I will highlight a number of new initiatives aimed at (1) recognizing research by new researchers, (2) reorganizing the conduct of our General Assembly and (3) beginning the process of providing better publicity for our members and our Society. It is exciting!

First you have likely seen our calls for the Bernoulli Society New Researchers Awards. This initiative is being led by our Youth Representative, Parthanil Roy and our Membership Secretary, Leonardo Rolla. New researchers self-nominate for this competition thus opening up opportunities to those who might not have a senior member as an advocate. Furthermore each individual submits a 3-page synopsis of their presentation, thus demonstrating their ability to succinctly communicate the innovation inherent in their research.

Initially there will be two rounds of New Researchers Awards. The first round was for new researchers active in mathematical statistics. Parthanil and Leo lead an active, engaged, committee in selecting the three awardees. Each of these three awardees will give an invited talk at the 2019 ISI World Statistics Conference in Kuala Lumpur, Malaysia. Furthermore we will feature them and their research in Bernoulli News. Please see the article in this issue with the names of the winners! The second round of New Researcher Awards will be for new researchers active in probability. These three awardees will give an invited talk at the 2020 IMS-BS World Congress in Seoul, South Korea. Please watch for the call, likely in late 2018-early 2019!

This award has a number of aspects that we hope, longer term, will provide an avenue for recognition to new researchers who, due to location or lack of mentorship, have limited access to senior members of our society who will advocate for their research contributions. In particular new researchers self-nominate thus they do not depend on mentors for the nomination. We would greatly welcome any ideas you might have in order to provide increased opportunities for outstanding new researchers from less well represented groups to receive recognition for their novel research.

We also decided to conduct a trial run for a very different kind of Bernoulli Society General Assembly. As you know the Bernoulli Society frequently hosts a young researchers' reception at the Conference on Stochastic Processes and their Applications. These receptions are in the evening and usually we take over a pub to run the reception. This year the reception (organized by our indomitable Membership Secretary, Leonardo Rolla) we will include a brief General Assembly. In particular all of the informational material that we normally present at a GA will be given as a handout.

... Continued on p. 1

**Deadline for the next issue: 30 September, 2018**  
Send contributions to: [miguel.decarvalho@ed.ac.uk](mailto:miguel.decarvalho@ed.ac.uk)

## A View from the President (continued from front cover)

The focus of the GA will be on our new initiatives and how we can better serve our membership. Our incoming President, Claudia Klüppelberg will conduct this GA. Please join us! There will be good company and refreshments. The Young Researchers Reception begins at 18:00 June 12, 2018 and the Bernoulli Society General Assembly begins at 18:30 June 12, 2018.

Lastly we have a new Bernoulli Society position: Bernoulli publicity chair. There is an ever increasing variety of new ways that Bernoulli might use to publicize its activities; many of these ways are widely used by new researchers (blogs, twitter, etc). Our chair will investigate and utilize the most relevant of these approaches. Also we'd like to provide greater recognition for our plenary speakers and speakers so that

the wider community can better appreciate the role of statistics and probability in broader science and society. So with a drum roll. . . . . Victor Panaretos. . . has graciously volunteered to be our Bernoulli Publicity Chair! Any ideas you might have in how we can better publicize the Bernoulli Society, our members' research and the importance of Statistics and Probability in society would be most welcome—feel free to send me ideas [samurphy@fas.harvard.edu](mailto:samurphy@fas.harvard.edu)!

As always I very much look forward to working with you!

*Susan A. Murphy*  
President of the Bernoulli Society  
Cambridge, MA

## News from the Bernoulli Society

### Bernoulli Journal Lecture

The *Bernoulli* Journal Lecture at the ISI World Congress 2019 will be given by Jonathan Taylor from the University of Stanford.

Further details on Jonathan's research can be found from

<http://statweb.stanford.edu/~jtaylor/>



Jonathan Taylor: *Bernoulli* Journal Lecturer

*Holger Dette*  
Bochum

## Bernoulli Society New Researcher Award

The New Researcher Award is for Bernoulli Society members who are active researchers of mathematical statistics. The main goal of this award is to recognize innovative research by new researchers.

The applicants for this award were asked to submit a 3-page synopsis of their presentation, along with their CV by February 28, 2018. The response to this award call was fabulous: 34 applications were submitted many of which were very strong applications making the selection procedure extremely challenging. After evaluating each CV and synopsis, the award committee has chosen the following new researchers for the award:

- Po-Ling Loh, University of Wisconsin-Madison;
- Gongjun Xu, University of Michigan;
- Lingzhou Xue, Pennsylvania State University.

Each of the awardees will deliver a 30-minute talk at the 62nd ISI World Statistics Congress to be held in Kuala Lumpur, Malaysia during August 18–23, 2019, and will receive funding (up to EUR 1000) from Bernoulli Society to compensate for travel and other expenses.

Apart from the above awardees, Bernoulli Society is awarding honourable mentions to the following re-

searchers:

- Quentin Berthet, University of Cambridge;
- Sebastian Engelke, University of Geneva;
- Subhabrata Sen, Microsoft Research New England and Massachusetts Institute of Technology.

Bernoulli Society would like to congratulate the above researchers and thank each and every applicant for their interest in the award.

It has been decided that another such award call will be in place aiming at new researchers in probability theory with a view to participating in the 10th

*World Congress in Probability and Statistics / IMS Annual Meeting* to be held during August 17–21, 2020 in Seoul, South Korea. An advertisement would appear in the website of Bernoulli Society (and other related academic societies) in the coming months, and also in the November 2018 issue of Bernoulli News. New researchers of probability theory are urged to keep an eye for this advertisement. We are absolutely certain that thanks to involvement of bright new probabilists, the second call will also become a grand success.

*Parthanil Roy*  
*Bernoulli Youth Representative*  
*Bangalore*



Richard Nickl being awarded the Ethel–Newbold-Prize by Sara van de Geer

## Richard Nickl Receives Ethel–Newbold-Prize

Richard Nickl held the Ethel–Newbold-Prize Lecture on "*Efficient Nonparametric Inference for a Non-linear Inverse Problem with the Schrödinger Equation*" after which he was awarded the Ethel–Newbold-Prize by Sara van de Geer. The Ethel Newbold Prize is to be awarded biannually to an outstanding statistical scientist for a body of work that represents excellence in research in mathematical statistics, and/or excel-

lence in research that links developments in a substantive field to new advances in statistics. The Lecture took place at the conference *Statistics Meets Friends*, on which further details can be found on p. 10 of this issue.

*Tatyana Krivobokova*  
*Göttingen*

## Michael Newton: Bernoulli Presidential Lecturer

Michael Newton will be the Bernoulli Presidential Lecturer at the ISI World Statistics Congress in Kuala Lumpur, Malaysia from 18–23 August 2019.

A brief summary of his academic trajectory and research contributions is available from

[https://en.wikipedia.org/wiki/Michael\\_A.\\_Newton](https://en.wikipedia.org/wiki/Michael_A._Newton)



Michael Newton: Bernoulli Presidential Lecturer

*Susan A. Murphy*  
*President of the Bernoulli Society*  
*Cambridge, MA*

## Aad van der Vaart: BS–EMS Special Invited Lecture

Aad van der Vaart had confirmed his presence at Palermo for the EMS 2019, 22–26 July 2019 for the BS–EMS Lecture.



Aad van der Vaart: 2019 EMS–BS Joint Lecturer

The other plenary speakers will be:

- Opening lecture: Judith Rousseau (Oxford University, UK).

- BS-EMS special invited lecture: Aad van der Vaart (University of Leiden, NL).
- Forum lectures: Victor Panaretos (Ecole Polytechnique Federale de Lausanne, CH).
- Special invited lecture: Genevera Allen (Rice University, USA).
- Special invited lecture: Gilles Blanchard (University of Potsdam, DE).
- Closing lecture: John Lafferty (Yale University, USA).

*Susan A. Murphy*  
President of the Bernoulli Society  
Cambridge, MA

## Awards and Prizes

### MacArthur Fellowship goes to Emmanuel Candès

Emmanuel Candès has been awarded a MacArthur Fellowship. As it can be read on the page of the MacArthur foundation, the

“MacArthur Fellowship is a \$625,000, no-strings-attached award to extraordinarily talented and creative individuals as an investment in their potential.”

Further details on Emmanuel work, including his research on compressed sensing and its applications, are available from:

<https://www.macfound.org/fellows/985>



Emmanuel Candès: MacArthur Fellow

*Susan A. Murphy*  
President of the Bernoulli Society  
Cambridge, MA



24–29 June (2018)

Edinburgh, UK

<https://bayesian.org/2018-world-meeting/>





## New Executive Members in the Bernoulli Society

### Bernoulli Publicity Chair: Victor Panaretos



Victor Panaretos is Associate Professor of Mathematical Statistics at the Institute of Mathematics of the EPFL. His research interests revolve around modeling and inference for functional and geometrical data and associated statistical inverse problems, primarily motivated by biological applications. He obtained his PhD in 2007 from the University of California at Berkeley, supervised by David Brillinger, where he received the Erich Lehmann award for his thesis. A recipient of an ERC Starting Grant Award, he was invited as one of “40 extraordinary scientists under 40” to attend the Summer edition of the World Economic Forum, and has been selected to deliver the 2019 Bernoulli Society Forum Lectures. An elected member of the International Statistical Institute since 2008, he serves on the editorial boards of the *Annals of Applied Statistics*, *Biometrika*, *EJS*, and *JASA Theory & Methods*. He has previously served as the Editor of *Bernoulli News* for two terms, and is currently serving in the Council of the International Statistical Institute and the Publications Committee of the Bernoulli Society.

The office of Publicity Chair is a new one, borne out of the increasing number and variety of Bernoulli Society activities and the commensurately increasing need for their broad and coherent public communication. The Publicity Chair will lead the coordination of publicity of Bernoulli Society activities across existing venues, as well as efforts to expand such channels of communication, in close collaboration with existing Bernoulli Officers such as the *Bernoulli News* Editor, the Web Editor, the Membership Secretary, the Youth Representative, and the E-Briefs Editor.

### Committee Chair, Conferences on Stochastic Processes: Zhen-Qing Chen



Zhen-Qing Chen is a professor of Mathematics and a Victor Klee Faculty Fellow at the University of Washington. He obtained his Ph.D in Mathematics in 1992 from Washington University in St. Louis. His research area is in probability theory, Markov processes, stochastic analysis and their applications. He has published more than 150 research papers in scientific journals, and one monograph jointly with Masatosh Fukushima on symmetric Markov processes and Dirichlet form theory. Zhen-Qing Chen has served in several editorial boards including the *Annals of Probability*, the *Annals of Applied Probability*, and *Stochastic Processes and their Applications*. Currently, he is the Editor-in-Chief for *Potential Analysis*, and the Coordinating Editor of Applied Mathematics, *Probability and Statistics* for the *Proceedings of the American Mathematical Society*. He is an elected Fellow of American Mathematical Society and an elected Fellow of the Institute of Mathematical Statistics.

#### **A view on the Committee for Conferences on Stochastic Processes**

The Committee for Conferences on Stochastic Processes (CCSP) is a subject area committee of the Bernoulli Society for Mathematical Statistics and Probability. The objective of CCSP is to foster the development and dissemination of the theory and application of stochastic processes by organizing international meetings, notably the conference on Stochastic Processes and their Applications (SPA). This series of conferences is held annually except for the years when the World Congress in Probability and Statistics takes place. The conference features plenary lectures presented by leading experts and a large variety of special sessions as well as contributed sessions. The committee will encourage and solicit proposals from all over the world to organize a SPA conference.

## Editor for Stochastic Processes and Their Applications: Sylvie Méléard



Sylvie Méléard has been Professor of Applied Mathematics at the Ecole Polytechnique for 13 years after serving successively at the Université du Mans, the Université Pierre et Marie Curie and the Université Paris-Ouest Nanterre. She specialized in modeling biodiversity and biological phenomena of ecology-evolution from a probabilistic point of view. The originality of this approach consists in describing finely the individual dynamics integrating all the possible random factors and to deduce macroscopic approximations according to the various scaling parameters. She heads the PEIPS research team, Population evolution and interacting particle systems. She is also the head of the chair of mathematical modeling of biodiversity, a research partnership with company Veolia and National Museum of Natural History. This network is made up of mathematicians and biologists who regularly exchange and collaborate. She is or has been associate editor of numerous journals. Plenary speaker ECMTB2011, Invited speaker ECM2016, (French) Research Prize 2013 and Chevalier de la Légion d'honneur.

## Regional Committee Chair, East-Asian and Pacific: Kostya Borovkov

Kostya Borovkov is a professor at the School of Mathematics and Statistics at the University of Melbourne. His research interests lie in several areas including functional limit theorems, large deviation theory, Monte Carlo methods, boundary crossing problems and mathematical finance. He got his PhD (Cand. Sci.) from Steklov Mathematical Institute in Moscow and was awarded a Dr. Sc. degree by the same institution and the Higher Attestation Commission of Russia in 1994. Kostya published about 80 research papers, (co-)authored three books and edited several research monographs. He played important role in organizing a number of important international conferences in the area of probability theory and mathematical statistics, including the First Congress of the Bernoulli Society in Tashkent (where he was in charge of the information support section of the organizing committee) and SPA-28 conference in Melbourne.



### **A view on the Regional Committee (East-Asian and Pacific)**

We live a vast and very heterogeneous region, where, on the one hand, there is a number of countries with strong mathematical and statistical traditions and schools, and a larger number of less scientifically and economically developed ones, on the other. One can envisage a number of activities that can assist further promoting our disciplines in the region, especially in its less developed parts, the main constraints being our time and financial budgets. We are now thinking about establishing a depository of video recordings of the lectures from short courses by eminent visitors and our colleagues organized at some of our universities, that would be made available to and advertised among research students in our region and beyond. That would be perhaps a more cost-efficient alternative to organizing 'live' schools for those students and beginning researchers, but doing that is also an interesting possibility. Further, there already exist a number of bilateral arrangements between the groups of probabilists and statisticians in our region whereby we can organize workshops and other activities. Extending and further advertising them under the Bernoulli Society umbrella would increase their impact and possibly lead to stronger collaboration between researchers in our region.

## Articles and Letters

### Digital Disease Detection with Big Data

Samuel Kou, Harvard University  
kou@stat.harvard.edu

Communicated by Susan A. Murphy

This article summarizes key ideas from the joint European Mathematical Society and Bernoulli Society lecture. Recent advances on using big data to detect and track infectious diseases are discussed along with insights we learned from them.

#### *§1. Big Data and Disease Detection*

The wide availability and growth of Internet and online platforms have profoundly transformed our society, from the daily lives of individuals, to the way business is run, to the interactions and communications between individuals, companies and governments. As people do Google search, use Facebook, Twitter, Instagram, etc., big data sets that collect the footprints of millions of online users are constantly generated. These big data contain information of the users' activities in nearly every aspect of life. They also offer the potential to transform decision making in industry, business, social policy and public health (Khoury and Ioannidis, 2014; Kim et al., 2014; McAfee and Brynjolfsson, 2012).

One area that has received recent attention is to use big data to track infectious diseases, which affect tens of millions of people worldwide. For instance, influenza causes about 500,000 death per year worldwide and about 3,000 to 50,000 per year in the US; dengue fever infects about 390 million people, causing up to 20,000 deaths per year worldwide. Accurate and reliable tracking and forecasting of infectious diseases can help public health officials and government agencies prepare and allocate resources for potential outbreaks, improve risk assessment and communication, issue warnings, and take preventive actions. Traditional disease surveillance tracks disease activity through patients' clinical visits or doctors' field diagnosis. However, owing to the time needed for processing and aggregating clinical information, the clinical-based surveillance often lags behind real time by weeks, which is far from optimal. In the case of influenza surveillance, the US Centers for Disease Control and Prevention (CDC)'s influenza-like illness report, which tracks influenza in the US, often have a delay of one to two weeks.

Big data generated from the Internet present the opportunity for *real-time* disease surveillance and tracking. For example, the surge of influenza (flu) related online search queries in a short time period, such as

“flu symptoms”, “flu treatment”, “flu medicine”, etc., can indicate a potential flu outbreak. The ubiquity of big data and that they track social behavior and trends in real time make it possible and attractive to build such a digital disease detection system.

#### *§2. The Rise and Fall of Google Flu Trends*

In November 2008, Google launched Google Flu Trends (GFT), which uses the volume of selected Google search terms to estimate current influenza-like illnesses (ILI) activity (Ginsberg et al., 2009). The introduction of GFT generated much excitement, and GFT was welcomed and identified by many as a good example of how big data would transform traditional predictive analysis (Helft, 2008). However, significant discrepancy between GFT's flu estimates and those measured by CDC started to emerge from May 2009. The discrepancy grew overtime, and by late August 2009, GFT underestimated the flu activity by more than 50% — CDC's true number was close to 5%, whereas GFT's estimate was about 2%. The subsequent revision of GFT (Cook et al., 2011) did not do much better. In January 2013, GFT overestimated the flu activity by more than 100% — CDC's true number was around 4.6%, whereas GFT's estimate was over 10%.

Close inspection of the original GFT algorithm reveals several limitations (Lazer et al., 2014; Santillana et al., 2014; Yang et al., 2015). First, GFT assumed that the relationship between total search volume and the proportion of people getting flu was static, but in reality people's search pattern changes over time, so does Google's search engine and the interaction between people and the search engine. Second, GFT did not take use of newly available ILI activity reports from CDC as a flu season evolves, even though CDC's reports contain crucial information of the severity of the flu season. Third, the idea of aggregating the search volumes of multiple query terms into a single variable as the predictor in the GFT model did not allow for changes in people's Internet search behavior over time to be accounted for (as the relative importance of

individual search terms changes over time). Fourth, GFT ignored the intrinsic time series properties of flu, including the seasonality of flu activity. Amid the promises and challenges, Google discontinued GFT in August 2015.

### §3. ARGO for Digital Flu Detection

The mishap of GFT leads people to question the value and feasibility of digital disease detection systems (Butler, 2013). We started in 2014 to investigate if it is possible to build such a system that is capable of generating accurate and reliable real-time tracking of infectious diseases. In the case of flu, we found that it is in fact possible to build an accurate real-time digital flu detection system by using Internet search data, and introduced our model ARGO in Yang et al. (2015), which stands for AutoRegression with GOOgle search data.

ARGO starts from a hidden Markov structure, postulating that (i) the prediction target, the CDC's ILI percentage, which measures the percentage of patients having flu like symptoms in a given week, follows an autoregressive (AR) model with lag  $N$ , after logit-transformation. Let  $p_t$  denote CDC's ILI percentage that we want to predict at week  $t$  (ahead of the time-delayed official report). Then ARGO assumes that  $y_t = \log(p_t/(1 - p_t))$  follows

$$y_t = \mu_y + \sum_{j=1}^N \alpha_j y_{t-j} + \epsilon_t, \quad \epsilon_t \stackrel{iid}{\sim} \mathcal{N}(0, \sigma^2).$$

ARGO also postulates that (ii) the vector of normalized search volumes of flu related query terms on Google at time  $t$  depends only on the flu activity at the same time. This assumption reflects the intuition that flu occurrence leads people to search flu related information online. Let  $X_{i,t}$  be the log-transformed normalized Google search volume of query term  $i$  at week  $t$ , and let  $\mathbf{X}_t = (X_{1,t}, X_{2,t}, \dots, X_{K,t})$ , where  $K$  is the total number of query terms under consideration. Then ARGO assumes that

$$\mathbf{X}_t | y_{1:t} \sim \mathcal{N}_K(\boldsymbol{\mu}_x + y_t \boldsymbol{\beta}, \mathbf{Q}).$$

In our study, we used more than 100 search query terms ( $K \geq 100$ ) and obtained the relative search volume of each query term from the publicly available *Google Trends* website, which gives us  $\mathbf{X}_t$  in real time. The query terms included "symptoms of flu", "treating flu", "flu duration", "flu vs cold", "flu contagious", etc. See Yang et al. (2015) for the detailed list of query terms.

For predicting  $y_t$  at week  $t$  given the time delayed CDC reports and the up-to-date (relative) Google search volumes of the query terms, we calculate the

predictive distribution  $f(y_t | y_{1:(t-1)}, \mathbf{X}_{1:t})$ , which is normal with mean linear in  $y_{(t-N):(t-1)}$  and  $\mathbf{X}_t$ . This leads to the predictive equation

$$\hat{y}_t = \mu_y + \sum_{j=1}^N \alpha_j y_{t-j} + \sum_{i=1}^K \beta_i X_{i,t}.$$

To train the ARGO model, we take  $N = 52$ , which captures the within-year seasonality of flu activity. The coefficients  $\mu_y$ ,  $\boldsymbol{\alpha} = (\alpha_1, \dots, \alpha_N)$ , and  $\boldsymbol{\beta} = (\beta_1, \dots, \beta_K)$  are obtained by minimizing

$$\sum_t (y_t - \mu_y - \sum_{j=1}^N \alpha_j y_{t-j} - \sum_{i=1}^K \beta_i X_{i,t})^2 + \lambda_\alpha \|\boldsymbol{\alpha}\|_1 + \lambda_\beta \|\boldsymbol{\beta}\|_1,$$

where  $\lambda_\alpha$  and  $\lambda_\beta$  are hyper-parameters. The training of ARGO has several features. (a) A two-year moving window that immediately precedes the desired date of estimation is used for the training period. This moving window estimation is to capture the most recent changes in people's search patterns, reflecting the fact that the search pattern and search engine both evolve over time. (b) In the two-year moving window, since there are more independent variables ( $> 150$ ) than the number of observations ( $= 104$ ),  $L_1$  penalty is used, which serves to select the most useful Google search queries for estimation. (c) The estimation dynamically incorporates the most recent information from the CDC reports as they become available. (d) The time series terms in the predictive equation helps capture the long-term cyclic information (seasonality) from past flu activity.

Figure 1 shows (in red) the prediction of ARGO for the flu activity (measured by the CDC's ILI activity level) for the time period of March 2009 to July 2015, compared to the ground truth (in black): the CDC-reported ILI activity level, published typically one or two weeks later. Also shown in Figure 1 (in green) is the GFT estimates (showing the latest updated GFT estimates) for the same time period. The lower panel shows the prediction error. ARGO's prediction stayed close to the ground truth throughout the period. It evidently outperformed GFT. Zooming in on the individual years, ARGO significantly outperformed GFT in each flu season. In fact, it also significantly outperforms other alternative methods as detailed in Yang et al. (2015). The prediction result demonstrates ARGO as an effective method to harness information from Internet searches to provide accurate and reliable real-time tracking of flu.



§4. ARGO for Tracking Dengue

Dengue is a mosquito-borne disease that threatens an estimated 3.9 billion people in 128 countries with an estimated 390 million infections each year. To reduce dengue mortality and morbidity, timely identification of outbreaks is critical, as it can inform and help preventative measures, such as mosquito population control and mosquito bite prevention. For dengue surveillance, governments traditionally rely on hospital-based reporting, a method that is often lagged and limited with frequent post-hoc revisions, due to communication inefficiencies among local and

national agencies and the time needed to aggregate information to the state level.

Encouraged by the promising result of using ARGO to track flu, we extended it for dengue tracking in Yang et al. (2017a), and tested it on producing near real-time estimates of dengue cases in five countries/states: Brazil, Mexico, Singapore, Thailand and Taiwan. The basic idea, similar to the case of flu tracking, is that dengue-related Google search volumes can indicate the ups and downs of dengue activity. The five countries/states were chosen to explore the applicability of ARGO in a diverse set of situations, as the five have different ecology, size, population, economic de-

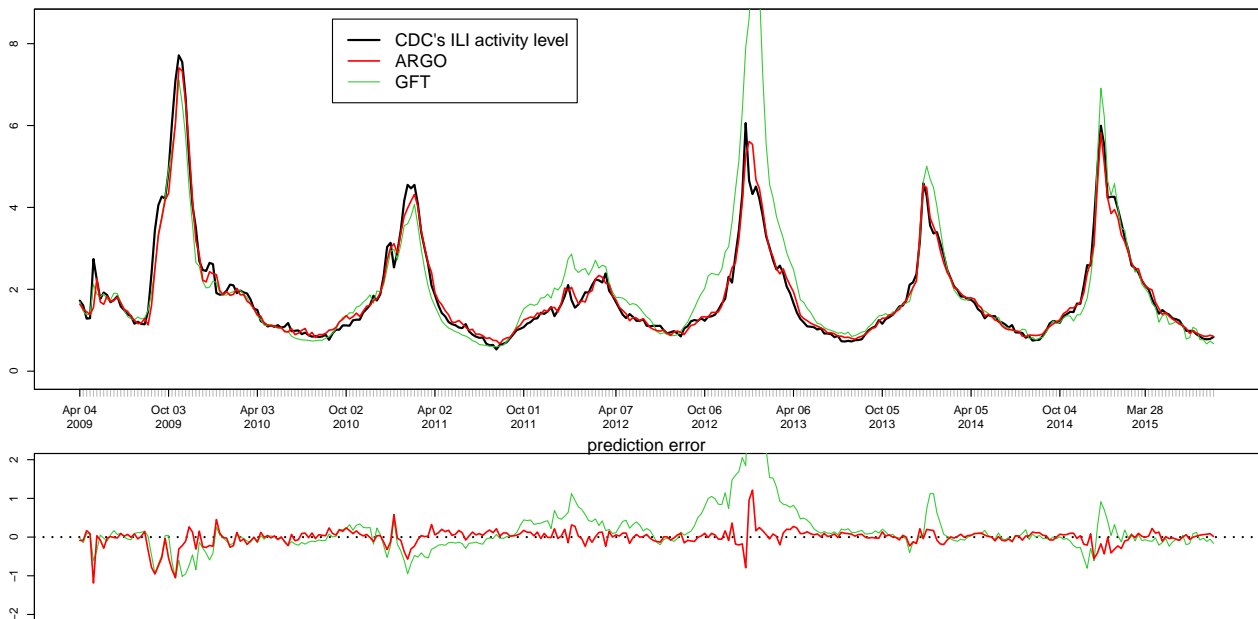


Figure 1: ARGO prediction of the flu level (red) in comparison to the ground truth, CDC's ILI activity level (black), as well as the latest updated estimates from GFT (green). The lower panel shows the estimation error.

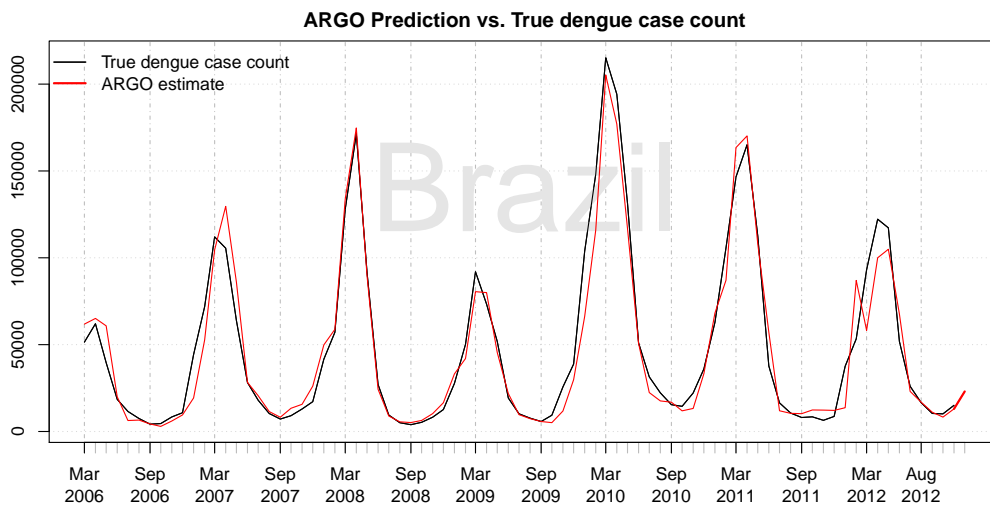


Figure 2: ARGO one-month-ahead prediction of the dengue case counts (red) in Brazil, compared to the official counts (black).

velopment level, Internet penetration (Singapore and Taiwan over 75% versus Thailand's 27%), and Google market share (Brazil, Mexico and Thailand over 90% versus Taiwan's 42% in 2012). We apply ARGO to forecast the monthly dengue case counts in the five countries/states, as the official dengue counts are only available in three countries at the monthly level.

Let  $y_t = \log(c_t + 1)$  be the log-transformed dengue case counts  $c_t$  at time  $t$ , and  $X_{k,t}$  the log-transformed (relative) Google search volume of query term  $k$  at time  $t$ . The query terms we used included "dengue symptoms", "dengue fever", "mosquito bites", etc. (see Yang et al. (2017a)). The hidden Markov structure of the ARGO model gives

$$y_t = \mu_y + \sum_{j \in J} \alpha_j y_{t-j} + \sum_{k \in K} \beta_k X_{k,t} + \epsilon_t, \quad \epsilon_t \stackrel{iid}{\sim} \mathcal{N}(0, \sigma^2),$$

where  $J$  is the set of auto-regressive lags, and  $K$  is the set of Google query terms. For forecasting the monthly dengue case counts, we took  $J = \{1, \dots, 12\} \cup \{24\}$ , i.e., the most recent 12 months plus the month exactly two years ago. The coefficients  $\mu_y$ ,  $\alpha = \{\alpha_j : j \in J\}$ , and  $\beta = \{\beta_k : k \in K\}$  are obtained by minimizing over a two-year moving window

$$\sum_t \left( y_t - \mu_y - \sum_{j \in J} \alpha_j y_{t-j} - \sum_{k \in K} \beta_k X_{k,t} \right)^2 + \sum_{j \in J} \lambda_{\alpha_j} |\alpha_j| + \sum_{k \in K} \lambda_{\beta_k} |\beta_k|$$

where  $\lambda_{\alpha_j}$  and  $\lambda_{\beta_k}$  are regularization hyper-parameters.

Figure 2 shows (in red) the ARGO prediction of dengue case counts in Brazil, one month ahead of the official case counts (shown in black) for the period of March 2006 to December 2012. A close agreement between ARGO prediction and the true counts is seen. In fact, ARGO outperformed other alternative methods as well. The full results and methodology details (including the specification of the hyper-parameters) are described in Yang et al. (2017a). The encouraging results show that the ARGO modeling framework can be used to improve the tracking of dengue activity in multiple locations around the world and that it can be a useful tool to help governments/public health agencies to prepare for and cope with potential dengue outbreaks.

### §5. Road Ahead in the Big Data World

The results of using ARGO to track flu and dengue suggests its versatility. It can be potentially applied to track other infectious diseases, such as Zika, malaria, yellow fever and Chikungunya. As long as a sizable proportion of the population do Internet search, in principle the aggregated Internet search information

can be utilized to track disease activities in real time. ARGO can be deployed for such purposes. Such tools that harness information from big data generated from the Internet can be particularly helpful for less developed countries where government-led hospital-based disease surveillance systems are lacking or ineffective.

ARGO can be generalized to other temporal or spatial scales. It can also incorporate other sources of information. One such source is electronic health records. Over the last two decades many hospitals and medical centers have adopted electronic health records (EHR) to give clinicians faster and easier access to retrieve, enter and modify patient information. The cloud-based EHR systems facilitate real-time retrieval of aggregated disease information. Yang et al. (2017b) extended ARGO to include EHR as well as Internet search data for flu tracking: the predictors  $X_t$  in the ARGO model now include variables derived from nationally aggregated flu-related patient visit counts from a cloud-based EHR system, in addition to Google search volumes. Further error reduction was achieved (Yang et al., 2017b).

The emergence of big data from online or cloud systems offers the potential for real-time tracking of social or public health events. Equally important is the development of statistical/mathematical models and methods that are capable to effectively extract information from the digital data sources and produce accurate and reliable predictions. In fact, GFT was criticized not because people do not believe the value of Internet search data, but because the predictions from GFT were misleading due to its methodological flaws to process the valuable information. Effective use of big data raises many interesting and challenging methodological questions. If not handled properly, they can lead to very inaccurate results. The failure to predict the outcomes of Brexit and 2016 US presidential election despite the large amount of data from social media is a vivid reminder.

Big data present big opportunities for predictive analysis and decision making, but only with proper and rigorous methods and reasoning can the potential be unleashed.

**Acknowledgement.** The material summarized in this article is based on fruitful collaborations with Mauricio Santillana and Shihao Yang.

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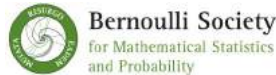
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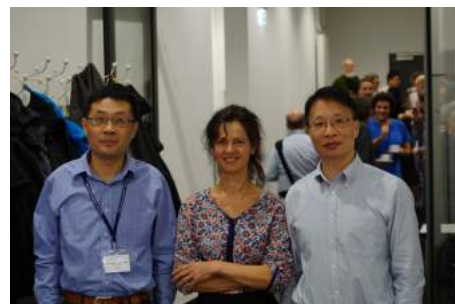
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## Past Conferences, Meetings and Workshops

Sponsored and Co-Sponsored by



### Statistics Meets Friends: Nov, 29–Dec, 1, 2017; Göttingen, Germany



The conference *Statistics Meets Friends* was held in Göttingen from Nov. 29th to Dec. 1st, 2017, at the Alte Mensa of the University of Göttingen. It was organized by the members of the scientific committee Timo Aspelmeier, Thorsten Hohage, Stephan Huckemann, Andrea Krajina, Tatyana Krivobokova, Johannes Schmidt-Hieber and Frank Werner, on the occasion of Axel Munk's 50th birthday under the motto "from biophysics to inverse problems and back", bridging the gap between mathematical statistics, inverse problems and biophysics, highlighting recent developments at their interfaces. There were approximately 100 participants and the conference featured 25 high quality invited talks by the following renowned scientists:

Rabindra N. Bhattacharya on "Monotone random dynamical systems: Existence of steady states and convergence", Peter Bühlmann on "AAA", Tony Cai on "Rate-optimal perturbation bounds for singular subspaces with applications to high-dimensional data analysis", Emmanuel Candès on "The likelihood ratio test in high-dimensional logistic regression is not a chi-square", Manfred Denker on "Improving statistical decision procedures", Holger Dette on "Relevant change points in high dimensional time series", Lutz Dümbgen on "Simultaneous inference about features of densities and regression functions", Alexander Egner on "Op-

tical nanoscopy and statistics: Towards the optimum resolution", Markus Grasmair on "Convergence rates for multiresolution based regularisation methods", Helmut Grubmüller on "Structure determination from single molecule X-ray scattering with three photons per image", Markus Haltmeier on "Compressed sensing and sparsity in photoacoustic tomography", Marc Hoffmann on "Nonparametric estimation of an inhomogeneous age-dependent model in a large population limit", Chris Holmes on "Probabilistic decision functions", Hajo Holzmann on "Inverse problems in econometrics", Thomas Hotz on "Statistics in circles", Zakhar Kabluchko on "Convex cones and statistics", Bernard A. Mair on "From positron emission tomography to potential theory and back", Enno Mammen on "Nonparametric estimation of locally stationary Hawkes processes", Victor M. Panaretos on "Nearly blind deconvolution of Gaussian processes", Richard Samworth on "Isotonic regression in general dimensions", David O. Siegmund on "Detection and estimation of local signals", Sara van de Geer on "On the asymptotic variance of the de-biased Lasso", Aad van der Vaart on "Credible sets for sparse models", and Harrison Huibin Zhou on "Theoretical and computational guarantees on meanfield variance Bayes method for community detection".

Richard Nickl held the Ethel-Newbold-Prize Lec-

ture on "*Efficient nonparametric inference for a nonlinear inverse problem with the Schrödinger equation*" after which he was awarded the Ethel–Newbold-Prize by Sara van de Geer.

In a unique atmosphere, joining young students and researchers with senior world-leading researchers, generous breaks allowed for ample discussions,

which, at a lavish conference dinner, were completed by shared anecdotes from Axel's scientific life, celebrating his jubilee.

On Behalf of the LOC  
Stephan Huckemann  
Göttingen

## Other Events

### GOF Days 2017: September 8–10, 2017; Karlsruhe, Germany



There were about 40 participants. The workshop consisted exclusively of invited talks. The participants were (in alphabetical order): Haeran Cho, Herold Dehling, Miguel Delgado, Holger Dette, Bruno Ebner, Kostas Fokianos, Roland Fried, Josua Goessmann, Norbert Henze, Lajos Horvath, Marie Hušková, Maria-D. Jiménez-Gamero, Estate Khmaladze, Rebecca Killick, Claudia Kirch, Bernhard Klar, Hira Koul, Anne Leucht, Simos Meintanis, Michael Messer, Axel Munk, Natalie Neumeyer, Yakov Nikitin, Ben Norwood, Stathis Paparoditis, Valentin Patilea, Kersten Reckrühm, Gaby Schneider, Stefanie Schwaar, Josef Steinebach, Christina Stöhr, Wolfgang Stummer,

Winfried Stute, Thomas Verdebout, Christian Weiß, Christoph Weitkamp, Martin Wendler, and Dominik Wied.

The workshop was animated by many lively discussions during and after the talks. It also stimulated many interactions between researchers, new research ideas were discussed, and new collaborations have been started. The conference location at the edge of the Black Forest was impressive. Papers presented at the workshop will be collected, following the rigorous standards, in a special issue of the journal *METRIKA*.

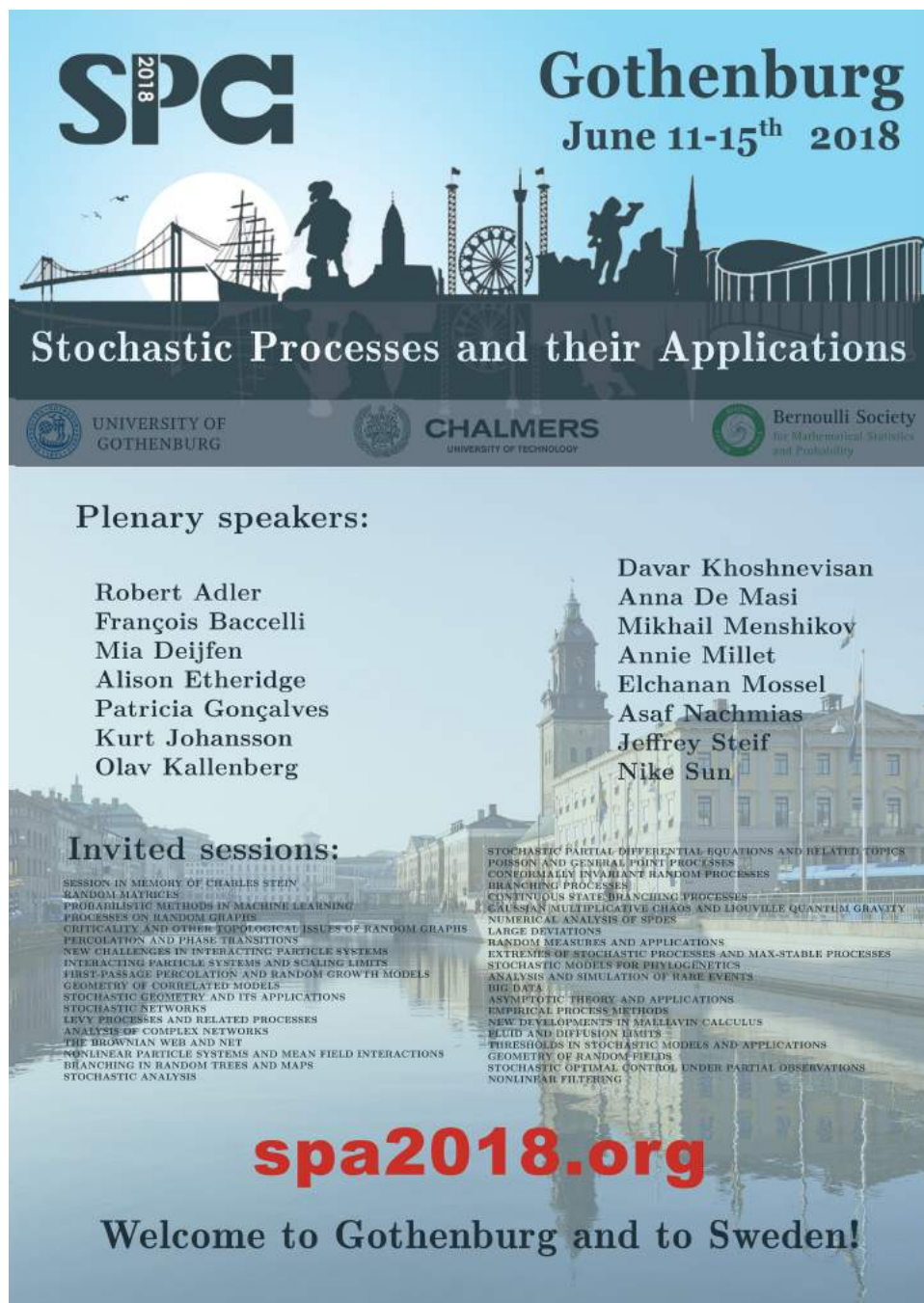
Norbert Henze  
Karlsruhe



# Forthcoming Conferences, Meetings and Workshops, and Calendar of Events

Sponsored and Co-Sponsored by  Bernoulli Society  
for Mathematical Statistics  
and Probability

Stochastic Processes and their Applications 2018: June 11–15, 2018;  
Gothenburg, Sweden



**SPC**  
2018

**Gothenburg**  
June 11-15<sup>th</sup> 2018

**Stochastic Processes and their Applications**

UNIVERSITY OF  
GOTHENBURG

CHALMERS  
UNIVERSITY OF TECHNOLOGY

Bernoulli Society  
for Mathematical Statistics  
and Probability

**Plenary speakers:**

Robert Adler  
François Baccelli  
Mia Deijfen  
Alison Etheridge  
Patricia Gonçalves  
Kurt Johansson  
Olav Kallenberg

Davar Khoshnevisan  
Anna De Masi  
Mikhail Menshikov  
Annie Millet  
Elchanan Mossel  
Asaf Nachmias  
Jeffrey Steif  
Nike Sun

**Invited sessions:**

SESSION IN MEMORY OF CHARLES STEIN  
RANDOM MATRICES  
PROBABILISTIC METHODS IN MACHINE LEARNING  
PROCESSES ON RANDOM GRAPHS  
CRITICALLY AND OTHER TOPOLOGICAL ISSUES OF RANDOM GRAPHS  
PERCOLATION AND PHASE TRANSITIONS  
NEW CHALLENGES IN INTERACTING PARTICLE SYSTEMS  
INTERACTING PARTICLE SYSTEMS AND SCALING LIMITS  
FIRST-PASSAGE PERCOLATION AND RANDOM GROWTH MODELS  
GEOMETRY OF CORRELATED MODELS  
STOCHASTIC GEOMETRY AND ITS APPLICATIONS  
STOCHASTIC NETWORKS  
LEVY PROCESSES AND RELATED PROCESSES  
ANALYSIS OF COMPLEX NETWORKS  
THE BROWNIAN WEB AND NET  
NONLINEAR PARTICLE SYSTEMS AND MEAN FIELD INTERACTIONS  
BRANCHING IN RANDOM TREES AND MAPS  
STOCHASTIC ANALYSIS

STOCHASTIC PARTIAL DIFFERENTIAL EQUATIONS AND RELATED TOPICS  
POISSON AND GENERAL POINT PROCESSES  
CONEDIMALLY INVARIANT RANDOM PROCESSES  
BRANCHING PROCESSES  
CONTINUOUS STATE BRANCHING PROCESSES  
GAUSSIAN MULTIPLICATIVE CHAOS AND LIOUVILLE QUANTUM GRAVITY  
NUMERICAL ANALYSIS OF SPDES  
LARGE DEVIATIONS  
RANDOM MEASURES AND APPLICATIONS  
EXTREMES OF STOCHASTIC PROCESSES AND MAX-STABLE PROCESSES  
STOCHASTIC MODELS FOR PHYLOGENETICS  
ANALYSIS AND SIMULATION OF RARE EVENTS  
BIG DATA  
ASYMPTOTIC THEORY AND APPLICATIONS  
EMPIRICAL PROCESS METHODS  
NEW DEVELOPMENTS IN MALLAVIN CALCULUS  
FLUID AND DIFFUSION LIMITS  
THRESHOLDS IN STOCHASTIC MODELS AND APPLICATIONS  
GEOMETRY OF RANDOM FIELDS  
STOCHASTIC OPTIMAL CONTROL UNDER PARTIAL OBSERVATIONS  
NONLINEAR FILTERING

**spa2018.org**

Welcome to Gothenburg and to Sweden!

## ISNPS 2018: June 11–15, 2018; Salerno, Italy



The ISNPS (International Society of Nonparametric Statistics) conferences take place biennially. The Fourth Conference of ISNPS is scheduled to take place in Salerno, Southern Italy, June 11–15, 2018 and is co-sponsored by the IMS, the ISI, and other organizations. The venue is the Grand Hotel Salerno, which is located on the bay of Salerno. Salerno is 34 miles (55 Km) south of Naples, and in less than one hour can be reached by bus or by train from the Napoli Capodichino International Airport, connected to many European cities by direct flights. Salerno is also well connected with Rome and Roma Fiumicino International Airport, by direct high speed trains which in two hours will take you to Salerno.

The conference will bring forth recent advances and trends in several areas of nonparametric statistics, in

order to facilitate the exchange of research ideas, promote collaboration among researchers from all over the world, and contribute to the further development of the field. The program will include plenary talks, special invited talks, invited talks, contributed talks and posters on all areas of nonparametric statistics.

Looking forward to seeing you in June 2018!

More details can be found from

<http://www.isnps2018.it>

*The Organizers*  
 Michele La Rocca  
 Brunero Liseo  
 Luigi Salmaso

## Data Science, Statistics & Visualization: July 9–11, 2018; Vienna, Austria



**9–11 July, 2018. TU Wien—Austria**

<http://iasc-isi.org/dssv2018/>

DSSV (Data Science, Statistics, and Visualization) 2018 will take place from July 9–11, 2018, in Vienna, being organized by TU Wien. This meeting shall create a forum to discuss recent progress and emerging ideas in these different disciplines and encourage informal contacts and discussions among all the par-

ticipants. The conference welcomes contributions to practical aspects of data science, statistics and visualisation, and in particular those which are linking and integrating these subject areas. Presentations should thus be oriented towards a very wide scientific audience, and can cover topics such as machine learning

and statistical learning, the visualisation and verbalization of data, big data infrastructures and analytics, interactive learning, advanced computing, and other important themes.

Keynote speakers include:

- Xuming He, University of Michigan, USA.
- Helwig Hauser, University of Bergen, Norway.

Invited speakers include:

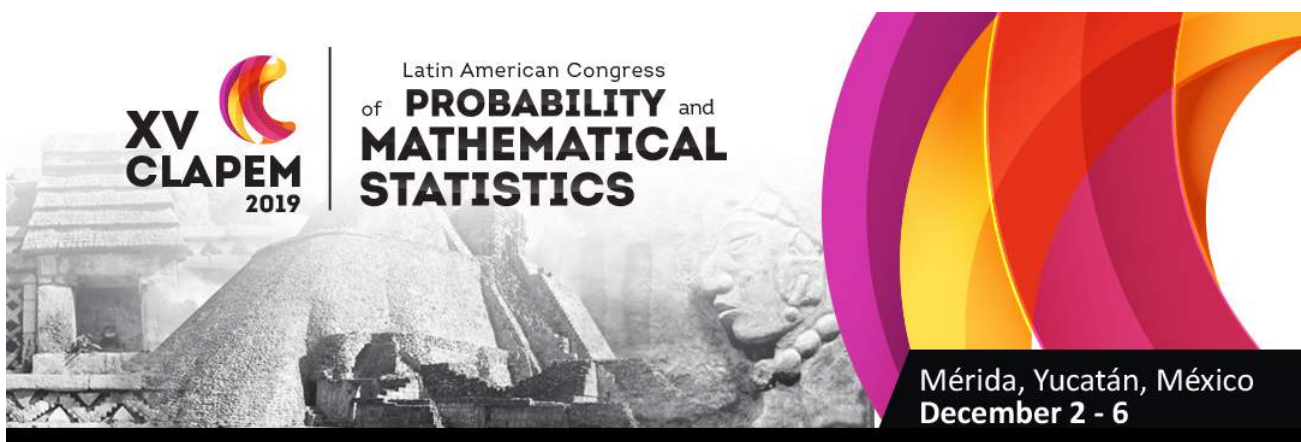
- Mia Hubert, KU Leuven, Belgium.
- Sara van de Geer, ETH Zurich, Switzerland.

- Ryan Tibshirani, Carnegie Mellon University, USA.
- Zeynep Akata, University of Amsterdam, The Netherlands.
- Eric Postma, Tilburg University, The Netherlands.

More details on the conference can be found on

<http://iasc-isi.org/dssv2018/>

Peter Filzmoser  
Vienna



## XV CLAPEM 2019: December 2–6, 2019; Merida-Yucatán, México

The XV Latin American Congress of Probability and Mathematical Statistics (also known as ‘CLAPEM’), will take place in 2–6 December, 2019, at the Hotel Castellano, Merida-Yucatán, México. CLAPEM (*Congreso Latinoamericano de Probabilidad y Estadística Matemática*) is the official meeting of the *Sociedad Latino Americana de Probabilidad y Estadística Matemática* (SLAPEM), the Latin American Chapter of the Bernoulli Society. It is the major event in Probability and Statistics in the region and it gathers an important number of researchers and students, predominantly from Latin America. It serves as a forum to discuss and to disseminate recent advances in the field, as well as to reveal the future of our profession.

Over nearly 40 years the CLAPEMs have greatly contributed to the development of Probability and Statistics in Latin America by promoting collaborations in the region as well as with the rest of the world. Previ-

ous editions were held in Caracas (1980,1985, 2009), Montevideo (1988), Ciudad de México (1990), San Pablo (1993), Viña del Mar (1995, 2012), Córdoba (1998), La Habana (2001), Punta del Este (2004), Lima (2007), Cartagena (2014) and San José (2016).

Through the organizing institutions and sponsor societies, México welcomes this 15th edition of the CLAPEM, we look forward for an exciting scientific program featuring great keynote speakers, invited thematic sessions, short courses as well as contributed and posters sessions.

More information at

<http://clapem2019.eventos.cimat.mx>

On behalf of the LOC  
Ramsés H. Mena  
México

## Other Events



## Lancaster Probability Days 2018: May 22–24, 2018; Lancaster, UK

Lancaster Probability  
Days 2018

Tuesday May 22 - Thursday May 24  
Lancaster University



[probability\\_days\\_2018/](http://www.lancaster.ac.uk/maths/probability_days_2018/)

The Lancaster Probability Days will be held at Lancaster University from 22nd to 24th May 2018. It is a series of three collaborative one-day workshops, each on a different probabilistic/statistical theme. This year's themes are Random Permutations, Random Matrices & Quantum Symmetries, and Statistical Learning Theory & Machine Learning. For registration and more information please visit the conference website at

<http://www.lancaster.ac.uk/maths/>

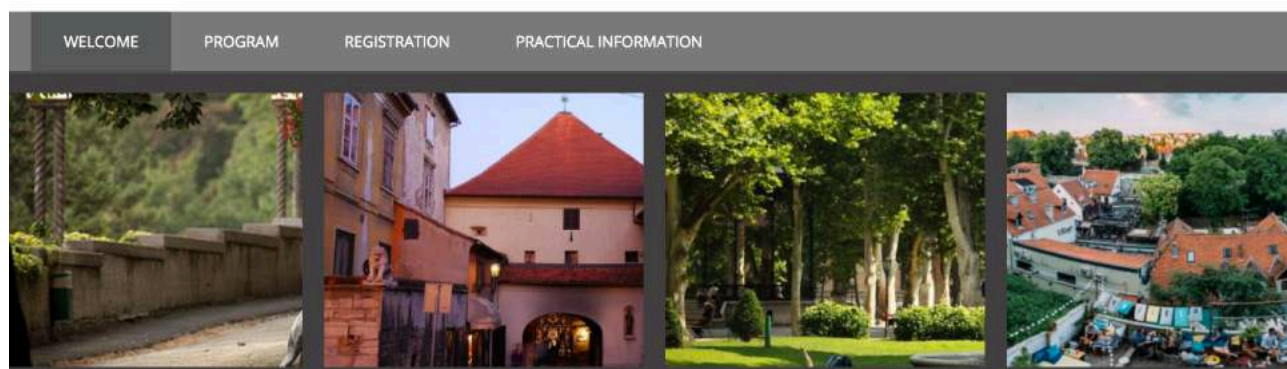
Registration closes on 30th April, 2018. This workshop is supported by an LMS Conference Grant, the Bank of England, and Lancaster University's Department of Mathematics & Statistics.

On behalf of the LOC  
*Natasha Blitvic, Azadeh Khaleghi (Chair)*  
*Amanda Turner, Dirk Zeindler*  
Lancaster

## EVA 2019: July 1–5, 2019; Zagreb, Croatia



**EXTREME VALUE  
ANALYSIS 2019**  
JULY 1-5 • ZAGREB



The EVA meeting (11th international conference on Extreme Value Analysis) will take place in Zagreb, Croatia, July 1–5, 2019, being currently organised by the Department of Mathematics, Faculty of Science, University of Zagreb. Since their inception in Vimeiro, Portugal in 1983, EVA conferences have regularly gathered many of the world's experts in Extreme Value Theory. Traditionally, the conferences feature

theoretical advances as well as important applications of EVT. The event is geared towards students, junior researchers, scientists and practitioners working in areas where statistics of extremes is applied.

Due to its position, culture, architecture and gastronomy, Zagreb has become a very popular travel destination in recent years. It is also the birthplace of two mathematicians who helped to lay the theoret-



ical foundations of Extreme Value Theory. In 1902, **Jovan Karamata**, a renown Serbian mathematician and the founder of regular variation theory was born here. A few years later, in 1906, **William Feller**, one of the most prominent probabilists of the 20th century, was born in Zagreb as Vilibald Srećko Feller. His two volume treatise *An Introduction to Probability Theory and Its Applications* is often regarded as a masterpiece of 20th century mathematical writing. The book


already pinpoints a large number of applications of heavy tailed distributions.

More detail on the meeting are available from

<https://web.math.pmf.unizg.hr/eva2019/>

Bojan Basrak  
Zagreb

## Calendar of Events

This calendar lists all meetings that have been announced in this and previous issues of *Bernoulli News* together with forthcoming meetings organized under the auspices of the Bernoulli Society or one of its Regional Committees (marked by ).


A more comprehensive calendar of events is available on the ISI Websites

- [www.bernoulli-society.org/index.php/meetings](http://www.bernoulli-society.org/index.php/meetings)
- [www.isi-web.org/index.php/activities/calend](http://www.isi-web.org/index.php/activities/calend)

### June 2018

-  June 11–15 (2018), *ISNPS2018 (4th Conference of the International Society for Nonparametric Statistics)*, Salerno, Italy.
-  June 11–15 (2018), *40th Conference on Stochastic Processes and their Applications*; Gothenburg, Sweden.
- June 24–29 (2018), *ISBA 2018 World Meeting*; Edinburgh, UK.
-  July 28–31 (2018), *XXII Brazilian School of Probability*; Rio de Janeiro, Brazil.

### July 2018

-  July 9–11 (2018), *DSSV (Data Science, Statistics and Visualisation) 2018*; Vienna, Austria.


### Quote of the Issue:

*“This award has a number of aspects that we hope, longer term, will provide an avenue for recognition to new researchers who, due to location or lack of mentorship, have limited access to senior members of our society who will advocate for their research contributions.”*


Susan A. Murphy

- July 23–27 (2018), *ECMTB 2018*; Lisbon, Portugal.

### June 2019

-  June 11–15 (2019), *41st Conference on Stochastic Processes and their Applications*; Evanston, Chicago, USA.


### July 2019

- July 1–5 (2019), *11th International Conference on Extreme Value Analysis (EVA2019)*, Zagreb, Croatia.
-  July 22–26 (2019), *32nd European Meeting of Statisticians*, Palermo, Italy.


### August 2019

-  August 18–23 (2019) *62nd ISI World Statistics Congress*; Kuala Lumpur, Malaysia.

### December 2019

-  December 1–6 (2019), *Latin American Congress of Probability and Mathematical Statistics (CLAPEM)*; Merida, Yucatán, Mexico.

### August 2020

-  August 17–21 (2020), *World Congress in Probability and Statistics*; Seoul, South Korea.

## Recent Issues of Official Publications

Sponsored by  Bernoulli Society  
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### Bernoulli

Vol. 24, No. 2: May 2018

Editor-in-Chief: H. Dette

<http://projecteuclid.org/current/euclid.bj>

- "Adaptive Confidence Sets for Matrix Completion," A. Carpentier, O. Klopp, M. Löffler, R. Nickl, 2429–2460.  
 "Evolution of the Wasserstein Distance Between the Marginals of Two Markov Processes," A. Alfonsi, J. Corbetta, B. Jourdain, 2461–2498.  
 "The Sharp Constant for the Burkholder–Davis–Gundy Inequality and Non-smooth Pasting," W. Schachermayer, F. Stebegg, 2499–2530.  
 "The  $M/G/\infty$  Estimation Problem Revisited," A. Goldenshluger, 2531–2568.  
 "Special Weak Dirichlet Processes and BSDEs Driven by a Random Measure," E. Bandini, F. Russo 2569–2609.  
 "Perturbation Theory for Markov Chains via Wasserstein Distance," D. Rudolf, N. Schweizer, 2610–2639.  
 "Gaussian Approximation for High Dimensional Vector Under Physical Dependence," X. Zhang, G. Cheng, 2640–2675.  
 "Equivalence Classes of Staged Trees," C. Görge, J. Q. Smith, 2676–2692.  
 "Max-linear Models on Directed Acyclic Graphs," N. Gissibl, C. Klüppelberg, 2693–2720.  
 "Coalescence of Euclidean Geodesics on the Poisson–Delaunay Triangulation," D. Coupier, C. Hirsch, 2721–2751.  
 "Sticky Processes, Local and True Martingales," M. Rasonyi, H. Sayit, 2752–2775.  
 "A New Approach to Estimator Selection," O. V. Lepski, 2776–2810.  
 "Concentration and Moderate Deviations for Poisson Polytopes and Polyhedra," J. Grote, C. Thäle, 2811–2841.  
 "Large Deviations for Locally Monotone Stochastic Partial Differential Equations driven by Levy Noise," J. Xiong, J. Zhai, 2842–2874.  
 "Large Deviations and Applications for Markovian Hawkes Processes with a Large Initial Intensity," X. Gao, L. Zhu, 2875–2905.  
 "Concentration Inequalities for Separately Convex Functions," A. Marchina, 2906–2933.  
 "Nonparametric Volatility Estimation in Scalar Diffusions: Optimality Across Observation Frequencies," J. Chorowski, 2934–2990.  
 "Simultaneous Quantile Inference for Non-stationary Long-memory Time Series," W. Wu, Z. Zhou, 2991–3012.  
 "Simultaneous Nonparametric Regression Analysis of Sparse Longitudinal Data," H. Cao, W. Liu, Z. Zhou, 3013–3038.  
 "Nested Particle Filters for Online Parameter Estimation in Discrete-time State-space Markov Models," D. Crisan, J. Míguez, 3039–3086.  
 "Applications of Distance Correlation to Time Series," R. A. Davis, M. Matsui, T. Mikosch, P. Wan, 3087–3116.  
 "On Limit Theory for Levy Semi-stationary Processes," A. Basse-O'Connor, C. Heinrich, M. Podolskij, 3117–3146.  
 "Wide Consensus Aggregation in the Wasserstein Space [...]," P. C. Álvarez-Esteban, E. del Barrio, J. A. Cuesta-Albertos, C. Matran, 3147–3179.

### Stochastic Processes and their Applications

Vol. 128, No. 5: May 2018

Editor-in-Chief: S. Méléard

<http://www.sciencedirect.com/science/journal/03044149>

- "Limit Theorems for Hilbert Space-valued Linear Processes under Long Range Dependence," M.-C. D, 1439–1465.  
 "Relation Between the Rate of Convergence of Strong Law of Large Numbers and [...]," R. Sato, K. Miyabe, A. Takemura, 1466–1484.  
 "Infinite Horizon Risk-sensitive Control of Diffusions Without any Blanket Stability Assumptions," A. Arapostathis, A. Biswas, 1485–1524.  
 "Favorite Sites of Randomly Biased Walks on a Supercritical Galton–Watson Tree," D. Chen, L. de Raphélis, Y. Hu, 1525–1557.  
 "Metastability for Small Random Perturbations of a PDE with Blow-up," P. Groisman, S. Sagiatti, N. Saintier, 1558–1589.  
 "Latent Voter Model on Locally Tree-like Random Graphs," R. Huo, R. Durrett, 1590–1614.  
 "Products of Random Variables and the First Digit Phenomenon," N. Chenavier, B. Massé, D. Schneider, 1615–1634.  
 "Covariance of Stochastic Integrals with Respect to Fractional Brownian Motion," Y. Maayan, E. Mayer-Wolf, 1635–1651.  
 "Convex Integral Functionals of Regular Processes," T. Pennanen, A.-P. Perkkiö, 1652–1677.  
 "Lower Bounds for Moments of Global Scores of Pairwise Markov Chains," J. Lember, H. Matzinger, J. Sova, F. Zucca, 1678–1710.  
 "Itô's Calculus Under Sublinear Expectations via Regularity of PDEs and Rough Paths," X. Guo, C. Pan, 1711–1749.  
 "Persistence Probabilities for Stationary Increment Processes," F. Aurzada, N. Guillotin-Plantard, F. Pène, 1750–1771.  
 "Asymptotics for Stochastic Reaction–diffusion Equation Driven by Subordinate Brownian Motion," R. Wang, L. Xu, 1772–1796.

### Bernoulli Society Bulletin e-Briefs

Vol. 30: July 2017

Editor-in-Chief: C. Constantinescu

<http://goo.gl/G9A0g1>

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Have a look at <http://goo.gl/7EP2cZ> for the latest articles in *Electronic Communications in Probability*, *Electronic Journal of Probability*, *Electronic Journal of Statistics*, *Probability Surveys* and *Statistics Surveys*, as well as *International Statistical Review*.

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| <i>President Elect</i>        | Claudia Klüppelberg (Germany)  | cklu@ma.tum.de         |
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# Join the Bernoulli Society



**Bernoulli Society**  
for Mathematical Statistics  
and Probability

*"If you are already a member, encourage your colleagues, postdocs and PhD Students to join the Bernoulli Society."*



## Publications and Meetings

The Bernoulli Society official journals are *Bernoulli* and *Stochastic Processes and their Applications*. In addition, the BS co-sponsors the following open-access online publications: *Electronic Communications in Probability*, *Electronic Journal of Probability*, *Electronic Journal of Statistics*, *Latin American Journal of Probability and Mathematical Statistics*, *Probability Surveys* and *Statistics Surveys*. Published twice a year, *Bernoulli News* provides detailed information about activities of the Society, while *Bernoulli e-Briefs* is a bimonthly electronic information bulletin that summarizes and draws the attention of relevant information to the membership.

The Bernoulli Society organizes or sponsors several international meetings which have a prominent relevance in the fields of mathematical statistics, probability, stochastic processes and their applications. These meetings are often held in conjunction with the ISI and other ISI Associations, the IMS or by the BS Regional and Standing Committees. Some of the meetings with a proud tradition are the *Bernoulli-IMS World Congress in Probability and Statistics* every four years, the *Conference on Stochastic Processes and their Applications* (SPA) organized every year, the *ISI World Statistics Congress* (formerly ISI Session), the *Latin American Congress in Probability and Mathematical Statistics* (CLAPEM) organized every two or three years, the *European Meeting of Statisticians* (EMS) organized every two years and the *European Young Statisticians Meeting* (EYSM) organized every two years.

## Benefits of Joining the Bernoulli Society

- Reduced registration fees for meetings organized or sponsored by the Bernoulli Society.
- Free online access to *Bernoulli* (back to the

first issue in 1995) and to *Stochastic Processes and their Applications* (back to the first issue in 1973). Receive the print version of *Bernoulli News* and the electronic information bulletin *Bernoulli E-Briefs*.

- Reduced subscription rates are available for print copies of *Bernoulli* and *Stochastic Processes and their Applications*, and to online version of the ISI *International Statistical Review*.
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- Special subscription rates on several journals in probability and statistics.
- Springer offers a 20% discount on their books, if ordered directly. Members with a BS-IMS joint membership have free on line access to the IMS journals: *Annals of Statistics*, *Annals of Probability*, *Annals of Applied Probability*, *Annals of Applied Statistics* and *Statistical Science*. They also have reduced subscription rates to print IMS publications.

## Membership Application and Fees

### Online Applications for Membership

- Bernoulli Society membership  
<http://isi.cbs.nl/bern-form.asp>
- Joint BS-IMS membership  
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- Joint BS-IMS-ISI membership  
[http://isi.cbs.nl/bern\\_ims\\_isi-form.asp](http://isi.cbs.nl/bern_ims_isi-form.asp)

### Membership Fees for 2018

- Full members: €80.
- First year of membership for members from developed countries: €40.
- Members from developing countries, first two years of postdoc, retired members: €24.
- Joint BS-IMS membership: \$165.
- Joint BS-IMS-ISI membership (only for elected ISI Members): €168.
- PhD Students: Free!!!