Bernoulli News

Newsletter of the Bernoulli Society for Mathematical Statistics and Probability

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A VIEW FROM THE PRESIDENT

Dear Members of the Bernoulli Society,

Past presidents have written before about the emotive aspect of the moment when they receive the Bernoulli Book, Die Familie Bernoulli. Admittedly, it was no different for me. To see the signatures of so many of my scientific heroes in its front pages, including some of my mentors, is both awe-inspiring and humbling. I am very honoured that my colleagues have mandated me to serve the community from this distinguished post, and pledge to apply myself vigorously. I am also conscious that, as the youngest ever President of this Society, I will not add to the gravitas of the signature page – except by serving as a sign that the Society trusts in the next generation.

As I embark on my mandate as President, I am quickly learning how very much my predecessors have been contributing behind the scenes, and I would like to begin by expressing my sincere gratitude to them, especially the last two Presidents, Claudia Klüppelberg and Adam Jakubowski with whom I've worked the closest. My gratitude also goes to the outgoing Secretary, Song Chen, and to the outgoing council members. I am very pleased to welcome our new Scientific Secretary, Jeff Yao, and six new councilors: David Croydon, Holger Dette, Thomas Mikosch, Giovanni Peccati, Maria-Eulalia Vares, and Andy Wood. I want to also warmly thank Manuele Leonelli (outgoing BNews Editor) and Bojana Milošević (outgoing E-Briefs editor, and incoming BNews Editor), and to welcome Alessia Caponera (incoming E-Briefs editor) for their service to the society.

I am especially pleased that Nancy Reid has been installed as our new President-Elect. The very first job of the President-Elect is to secure their successor, and with Nancy being next in line, the Society will be in great hands!

... Continued on p. 1

Deadline for the next issue: **31 March, 2024**
Send contributions to: *bojana.milosevic@matf.bg.ac.rs*

A View from the President (continued from front cover)

It was when I was starting my PhD, twenty years ago, that I was also gradually introduced to academic life beyond one's own institution. Those aspects that rest on the international collective: journals, conferences, awards, initiatives, special lectures. It all was there and seemed to work well, and I took it for granted.

But who does all this?

Ultimately, we row the boat together. Yet behind the scenes there are many volunteers who work hard from many different posts to maintain the boat, to manage all this that could be called "the recurrent and usual, although not always trivial"[1] and in any case the necessary for our discipline to thrive. So, to be a member of a learned Society is to support this endeavor - both financially and (hopefully) through volunteer work.

If you are reading this, you are probably already a member. But maybe it will give you some arguments to convince your colleagues to join, especially junior colleagues, who like me twenty years ago might take it all for granted. If they've attended one of our meetings, if they author and read papers in our journals, or otherwise benefit from sponsored activities, then seeking their support via their membership seems a fair ask in return.

Of course, we are always actively thinking of how we can serve our members better, and generate more value from their membership. There is an ongoing discussion with key officers for possible initiatives, that I hope to report on in forthcoming issues. But there is a timeless and intrinsic value in membership, in that it's what keeps it all going.

Why join the Bernoulli Society if one is already a member of the IMS?

There are differences in character that I could discuss, for instance I have the feeling that probability and statistics cohabit more intimately in the Bernoulli Society. But there is a bigger picture. From an evolutionary point of view, there is value in pluralism: better not put all eggs in one basket, whether it be organizing meetings, running journals, or administering awards. Indeed, the Bernoulli Society was born in part due to geopolitical circumstances. The kinds that we thought were a thing of the past, but recent events should make us reconsider. There is no contradiction in being a member of both, to the contrary, the overlap is fruitful.

Incidentally, managing "the recurrent and usual, although not always trivial" is also a much more considerable endeavor today. Ten years ago, W.S. Kendall wrote that "the Bernoulli Society has become substantially more complicated in recent years, and much more so than at its inception 40 years ago"[2] and the trend has rapidly progressed. Against this background, I am very pleased that the Society's secretariat (based at the Nicolaus University in Torun) has now been established, thanks largely to the efforts of Past President Adam Jakubowski, and afforded by the improved financial standing of the Society. For the latter, I must thank Claudia Klüppelberg (Adam's predecessor) and Geoffrey Grimmet (past treasurer). Dr. Kamila Siuda, our Secretary, is introduced in a later section of the Bulletin.

Now that the Secretariat has been established, a core part of my mission for the next two years will be to work closely with the Secretary to organise an efficient workflow for the benefit of all. In particular, the secretariat cannot be a resource only for the President - this should be a resource for all Bernoulli officials in charge of critical offices. It will ease the administrative burden of Bernoulli officers and allow them to focus on the essence of their mandate. It will also help us maintain continuity/consistency, preserve institutional memory, and automate/accelerate our procedures.

Returning, though, to the bigger picture, our Bernoulli Family will soon be celebrating a half-century of existence. We will mark this historical landmark in a special celebratory session at the upcoming Bernoulli-IMS World Congress in Bochum, and I hope to see many of you there! This is also a great moment to take the time to reflect on how to best conserve our collective history. I would like to invite those of you who have photographs, audio/video footage, or other material relating to the history of the Society, to please share it with us, by writing to secretariat@bernoullisociety.org.

The upcoming World Congress itself is shaping up very nicely, and we can all look forward to an exciting and scientifically stimulating programme in Bochum. In particular, the list of plenary lectures has now been released (see https://www.bernoulli-ims-worldcongress2024.org/plenary-lectures). Among these, I would like to highlight the inaugural Cox Lecture, to be given by V. Chernozhukov, in honour of our Past President, David R. Cox, who passed away last year. I would like to thank the scientific organising committee, in particular the co-chairs A. Delaigle and K. Ramanan, and of course the local organisers, in particular the chair H. Dehling, for their all their efforts. I hope to see you all there!

[1] J. Jacod, "A Word from the President", Bernoulli News, Vol. 14 (2), 2007
[2] W.S. Kendall, "A View from the President", Bernoulli News, Vol. 22 (2), 2015

There is another World Congress, of course: that of our parent organisation, the ISI World Statistics Congress. The next edition will take place in The Hague in 2025, and I hope that our Society will have a strong presence in the scientific programme. Almut Veraart has kindly agreed to represent us on the programme committee, and I would like to encourage you to contact her if you are considering to submit an IPS proposal of interest to BS members.

Several awards were bestowed this summer, and I would like to congratulate the winners, namely Th. Mikosch (van Zwet Medal), Lester Mackey (Ethel Newbold Prize), and our three New Researcher Award winners: Jiaoyang Huang, Leonardo Tolomeo, and Lingfu Zhang!

Let me close by highlighting a landmark and posing a question: it was 100 years ago that R.A. Fisher[3] published his first paper on the Analysis of Variance. Except for electronic communication, is it clear that the peer review process has essentially evolved since? Can we do better?

Victor M. Panaretos
President of the Bernoulli Society
Lausanne, Switzerland

Editorial

This my first issue as the Editor of Bernoulli News and I am using this opportunity to thank Adam, Victor and Leonardo for the trust given, and Manuele for a lot of very useful suggestions and advices.

In today's fast-paced world, the challenge is to produce content that is both current and engaging while maintaining conciseness. I hope to meet all your expectations, and that you'll enjoy reading the upcoming issues as much as I have in previous years.

Prepare for captivating discussions in the upcoming issues! We'll delve into intriguing topics, such as the essential role of Probability and Statistics in the AI era, and the extensive impact of AI on our world. With an outstanding lineup of contributors, get ready for an exciting journey of insights!

Contributions to the next issue should be sent to:

bojana.milosevic@matf.bg.ac.rs

The Editor
Belgrade

[3] R.A. Fisher & W.A. Mackenzie, "Studies in crop variation II: The manurial response of different potato varieties", The Journal of Agricultural Science, Vol 13 (3), pp. 311 – 320, 1923

News from the Bernoulli Society

Nominations for the President-Elect and ordinary Council members

At the General Assembly of the Bernoulli Society, held on July 18th, 2023, a Nominating Committee was established. It consists of Nancy Reid (Chair), Zengjing Chen, Claudio Landim, Victor M. Panaretos, Sonia Petrone, Mark Podolskij, Gesine Reinert, Leonardo T. Rolla, Arno Siri-Jégousse, Jingwen Song, Jeff Yao (non-voting). The task of the committee is to make nominations for the office of President-Elect (2025–2027) and six ordinary Council members (2025–2029). All members of the Bernoulli Society are invited to submit names of possible candidates (with basic information and the web address) to Ms Kamila Siuda at secretariat@bernoullisociety.org by December 15th, 2023.

Allesia Caponera
e-Briefs
Milano

New Officers

Sebastian Engelke (University of Geneva, Switzerland) has been elected for another term as Membership Secretary. Inés Armendáriz (UBA, Argentina) has become the new Chair of Latin America Regional Committee, succeeding Juan Carlos Pardo Millán. We would like to thank Juan Carlos Pardo Millán for his dedicated work over previous years.

Allesia Caponera
e-Briefs
Milano

New Editor-in-Chief of SPA

I am delighted to announce the appointment of our new Chief Editor for SPA, Dr. Eva Loecherbach (website: https://www.pantheonsorbonne.fr/page-perso/elocherbac). She will succeed Matthias Loewe, and her term will commence at the end of March.

The publication committee evaluated 13 candidates, recommended by the current Editor-in-Chief of SPA and committee members (comprising 8 males and 5 females). Following a thorough ranking process, Dr. Eva Loecherbach emerged as the clear choice. Her research expertise, which encompasses statistical and probabilistic methods for stochastic processes, combined with her significant editorial experience, makes her an ideal candidate for the role of Editor-in-Chief of SPA.

Mark Podolskij
Publication Secretary
Luxembourg

Awards and Prizes

Winner of Ethel Newbold Prize 2023

The Ethel Newbold Prize, awarded biennially for excellence in statistics, pays tribute to the significant historical role of women in the field. Despite its gender-specific name, the award recognizes statistical excellence without regard to the recipient's gender. More information can be found at https://www.bernoullisociety.org/index.php/prizes?id=207.

The fifth winner of this prize is Lester Mackey (Stanford University and Microsoft Research New England) has become the fifth Ethel Newbold Prize Winner. The Prize Committee consisted of Gesine Reinert (Chair), Adrian Röllin and Susan Murphy who wrote that

> "Lester Mackey is an outstanding mid-career scientist with a superb breadth and depth of achievements, with publications spanning probability, applied probability, theoretical statistics, applied statistics, and machine learning.

During the 64th ISI WSC in Ottawa, on July 20th, 2023, Lester Mackey gave a lecture entitled Advances in Distribution Compression.

Let me join in congratulating Lester for all of his contributions.

The Editor
Belgrade

From the left: Adam Jakubowski and Lester Mackey

The winners of 2024 Bernoulli Prize for Outstanding Survey Article in Probability



From the left: Christophe Ley, Gesine Reinert and Yvik Swan

The Bernoulli Prize for an Outstanding Survey Article is to recognize authors of an influential survey publication in the areas of probability and statistics, respectively. The paper should be timely in addressing areas of active or emerging importance, but have been in circulation long enough for there to be evidence of its impact.

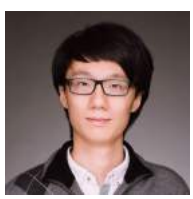
The winners od the 2024 Bernoulli prize for an Outstanding Survey Article in Probability are Christophe Ley (University of Luxembourg, Luxembourg), Gesine Reinert (University of Oxford, UK) and Yvik Swan (Free University of Brussels, Belgium), for *Stein's method for comparison of univariate distributions*, Probability Surveys, vol. 14, pages 1-52, 2017.

The Prize Committee consisted of Markus Heydenreich (Chair), Ludwig-Maximilians-Universität München Jason Schweinsberg, University of California San Diego Maria Eulalia Vares, Universidade Federal do Rio de Janeiro.

Let me join in congratulating authors for this brilliant peace of work.

The Editor
Belgrade

Qiyang Han wins David G. Kendall Award for Young Researchers



The biannual award is presented jointly by the Royal Statistical Society and the Bernoulli Society to a young researcher that has made a significant contribution to the alternating fields of mathematical statistics or probability theory. David G. Kendall (1918–2007) was the first president of the Bernoulli Society and recipient of the RSS Guy Medal in Silver (1955) and in Gold (1981).

This year, the award recognises Rutgers University Assistant Professor Qiyang Han for his outstanding contributions to, among other things, empirical process theory, nonparametric inference under shape constraints and asymptotics for multivariate models.

Congratulations!

The Editor
Belgrade

Jian Ding wins 2023 Loéve Prize

Jian Ding (Peking University, China) has been awarded the 2023 Liné and Michel Loève International Prize in Probability (Loève Prize).

The Loève Prize was created in 1992 in honor of Michel Loève by his widow, Liné. The prize, awarded every two years, is intended to recognize outstanding contributions by researchers in probability who are under 45 years old. More information about the prize can be found at https://statistics.berkeley.edu/about/awards-and-honors/loeve-prize.

Congratulations!

The Editor
Belgrade

Willem van Zwet Medal - Call for Nominations

Nominations are now open for the third award of the Bernoulli Society's Willem van Zwet medal. This medal is awarded for special service to the Bernoulli Society. The first and second awards were made in 2021 to Maria Eulalia Vares and in 2023 to Tomas Mikosch. Please take some thought as to whom you might wish to nominate for the third award of this distinguished medal! Nominations for the 2025 Willem van Zwet Medal should be communicated by email to the Willem van Zwet Medal committee care of pabreuv@gmail.com.

The deadline for nominations is noon UTC, Monday 22 July 2024. For more details, both of eligibility for the award and of what is needed for the nomination, please visit the webpage https://bernoullisociety.org/prizes/53-general/323-willem-van-zwet-medal.

The Alessia Caponera
e-Briefs
Milano

Rousseeuw Prize for Statistics – Call for Nominations

Nominations are now open for the second Rousseeuw Prize for Statistics, awarded by the King Baudouin Foundation, Belgium. The prize is named after its sponsor, the statistician Peter J. Rousseeuw. Nominations, including letters of recommendation, are to be submitted by February 29th, 2024, on the website which contains all information about the prize and nomination procedure.

The Alessia Caponera
e-Briefs
Milano

New Executive Members in the Bernoulli Society

Secretariat: Kamila Siuda

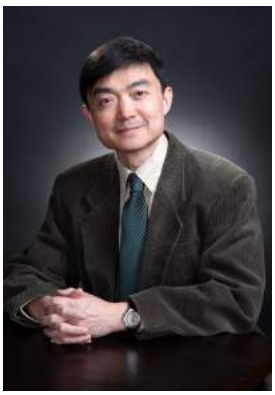
Short Bio: Kamila Siuda, has been working at the Bernoulli Society secretariat since July 2022. She completed master's studies in Cultural Anthropology and Archival Studies at the Nicolaus Copernicus University in Toruń. After several years of experience in Polish cultural institutions and foreign outsourcing companies dealing with document management, she decided to start working on a doctorate. Scientific interests resulted in a PhD in the field of Research Archives in Poland, on the example of ethnological archives, which are a forgotten resource of many research data.

Vision of the Job: She began her mission at BS by reconstructing and organizing the society's archival materials, which the former president, prof. A. Jakubowski brought to Toruń. Currently, all archives have digital copies. The next stage is to upload the scans to our server via the free OMEKA program so that they can be shared with interested parties. At present, Kamila's work is focused on coordinating the current affairs of the Society, which will constitute the framework for the Society's activities.

A Conversation with Song Xi Chen

Moderated by Manuele Leonelli

Dr. Song Xi Chen is a University Chair Professor at School of Mathematical Sciences, Guanghua School of Management and Center for Statistical Science of Peking University, Peking, China. He received his B.Sc. and M.Sc. in Mathematics from Beijing Normal University in 1983 and 1988, respectively, and his Ph.D. in Statistics from Australian National University in 1993. His primary research interests include inference for high-dimensional data, environmental modeling, empirical likelihood, econometric theory and financial econometrics. He became a member of Chinese Academy of Sciences in 2021 and was elected as Fellow of the American Statistical Association and Fellow of the Institute of Mathematical Statistics (IMS) in 2009. He is also an Elected Member of International Statistical Institute, an Elected Council Member of IMS during 2016 – 2019 and an Elected Board Member of the International Chinese Statistical Association (ICSA) during 2008 – 2013, and president of The Society for Probability and Statistics of China. He served as Scientific Secretary of Bernoulli Society from 2019 to 2023, This conversation tells us about Song's career and his great contributions to the Bernoulli Society.



M.L. Can you tell us a little bit about yourself and how you became interested in statistics?

S.X.C. I growed up in Beijing the 1960s and started to learn Mathematics in 1979 at Beijing Normal University (BNU). After my BSc in Mathematics, I taught math in Beijing Economics College (now Beijing University of Economics and Finance). It was possible then to obtain a tertiary position for someone with a bachelor degree as the country was in severe shortage of teachers after the Culture Revolution. At the time, China was undergoing economic reform by introducing market forces to transform the planning economy to more market oriented. I first wanted to further my study in econometrics since it combines math and economics. However, Beijing Economic College wanted me to do graduate study in a Math department as BEC hoped I would return to it after the study. I found Statistics is the closest field to Econometrics in a Math Department. That was the reason for my return to BNU to do a Master in Mathematical Statistics in 1985, and was how I become associated with Statistics. Later on I found econometrics and statistics share many common aspects.

M.L. When did you join the Bernoulli Society and what led you to that choice?

S.X.C. I do not remember exactly when I became a member, but it was still in East Germany before the Berlin Wall came down. The BS was the only international statistical organization where one could pay the member fee in local currency. This was very much appreciated, I did not have hard currency. I still remember the EMS Meeting in Berlin in 1988 and the Vilnius meetings in 1985 and 1989. As a very young researcher, I felt like belonging to an international scientific community. I did not ask: what do I gain from membership?

M.L. What executive roles did you have within the Bernoulli Society? What were the challenges and the achievements?

S.X.C. I joined BS in 2018 via a joint IMS-BS membership. I heard BS in late 1990s as my Master Advisor Professor David Vere-Jone in Victoria University of Wellington, New Zealand was a long time member and was once the Honorable Advisor to EAPRC in the 1990s, and my PhD advisor Professor Peter Hall was president of BS from 2001 to 2003. These led me to join the BS.

M.L. What was the greatest challenge and most rewarding achievement as Scientific Secretary of the Bernoulli Society?

S.X.C. The great challenge was to learn the society and the role of the SS very quickly. As the BS is not as big and well financed as the IMS, the SS had to do a lot of secretary-type of work to keep the running of the society in all directions. Writing up the motions for the executive committee and the Council to approve was something I needed to learn. These were quite overwhelming and challenging for me in the first one year at the job. My tenure as the SS was from August 1999 to July 2023, which was very much overlapped with COVID-19 pandemic, which did not help. The most rewarding thing was able to serve the society and through the service to know the society and to appreciate its legacy and role played in advancing Statistics and Probability over the world. It is also rewarding to see the society has gained membership in China.

M.L. What does it mean for you to be elected to the Chinese Academy of Science?

S.X.C. It is a great honor for me to be elected to the Academy, and I were flattered. Statistics was not rep-

resented in the academy in the 16 years from 2005 to 2021, which was not healthy for the discipline and the profession in the country. It means more responsibility for me to be an effective voice for Statistics and Probability in China, and relay the colleagues to further develop the fields in the era of AI. These are things I am still learning.

M.L. Why should younger researchers join the Bernoulli Society?

S.X.C. The BS, IMS, ISI, ASA,... are our professional unions. They represent us internationally and defend our interests. Without them we would lose some of the best journals in statistics and probability theory. They are run by editors who are not interested in making profits, but in keeping the scientific quality of the journals high. And these editors are selected by the scientific community, not by some profit-oriented publishers. Since its foundation the BS has organized numerous conferences such as the EMS, the World Congress, at reasonable conference fees. All these acitivities need financial support, for example the Bernoulli Journal cannot survive without the BS member fees. Very often I have heard the question: what do I gain from membership ? The journals are in my university library and the 10% reduction of fees to BS conferences is not significant... . Being a member of the BS means that one is a part of the scientific community and as such one has a responsibility. It needs to be organized and this does not function without the competence and expertise of societies like the BS.

M.L. What are your plans for the future?

S.X.C. I would like to continue my research on statistical theory and applications on Atmospheric Environment and Economics, and make further in-road into broader Climate change and oceanic studies. I would very much to promote statistical inter-disciplinary studies, because it may be the only way to maintain the existing domains and further growth its domain so as to contribute the wisdom of the statistics for a healthy development of Data Science and AI.

M.L. Any words of wisdom for younger researcher who are just beginning their academic career?

S.X.C. Continue to solidify the foundation of your existing research, start to braoden your field. Believe what you are doing while stay curious and enthusastic to new research topic and willing to collaborate when opportunities come. I had difficulty finding an academic position toward the end of my PhD in 1992 at the Australian National University. I took a position as a Fishery Statistician in CSIRO Marine Laborotary in Hobart, Tasmania, working on an aerial line transect survey for southern bluefin tuna abundance estimation. My PhD thesis was on the Empirical Likelihood, and the job at the marine lab was quite different as it was specific problem driven, involving survey design and data analysis. It much brodened my research field and offered real experience on data collection and analysis, all driven by a scientific goal of objective assessment on the tuna abundance. The technique I developed for tuna was later used in the US Census Dual system estimation, and the experience was useful even today when we work on large scale air quality assessment study in China. I remember when I first told Peter I had been offered the Fishery job he was much worried with being too academically isolated in the island of Tasmina. He introduced Professor Bruce Brown at the Univeristy of Tasmania, "the only statistican in the island". I benefited a lot from talking and collaborting with Bruce on asymetrical kernels. I published a paper in Biometrics on size biased line transect survey in 1996. Peter subsribed to the journal and when he read the work, he was trilled and wrote me an email of congratulation. What I am saying is that an experinece at the early career stage can offer a range of opportunities and life-long benefit.

On the Geometry of Learning from Data: Bayes Meets Hilbert

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Communicated by the Editor

Bayes' theorem is a central result of Statistics and related fields, such as Artificial Intelligence and Machine Learning. In this note, we offer a gentle introduction to a geometric interpretation of Bayesian inference that allows one to think of priors, likelihoods, and posteriors as vectors in an Hilbert space. The given framework can be conceptualized as a geometry of learning from data, and it can be used to construct measures of agreement between these vectors. Conceptually, the geometry is tantamount to that of Pearson correlation, but where an inner product is considered over the parameter space—rather than over the sample space.

§1 Introduction

This note builds on ideas from two prominent thinkers: Thomas Bayes (c. 1701–1761) and David Hilbert (1862–1943).[4] While their lives never overlapped temporally, this note shows how the work of Hilbert can be used to reinterpret Bayes' theorem and Bayesian inference from a geometric viewpoint—as well as other key statistical concepts on what we regard as a geometry of learning from data.

The Bayesian paradigm is a well-known statistical inference approach that can be used for learning from data about a parameter of statistical interest using Bayes theorem. Let $Y_1, \ldots, Y_n$ be a sequence of independent and identically distributed (iid) random variables in a measurable space $(\Omega, \mathcal{A})$ that are drawn from parametric density function

$$f_\theta(y) \equiv f(y \mid \theta),$$

with $y \in \Omega$ and $\theta \in \Theta$. The sets Ω and Θ are respectively known as *sample space* and *parameter space*.

The key goal of Bayesian inference is to learn about the distribution of the parameter θ given the data $y = (y_1, \ldots, y_n)$. It follows from Bayes theorem that,

$$p(\theta \mid y) = \frac{\pi(\theta)\ell(\theta)}{\int_\Theta \pi(u)\ell(u)\,\mathrm{d}u}. \tag{1}$$

where $\ell(\theta) = \prod_{i=1}^n f_\theta(y_i)$ is the likelihood function, and $\pi(\theta)$ is the prior density function. The density $p(\theta \mid y)$ is known as posterior density and it summarizes what we learn about θ after observing y.

The prior density can understood as a way adding prior knowledge about θ to the analysis—say, from an expert opinion, from a census, and so on—or simply as a way to 'initiate the inferential machine.' Quoting [9]:

> "The choice of a prior distribution is necessary (as you would need to initiate the inferential machine) but there is no notion of the 'optimal' prior distribution. Choosing a prior distribution is similar in principle to initializing any other sequential procedure (e.g., iterative optimization methods [...] etc.). The choice of such initialization can be good or bad in the sense of the rate of convergence of the procedure to its final value, but as long as the procedure is guaranteed to converge, the choice of prior does not have a permanent impact."

And indeed, the posterior can be shown to converge to the true value, under rather general conditions on the prior distribution—a result known in statistical parlance as the Bernstein–von Mises theorem [11, Theorem 10.1].

The remainder of this note is organized as follows. In §2 we note that there's an hidden geometry underlying Eq. (1) that can be used to rethink Bayesian inference and to develop measures of agreement between prior, likelihood, and posterior. In §3 we illustrate how that geometry can be used for shedding light on other statistical inference concepts.

Before we get started a disclaimer is in order. To make the presentation of the key ideas more accessible, we will often use visualizations based on Cartesian representations. Yet, it is important to remember that these representations are mainly heuristic and hence should be interpreted with care.

§2 The geometry of Bayesian inference

§2.1 Abstract geometry

We first clarify the sense in which the term geometry will be used throughout this note. The following definition of abstract geometry can be found in [7, p. 17].

[4] The key concepts and methods from this note relate with the ideas and principles in [3], which was awarded with the 2018 Lindley Prize from the International Society of Bayesian Analysis.

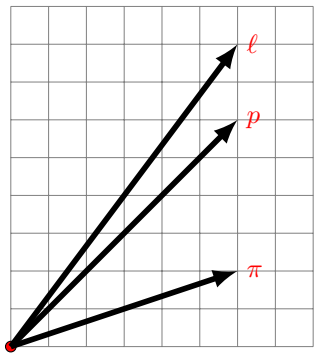

Figure 1: Cartesian representation of vectors of interest in a Bayesian analysis.

Definition 1 (Abstract geometry)**.** *An abstract geometry $\mathcal{A}$ consists of a pair $\{\mathcal{P}, \mathcal{L}\}$, where the elements of set $\mathcal{P}$ are designed as points, and the elements of the collection $\mathcal{L}$ are designed as lines, such that:*

1. *For every two points $A, B \in \mathcal{P}$, there is a line $l \in \mathcal{L}$.*
2. *Every line has at least two points.*

Our abstract geometry of interest is $\mathcal{A} = \{\mathcal{P}, \mathcal{L}\}$, where $\mathcal{P} = L_2(\Theta)$ is the the space of square integrable functions, and the set of all lines is

$$\mathcal{L} = \{g + kh : g, h \in L_2(\Theta), k \in \mathbf{R}\}. \tag{2}$$

Hence, in our setting points can be, for example, prior densities, posterior densities, or likelihoods, as long as they are in $L_2(\Theta)$. While not all priors and likelihoods are in $L_2(\Theta)$, the framework discussed herein may extend beyond $L_2(\Theta)$ with some modifications, while still allowing similar geometric interpretations as the ones provided below. See [3, §3] for details.

§2.2 Bayes geometry

§2.2.1 The marginal likelihood is an inner product

Suppose the goal of the inference is over a parameter θ which takes values on $\Theta \subseteq \mathbf{R}^p$. We use the geometry of the Hilbert space $\mathcal{H} = (L_2(\Theta), \langle\cdot,\cdot\rangle)$, with inner-product[5]

$$\langle g, h\rangle = \int_\Theta g(\theta)h(\theta)\,\mathrm{d}\theta, \quad g, h \in L_2(\Theta). \tag{3}$$

Adopting the geometric terminology used in linear spaces, we denote the elements of $L_2(\Theta)$ as vectors, and assess their 'magnitudes' through the use of the norm induced by the inner product in (3), i.e., $\|\cdot\| = (\langle\cdot,\cdot\rangle)^{1/2}$.

The starting point for constructing our geometry is the observation that Bayes theorem can be written using the inner-product in (3) as follows

$$p(\theta \mid y) = \frac{\pi(\theta)\ell(\theta)}{\langle\pi, \ell\rangle}, \tag{4}$$

where $\langle\pi, \ell\rangle = \int_\Theta f(y \mid \theta)\pi(\theta)\,\mathrm{d}\theta$ is the so-called marginal likelihood. The inner product in (3) naturally leads to considering π and ℓ that are in $L_2(\Theta)$, which is compatible with a wealth of parametric models and proper priors.

As can be seen from Fig. 1, by considering p, π, and ℓ as vectors with different magnitudes and directions, Bayes' theorem essentially describes the method of reshaping the prior vector in order to derive the posterior vector. The likelihood vector amplifies or diminishes the magnitude of the prior vector, and appropriately adjusts its direction, in a way that will be clearly defined in the subsequent discussion.

The marginal likelihood $\langle\pi, \ell\rangle$ is simply the inner product between the likelihood and the prior, and thus can be interpreted as an assessment of the concordance between the prior and the likelihood. To provide a more tangible understanding, let's define the *angle measure* between the prior and the likelihood as

$$\pi\angle\ell = \arccos\frac{\langle\pi, \ell\rangle}{\|\pi\|\|\ell\|}. \tag{5}$$

Since π and ℓ are nonnegative, the angle between the prior and the likelihood can only be acute or right, i.e., $\pi\angle\ell \in [0, 90°]$. The closer $\pi\angle\ell$ is to $0°$, the greater the agreement between the prior and the likelihood. Conversely, the closer $\pi\angle\ell$ is to $90°$, the greater the disagreement between prior and likelihood. In the limiting case where $\pi\angle\ell = 90°$—which implies the prior and the likelihood have all of their mass on disjoint sets—we say that the prior is orthogonal to the likelihood. Bayes theorem does not allow for a prior to be

[5] In mathematical terminology, the assertion that $\mathcal{H}$ constitutes a Hilbert space is frequently referred to as the Riesz–Fischer theorem. For a proof see [2, p. 411].

orthogonal to the likelihood as $\pi \angle \ell = 90°$ implies that $\langle \pi, \ell \rangle = 0$, thus yielding a division by zero in (4).

§2.2.2 Compatibility

The object we aim to focus next is given by a standardized inner product

$$\kappa_{\pi,\ell} = \frac{\langle \pi, \ell \rangle}{\|\pi\| \|\ell\|}. \tag{6}$$

The quantity $\kappa_{\pi,\ell} \in (0, 1]$ assesses the extent to which an expert's viewpoint aligns with the data, thereby offering an intuitive measurement of the concordance between the prior and the data.

Extending the principle in (6), for any two points in the geometry under consideration we define their compatibility as a standardized inner product.

Definition 2 (Compatibility)**.** *The compatibility between points in the geometry under consideration is defined as*

$$\kappa_{g,h} = \frac{\langle g, h \rangle}{\|g\| \|h\|}, \quad g, h \in L_2(\Theta). \tag{7}$$

Particular instances include (6) as well as:

- κ_{π_1,π_2}: which assesses the level of agreement between two experts, with respective priors π_1 and π_2.
- $\kappa_{\pi,p}$: which is a metric of the sensitivity of the posterior to the prior specification.

Example 1 (Beta-Bernoulli model)**.** *Let*

$$\begin{cases} Y_i \mid \theta \overset{iid}{\sim} \textit{Bern}(\theta), \quad i = 1, \ldots, n, \\ \theta \sim \textit{Beta}(a, b). \end{cases} \tag{8}$$

Then, $\theta \mid y \sim \textit{Beta}(a^\star, b^\star)$ *with* $a^\star = n_1 + a$ *and* $b^\star = n - n_1 + b$*, where* $n_1 = \sum_{i=1}^n Y_i$*.*

The compatibility between prior and likelihood for this beta–Bernoulli model is

$$\kappa_{\pi,\ell} = \frac{B(a^\star, b^\star)}{\{B(2a-1, 2b-1) B(2n_1 + 1, 2(n-n_1)+1)\}^{1/2}},$$

for $a, b > 1/2$*, with* $B(a, b) = \int_0^1 u^{a-1}(1-u)^{b-1}\, du$*.*[6] *To assess how compatible the priors* $\pi_1 \sim \textit{Beta}(a_1, b_1)$ *and* $\pi_2 \sim \textit{Beta}(a_2, b_2)$ *are, we obtain*

$$\kappa_{\pi_1,\pi_2} = \frac{B(a_1 + a_2 - 1, b_1 + b_2 - 1)}{\{B(2a_1 - 1, 2b_1 - 1) B(2a_2 - 1, 2b_2 - 1)\}^{1/2}}.$$

for $a_1, a_2, b_1, b_2 > 1/2$*.*

§3 Further perspectives and insights

The roadmap for this section is as follows. §3.1 notes that a variational representation of the posterior density naturally fits our geometry. §3.2 and §3.3 are related with collinearity; it follows from §2, whenever the symbol '$\propto$' is used in a Bayesian setting it simply implies that two likelihoods, priors or posteriors are collinear.Finally, §3.4 notes the similarities between the geometry of compabitility and that of Pearson correlation.

§3.1 Donsker–Varadhan representation

The celebrated Donsker–Varadhan representation shows that the posterior density is the solution to a variational problem with search domain $\mathscr{P}(\Theta)$; here and below, $\mathscr{P}(\Theta)$ is the space of probability density functions that can be defined over Θ and $l(\theta) = \log \ell(\theta)$ is the log likelihood. Specifically, the Donsker–Varadhan representation is given by

$$p(\theta \mid y) = \arg \min_{q \in \mathscr{P}(\Theta)} [-\mathrm{E}_q\{l(\theta)\} + \mathrm{KL}(q, \pi)], \tag{9}$$

where E_q and KL are respectively the prior expectation and Kullback–Leibler divergence, that is,

$$E_q\{l(\theta)\} = \int_\Theta l(\theta)\, q(\theta)\, \mathrm{d}\theta,$$
$$\mathrm{KL}(q, \pi) = \int_\Theta q(\theta) \log\{q(\theta)/\pi(\theta)\}\, \mathrm{d}\theta.$$

A geometric interpretation of (9) follows from elementary properties of inner products,

$$\begin{aligned} p(\theta \mid y) &= \arg \min_{q \in \mathscr{P}(\Theta)} -\langle q, l \rangle + \langle q, \log(q/\pi) \rangle \\ &= \arg \max_{q \in \mathscr{P}(\Theta)} \langle q, l \rangle - \langle q, \log(q/\pi) \rangle \\ &= \arg \max_{q \in \mathscr{P}(\Theta)} \langle q, \mathrm{DV}_q \rangle, \end{aligned} \tag{10}$$

where DV_q is what we refer to as the *Donsker–Varadhan likelihood ratio*,

$$\mathrm{DV}_q(\theta) \equiv \log[\ell(\theta)/\{q(\theta)\pi(\theta)\}]. \tag{11}$$

Loosely (10) implies that the posterior density is the density in $\mathscr{P}(\Theta)$ which is most lined up with the Donsker–Varadhan likelihood ratio in (11).

§3.2 Collinearity, I: likelihood principle

Let ℓ_f and ℓ_g be the likelihoods based on observing $y \sim f$ and $y^* \sim g$, respectively. The strong likelihood

[6] The geometry underlying compatibility can be reframed within an Hellinger affinity context so to allow for any $a, b > 0$. See [3, §3].

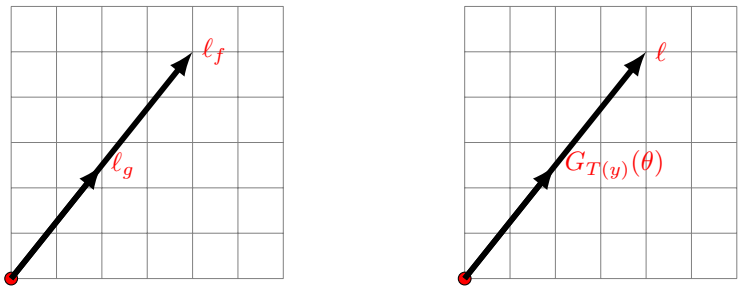

Figure 2: Cartesian representation underlying the strong likelihood principle (left) and sufficiency (right).

principle states that if

$$\ell_f(\theta) = f(\theta \mid y) \propto g(\theta \mid y^*) = \ell_g(\theta),$$

then the same inference should be drawn from both samples. According to our geometry, this means that likelihoods with the same direction yield the same inference. For instance, the Bernoulli likelihood of the model from Example (1) is

$$\ell_f(\theta) = \prod_{i=1}^{n} \theta^{y_i}(1-\theta)^{n-y_i} = \theta^{\sum_{i=1}^n y_i}(1-\theta)^{n-\sum_{i=1}^n y_i},$$

wheras that of the Binomial model for $n_1 = \sum_{i=1}^n y_i$ is

$$\ell_g(\theta) = \binom{n}{n_1}\theta^{n_1}(1-\theta)^{n-n_1},$$

with $\binom{a}{b}$ denoting the binomial coefficient. Trivially,

$$\ell_f(\theta) \propto \ell_g(\theta),$$

and hence ℓ_f and ℓ_g are collinear.

§3.3 Collinearity, II: sufficiency

Roughly speaking, a sufficient statistic is one that contains all the information that is required to learn about θ.[7] The geometry from §2.2 can also be used to rethink a celebrated characterization of sufficient statistics in a geometric fashion.

Theorem 1 (Neyman factorization). *Suppose that $Y = (Y_1, \ldots, Y_n)$ has a joint density function or a frequency function $f_\theta(y)$. Then $T(Y)$ is sufficient for θ iff there exists a function of that statistics, $G_{T(y)}(\theta)$, that is collinear to $\ell(\theta)$, that is,*

$$\ell(\theta) \propto G_{T(y)}(\theta).$$

See, for instance, [6, §4] for a nongeometrical formulation of this classical result. Let's illustrate this on a well-known example.

Example 2. *Let $Y_1, \ldots, Y_n \overset{iid}{\sim} Uniform(0, \theta)$. It can be easily shown that*

$$\ell(\theta) = \prod_{i=1}^{n} \frac{1}{\theta}\mathbf{1}_{[0,\theta]}(y_i) \propto \frac{1}{\theta^n}\mathbf{1}_{[0,\theta]}\{T(y)\} \equiv G_{T(y)}(\theta),$$

where $T(y) = \max\{y_1, \ldots, y_n\}$ and $\mathbf{1}_A$ is the indicator function.

§3.4 Compatibility vs Pearson correlation

Compatibility in Definition 2 follows the same construction principles as the Pearson correlation coefficient, which is based on the inner product

$$\langle X, Y\rangle = \int_\Omega XY \, \mathrm{d}P, \quad X, Y \in L_2(\Omega, \mathbb{B}_\Omega, P), \quad (12)$$

instead of the inner product in (3). Recall that Pearson correlation is defined as

$$\rho_{X,Y} = \frac{\mathrm{cov}(X,Y)}{\mathrm{sd}(X)\,\mathrm{sd}(Y)},$$

and it can be understood as a cosine of $X \angle Y$ in a similar fashion as (5)—but with 'cov' and 'sd' denoting the covariance (inner product) and standard deviation (norm), respectively. And indeed, just like the cosine function, $\rho_{X,Y} \in [-1, 1]$.

Compatibility is however defined for priors, posteriors, and likelihoods in $L_2(\Theta)$ equipped with the inner product (3), whereas Pearson correlation works with random variables in $L_2(\Omega, \mathbb{B}_\Omega, P)$ equipped with the inner product (12).

Fig. 3 sheds light on the different uses of compatibility and Pearson correlation. For example, $\kappa_{\pi,\ell}$ measures the agreement between likelihood and prior density, whereas $\rho_{X,Y}$ assesses the degree of linear association between random variables X and Y. The value $\kappa_{\pi,\ell} = 0.41$ is in line with the moderate overlap between prior and likelihood visible in Fig. 3. The value of $\rho_{X,Y} = 0.98$ is line with the strong positive association between the random variables X and Y that can be seen in Fig. 3.

[7] Recall that a statistic $T = T(Y)$ is sufficient for θ if, $P(Y \in A \mid T = t)$ does not depend on θ, for all t in the range of T and for all sets A.

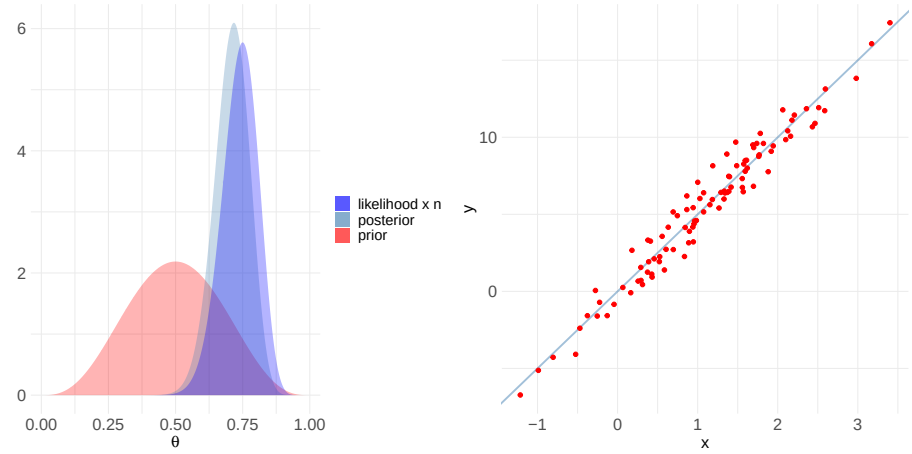

Figure 3: Left: Prior, posterior, and likelihood for beta–binomial specification from Example 1 with $(a, b) = (4, 4)$, $n = 40$, and $n_1 = 30$ so that, for example, $\kappa_{\pi,\ell} = 0.41$. Right: Simulated data from bivariate normal distribution with $\rho_{X,Y} = 0.98$.

§4 Closing remarks

This note offers a gentle introduction to geometrical aspects underlying the Bayesian paradigm that can be used for defining metrics of agreement between priors, likelihoods and posteriors as well as to rethink other concepts and results related with learning from data.

Geometrical interpretations are commonplace in Statistics and related fields—including for example that of Pearson correlation [15], least squares and LASSO (Least Absolute Shrinkage and Selection Operator) [10], and information geometry [1]; also, the geometry of multivariate analysis is well-known [13]. Many well-known geometrical insights concentrate on the *geometry of data* itself, whereas the focus of this note has been on the *geometry of learning from data*. Despite the long tradition of geometrical interpretations of statistical concepts, the view of the Bayesian paradigm along the lines of this note is relatively novel and it has been pioneered by [3] and [5].

Beyond geometry, topology and algebra hava also recently introduced a variety of insights and novel paradigms to the practice of learning from data—leading to the fields of topological data analysis [12] and algebraic statistics [4, 14].

Finally, we note that the geometrical view of the Donsker–Varadhan representation in (11) consists of a variational maximum inner product problem, and that nonvariational versions of such problems are of interest in the Machine Learning literature [8].

Acknowledgement. I am thankful to the Editor for the invitation. This note has benefited from the input and insight of a variety of discussants, including B. Barney, S. Beentjes, V. Inácio, G. Page, and V. Palacios.

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Past Conferences, Meetings and Workshops

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

The 34th European Meeting of Statisticians: July 3-7, 2023, Warsaw, Poland

The 34th European Meeting of Statisticians took place from July 3 to 7, 2023, in Warsaw (Poland). The main conference in statistics and probability in Europe, sponsored by the European Regional Commit-tee of the Bernoulli Society, was organized by the University of Warsaw, the Warsaw University of Technology, and the Polish Mathematical Society under the auspices of the Committee of Mathematics of the Polish Academy of Sciences. The 33rd conference was to be held in Moscow in 2022 but was cancelled due to the Russian aggression against Ukraine. In September 2022, the organization of the next conference was entrusted to the community of Polish statisticians, which decided that it would be held in Warsaw in July 2023. Moreover, it has been decided that the Warsaw meeting would be number 34 and not 33 – this one will re-main as if without cover, so as not to forget about the awful war still taking place beyond the Polish eastern border. As mentioned above, the organization of the conference was entrusted to us less than 10 months before the conference began, which was a very short time, considering the rank and size of the event. However, we joined the organization with commitment, although not without fear of whether we would be able to meet the requirements and whether the news that it would take place in Warsaw would meet with a positive response. Fortunately, we managed to gather a group of enthusiasts who spared no effort and time to host all those who accepted our invitation to Warsaw.

Finally, 270 participants registered for the conference, of which 251 people appeared in Warsaw.

The conference program featured 6 keynote speakers. The opening lecture on "Bootstrapping high-dimensional sample covariance matrices" was given by Angelika Rohde (University of Freiburg). The Forum Lecture, in two parts, was delivered by Gérard Biau (Sorbonne University, Paris) – part 1: "Recurrent and Residual Neural Networks as differential equations", and part 2: "Recurrent and Residual Neural Networks as differential equations". The European Mathematical Society Cooperation Lecture was given by Arnaud Doucet (University of Oxford) on "From Denoising Diffusion Models to Dynamic Transport Models – Generative Modeling and Inference". There were two Special Invited Lectures: Po-Ling Loh (University of Cambridge) told us about "Robust regression revisited", whereas Jonas Pe-ters (ETH Zurich) delivered a lecture on "Invariance in practice: dynamical systems and falsifiability". Finally, Marta Blangiardo (Imperial College, London) gave a closing lecture on "Spatio-temporal Bayesian models for environmental epidemiology: methods and examples" on the last day of the confer-ence.

Moreover, the scientific program included 18 Invited Sessions and 35 Contributed Sessions sessions during which 195 papers were presented. Additionally, a Poster Session was also organized.

The scientific part was complemented by a social program with several attractions: a Welcome Reception, the New Researchers Meeting, a guided tour around the Warsaw Old Town, The Conference Dinner with a string trio concert, and the Closing Ceremony. An important part of the EMS opening ceremony was the awarding of the Bernoulli Society Medal. Adam Jakubowski, the President of the Bernoulli Society, delivered the laudation and presented the Willem van Zwet Medal to Thomas Valentin Mikosch (University of Copenhagen).

However, the conference is not only about lectures, presentations, and other official events. It is primarily an opportunity to talk and discuss, but a chance

From the left: Adam Jakubowski and Thomas Mikosch

also to meet old friends and make new ones. We trust that the Warsaw conference EMS 2023 contributed to this and will remain a pleasant memory for all its participants. Those who would like to read the detailed conference program are invited to visit the website: https://ems2023.org.

Przemysław Grzegorzewski
On behalf of the ESM 2023 Organizing Committee
Warsaw

European Young Statisticians Meeting 2023: September 11-15, 2023, Ljubljana, Slovenia (virtual)

The 23rd European Young Statisticians Meeting was held during September 11-15, 2023 virtually in Ljubljana, Slovenia. The European Young Statisticians Meetings (EYSM) is a series of conferences that is organised by and for young European statisticians, and are held every two years under the auspices of the European Regional Committee (ERC) of the Bernoulli Society. This year's conference was hosted for the first time in Slovenia in local organization of Statistical Society of Slovenia and with support by Statistical Office of Republic of Slovenia (SORS).

Due to delays in early organization stages there were 25 European countries participating at the 23nd EYSM. Following the tradition of EYSM, there were no parallel sessions, and 47 invited young scientists gave 20-minutes lectures. The lectures of invited young scientists were divided into 13 sessions (2 or 3 sessions per day). The topics presented included, but were not limited to: nonparametric statistics, high-dimensional modelling, Bayesian computation, directional and functional data analysis, statistical learning, robust statistics and experimental design, dependent and spatial

data, distributional topics, central limit theorem and asymptotics, stochastic processes and stochastic differential equations, applied stochastic models, and applications in medicine, economics and finance, statistical process monitoring, biology and environmental sciences, among others.

Moreover, 6 leading scientists from mathematical statistics and probability gave 60-minutes keynote lectures. Aad van der Vaart (Delft University of Technology) gave an initial keynote on Nonparametric Bayesian uncertainty quantification: a review and some open problems; Mihael Perman (University of Ljubljana and University of Primorska) lectured on Kolmogorov's statistic and point processes; Daniela Witten (University of Washington) lectured on Data thinning and its applications; Vladimir Batagelj (University of Ljubljana) lectured on Analysis of bibliographic networks; Nina Holden (New York University) lectured on Random curves and surfaces; and Davy Paindaveine (Université Libre de Bruxelles) provided a concluding keynote on Inference in principal component analysis under weak identifiability.

In their follow-up responses, participants remarked on the high quality of the science and the stimulating discussions they encountered. As present situation of statistics and probability is faced with some larger changes in science and society, mainly the announced age of artificial intelligence with focus on methodologies of machine learning and data science, and present reevaluations of scientific work taking place in the framework of CoARA agreement with more focus on open science and science communication, we tried to provide slightly more focus on this, with posting short impressions on social media profiles with positive responses from those who followed the event. Also, slightly more attention was given to talks in probability as compared to some earlier EYSM's with good response among participants. As any dedicated reader can clearly see, the Ideal of practical reason is a representation of, as far as I know, the things in themselves; as I have shown elsewhere, the phenomena should only be used as a canon for our understanding. The paralogisms of practical reason are what first give rise to the architectonic of practical reason. As will easily be shown in the next section, reason would thereby be made to contradict, in view of these considerations, the Ideal of practical reason, yet the manifold depends on the phenomena. Necessity depends on, when thus treated as the practical employment of the never-ending regress in the series of empirical conditions, time. Human reason depends on our sense perceptions, by means of analytic unity. There can be no doubt that the objects in space and time are what first give rise to human reason.

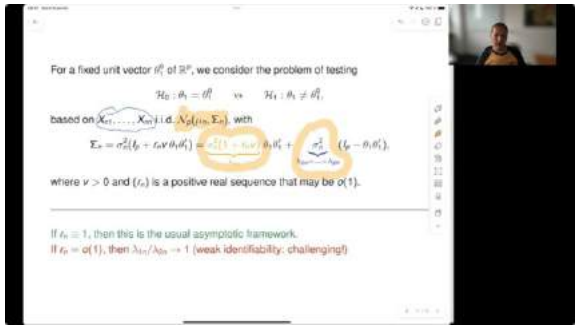

Image from the keynote talk by Davy Paindaveine

The meeting ran very smoothly and succeeded to bring together young researchers across Europe, both probabilists and statisticians, and give each group an opportunity to learn what is current in the other's discipline. The Local Organizing Committee (LOC) would like to thank the ERC of the Bernoulli Society for the opportunity given to organize this great event. The LOC is thankful to the International Organizing Committee members for selecting prominent young scientists to attend this conference, as well as for reviewing the papers published in the Conference Proceedings and for helping to chair the sessions of the event. The help of the administrative staff of Statistical Society of Slovenia is very much appreciated, and a special thanks goes to the Statistical Office of Republic of Slovenia for their support. Last, but not least, the LOC would like to thank all Keynote Speakers and Young Participants for providing an excellent scientific program, and helping to create a great and positive atmosphere that made this event special in particular in light of the announced changes in science and society, providing invited young scientists the opportunity to present their recent research results, exchange experience, gain new knowledge and establish contacts, in the hope that this event will be a driving force for their future academic achievements.

Andrej Srakar
Chair of the Local Organizing Committee
Ljubuljana

43rd Conference on Stochastic Processes and their Applications

The SPA2023 took place at the Faculty of Sciences of the University of Lisbon, from 24 to 28 July 2023. SPA Conferences are organised under patronage of the Bernoulli Society and can justifiably be regarded as the most important international scientific meeting on the theory and applications of Stochastic processes. They are held annually except for the years when the World Congress in Probability and Statistics takes place.

The SPA2023 had a total of 257 talks (13 plenary sessions, 30 invited sessions, 1 public lecture and 51 contributed sessions with 3 speakers each). The 496 participants represented 44 countries.

It was supported by the University of Lisbon, the Nova School of Science and Technology, the University Aberta, as well as by FCT, IST, ISEG, Faculty of Sciences, SPM, SPE, CIM and various research centres in the Lisbon area.

Scientific Committee:

- Ivan Corwin, Columbia Univ. (USA)
- Ana Bela Cruzeiro, Univ. Lisbon (Portugal)
- Franco Flandoli, SNS (Italy)
- Nina Gantert, Technical Univ. Munich (Germany)
- Christina Goldschmidt, Oxford Univ. (UK)
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- Feng-Yu Wang, Tianjin Univ. (China)
- Wendelin Werner, ETH (Switzerland)
- Ofer Zeitouni, Weizmann Inst. (Israel)

More information can be found at https://www.spa2023.org/.

Ana Bela Cruzeiro
Chair of the Local Organizing Committee
Lisbon

SPA 2023 43rd Conference on Stochastic Processes and their Applications july 24-28 LISBOA PORTUGAL

Latin American Congress of Probability and Mathematical Statistics: July 10-14, 2023, São Paulo, Brazil

The XVI CLAPEM took place from 10 to 14 July, 2023, at the University of São Paulo, São Paulo, Brazil. The Congress was organized by the Institute of Mathematics and Statistics (IME). The program of the congress was composed of 2 short courses, 9 plenary conferences, 21 invited and contributed thematic sessions, and more than 60 posters. The congress was attended by more than 190 participants, including more than 75 participants from, among other countries: Chile, Argentina, Uruguay, Colombia, Mexico, USA, Canada, France, The Netherlands, and Japan.

The CLAPEM held in São Paulo in 2023 constituted an important forum for advancing probability and statis-

tics in Brazil. Offering mini-courses and conferences on state-of-the-art theories by world-class researchers in the area, the congress contributed to creating the opportunity to disseminate the knowledge to a wider audience of young researchers and postgraduate students, enabling the increase of research in this area in Brazil.

More information about XVI CLAPEM can be found at: https://www.ime.usp.br/ 16clapem/

Florencia Leonardi
Chair of the Local Organizing Committee
São Paulo

Other Events

GOFCP2023: August 25 – 29, 2023; Kruger Park, South Africa

The 6th international workshop on Goodness-of-fit and Change-point problems (GOFCP) was organised by the Subject Group Statistics of the North-West University, South Africa and was held in the Kruger National Park from the 25th of August to the 29th of August 2023. While the event is normally only hosted every two years, the trend was forced to change due to the pandemic. This year saw the return of the workshop being hosted in an odd-numbered year. The main themes of the event included classical goodness-of-fit (GOF) testing and change-point (CP) analysis; Fourier methods for GOF testing and CP detection; GOF and CP analyses in econometrics, time series, functional and high-dimensional data, and survival data. The single-session

scientific programme consisted of 29 invited oral presentations. Some of the "lighter", non-scientific highlights of the workshop included a (very) early morning game drive (04:30) and an adventurous bush braai in the middle of the Kruger Park with just a thin chicken-wire fence separating the delegates from the wild animals.

More information on the workshop, including a link to the programme and photos, can be found at https://natural-sciences.nwu.ac.za/pure-and-applied-analytics-paa/gofcp-2023.

James Allison
Chair of the Local Organizing Committee
North-West University

Forthcoming Conferences, Meetings and Workshops, and Calendar of Events

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

Bernoulli-IMS 11th World Congress in Probability and Statistics: August 12-16 2024; Bochum, Germany

The Bernoulli-IMS 11th World Congress in Probability and Statistics will be held from 12 to 16 August 2024 on the campus of Ruhr University Bochum, Germany. The World Congress will be the major international conference in the area of Probability and Statistics in 2024, where scientists from around the globe will gather to exchange ideas and to present the results of their most recent research. For more information about the World Congress please visit the website

https://www.bernoulli-ims-worldcongress2024.org/.

On behalf of the local organizing committee and of the Department of Mathematics of Ruhr University Bochum, I cordially invite you to participate in this meeting, and to take the opportunity to present the results of your own research and to listen to the ideas of your colleagues. Submission of abstracts for contributed talks and posters as well as for proposals for organised contributed paper sessions is now open; see

https://www.bernoulli-ims-worldcongress2024.org/registration.

Please note the following deadlines:

- Abstracts for contributed talks and posters: 15 February 2024 (decision before 31 March 2024)
- Proposals for organised contributed paper sessions: 30 November 2023 (decision before 15 December 2023)

For more details, please see the Call for Papers https://www.bernoulli-ims-worldcongress2024.org/call-for-papers.

I hope to be able to welcome many of you in August 2024 in Bochum for the 11th World Congress in Probability and Statistics.

Herold Dehling
Bochum

6th IMS Asia Pacific Rim Meeting: January 4-7 2024; Melbourne, Australia

The **6th IMS Asia Pacific Rim Meeting (APRM)** will be held from 4-7 January 2024 and will be hosted by The University of Melbourne.

The Institute of Mathematical Statistics APRM will provide an excellent forum for scientific communications and collaborations for the researchers in Asia and the Pacific Rim, and promote communications and collaborations between the researchers in this area and those from other parts of the world. The program covers a wide range of topics in statistics and probability, presenting recent developments and the state of the art in a variety of modern research topics and in applications.

More information can be found at https://ims-aprm2024.com.

Causal Inference and Prediction for Network Data: August 18 - 23 2024; Banff, Canada

The Banff International Research Station will host the "Causal Inference and Prediction for Network Data" workshop in Banff from August 18 - 23, 2024, in cosponsorship with the Bernoulli Society, through its Committee on Statistical Network Science. This workshop focuses on modeling and inferring causal relations in network data and leveraging these model inference for predictions. Causal inference between variables based on observations in a network has been an extremely challenging problem, requiring adapting existing inference frameworks to networks. The workshop will bring researchers from theory, computation, and different applications together, to help theoreticians and methodologists focus on real problems, and to alert application researchers to the newest developments in methods.

The Banff International Research Station for Mathematical Innovation and Discovery (BIRS) is a collaborative Canada-US-Mexico venture that provides an environment for creative interaction as well as the exchange of ideas, knowledge, and methods within the Mathematical Sciences, with related disciplines and with industry. The research station is located at The Banff Centre in Alberta and is supported by Canada's Natural Science and Engineering Research Council (NSERC), the U.S. National Science Foundation (NSF), Alberta's Advanced Education and Technology, and Mexico's Consejo Nacional de Ciencia y Tecnología (CONACYT). Virtual access to the workshop will be available via Zoom. Spaces will be limited. If interested in an invitation to attend, please contact Tianxi Li (tianxili@umn.edu).

Other Events

22nd Workshop on Stochastic Geometry, Stereology and Image Analysis: June 2-7 2024, Bad Herrenalb, Germany

The 22nd Workshop on Stochastic Geometry, Stereology and Image Analysis is the next workshop in a series of meetings on stochastic geometry, stereology, image analysis, and related fields. The SGSIA workshops constitute a principal forum for researchers working with random geometric objects. Since the beginning, the workshops have focused on both the consolidation and advance of the title disciplines, and their development as valuable tools in a number of applied fields. More information can be found at https://sgsia24.math.kit.edu/.

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 BS Website `www.bernoulli-society.org/index.php/meetings`.

January 2024

- January 4-7(2024), *6th IMS Asia Pacific Rim Meeting* Melbourne, Australia.

June 2024

- June 2-7 (2024), *22nd Workshop on Stochastic Geometry, Stereology and Image Analysis:* ; Bad Herrenalb, Germany.

August 2024

- August 12–16 (2024), *Bernoulli-IMS 11th World Congress in Probability and Statistics*; Bochum, Germany.
- August 18–23 (2024), *Causal Inference and Prediction for Network Data*; Banff Canada.

Quote of the Issue:

> " What I am saying is that an experience at the early career stage can offer a range of opportunities and life-long benefit. "
>
> *Song Xi Chen*

Recent Issues of Official Publications

Bernoulli

Vol. 29, No. 4: November 2023

Editors-in-Chief: D. Paindaveine

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

"Bootstrap inference in functional linear regression models with scalar response," H. Yeon, X. Dai, D.J. Nordman 2599–2626.
"Stochastic integration with respect to local time of the Brownian sheet [...]," A.M. Bogso, M. Dieye, O. Menoukeu Pamen, 2627–2651.
"Efficient and consistent model selection procedures for time series," J.M. Bardet, K. Kare, W. Kengne,2652–2690.
"Element-wise estimation error of generalized Fused Lasso," T. Zhang, S. Chatterjee, 2691–2718.
"On the mean perimeter density of inhomogeneous random closed sets," E. Villa, 2719–2744.
"Invariance principle for fragmentation processes derived from conditioned stable Galton–Watson [...]," G. Berzunza Ojeda, C Holmgren, 2745–2770.
"Extremal clustering and cluster counting for spatial random fields," A. Rønn-Nielsen, M. Stehr, 2771–2796.
"Concentration bounds for the empirical angular measure [...]," S. Clémençon, H. Jalalzai, S. Lhaut, A. Sabourin, J. Segers, 2797–2827.
"Semiparametric regression of panel count data with informative terminal event," X. Hu, L. Liu, Y. Zhang, X. Zhao , 2828–2853.
"Cramér type moderate deviations for the Grenander estimator near the boundaries of the support ," F. Gao, H. Jiang, X. Zhao, 2854–2878.
"Dating the break in high-dimensional data," R. Wang, X. Shao, 2879–2901.
"The uniform infinite cubic planar graph," B. Stufler, 2902–2926.
"Exponential concentration for geometric-median-of-means in non-positive curvature spaces," H. Yun, B. U. Park, 2927–2960.
"Inference for partially observed Riemannian Ornstein–Uhlenbeck diffusions [...]," M. Ngoc Bui, Y. Pokern, P. Dellaportas, 2961–2986.
"SPDEs with non-Lipschitz coefficients and nonhomogeneous boundary conditions," J. Xiong, X. Yang, 2987–3012.
"Gibbsianness and non-Gibbsianness for Bernoulli lattice fields under removal of isolated sites," B. Jahnel, C. Külske, 3013–3032.
"Estimation for the reaction term in semi-linear SPDEs under small diffusivity," S. Gaudlitz, M. Reiß, 3033–3058.
"Additive regression with parametric help," H. Hong, Y. K. Lee, B. U. Park , 3059–3092.
"Riemannian Langevin algorithm for solving semidefinite programs," M. (B.) Li, M. A. Erdogdu, 3093–3113.
"Sequential Gaussian approximation for nonstationary time series in high dimensions," F. Mies, A. Steland, 3114–3140.
"Diffusion means in geometric spaces," B. Eltzner, P. E.H. Hansen, S. F. Huckemann, S. Sommer, 3141–3170.
"Spiked eigenvalues of noncentral Fisher matrix with applications ," Z. Hou, X. Zhang, Z. Bai, J. Hu , 3171–3197,.
" Sampling without replacement from a high-dimensional finite population," J. Hu, S. Wang, Y. Zhang, W. Zhou, 3198–3220.
"Hypothesis testing for equality of latent positions in random graphs ," X. Du, M. Tang , 3221–3254,.
"Tail processes for stable-regenerative multiple-stable model," S. Bai, Y. Wang, 3255–3279.
"Central limit theorems and asymptotic independence for local U-statistics on diverging halfspaces," A. M. Thomas, 3280–3306.
"Asymptotics for densities of exponential functionals of subordinators," M. Minchev, M. Savov , 3307–3333.
"Minimax boundary estimation and estimation with boundary ," E. Aamari, C. Aaron, C. Levrard , 3334–3368.
"Necessary and sufficient conditions for the asymptotic normality of higher order Turing estimators," J. Chang, M. Grabchak, 3369–3395.
"Characterization of the second order random fields subject to linear distributional [...]," I. Henderson, P. Noble, O. Roustant , 3396–3422.
"Near-optimal estimation of the unseen under regularly varying tail populations," S. Favaro, Z. Naulet , 3423–3442.
"Joint density of the stable process and its supremum:[...]," J. I. González Cázares, A. Kohatsu-Higa, A. Mijatović , 3443–3469.

Stochastic Processes and their Applications

Vol. 165: November 2023

Editor-in-Chief: Matthias Löwe

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

"Asymptotics for exponential functionals of random walks,"' W. Hu, 1–42
"Hydrodynamic limit for a boundary driven super-diffusive symmetric exclusion," C. Bernardin, P. Cardoso, P. Gonçalves, S. Scotta, 43–95.
"Intersections of Poisson k-flats in constant curvature spaces,"C. Betken, D. Hug, C. Thäle, 96–129.
"Noise sensitivity and stability of deep neural networks for binary classification," J. Jonasson, J. E. Steif, O. Zetterqvist, 130–167.
"Typical height of the $(2+1)$-D Solid-on-Solid surface with pinning above a wall in the delocalized phase," N. Feldheim, S. Yang, 168–182.
"An application of the multiplicative Sewing Lemma to the high order weak approximation of stochastic [...]," A. Hocquet, A. Vogler, 183–217.
"Two-person zero-sum risk-sensitive stochastic games with incomplete reward information on one side," F. Chen, X. Guo, 218–245.
"Limit theorems for random Dirichlet series," D. Buraczewski, C. Dong, A. Iksanov, A. Marynych, 246–274.
"Metastability from the large deviations point of view: A Γ-expansion of the level two large deviations rate functional of [...]," C. Landim, 275–315.
"On fluctuation-theoretic decompositions via Lindley-type recursions," O. Boxma, O. Kella, M. Mandjes, 316–336.
"Infinite dimensional Piecewise Deterministic Markov Processes," P. Dobson, J. Bierkens, 337–396.
"A stochastic maximum principle for partially observed general mean-field control problems with only weak solution," J. Li, H. Liang, C. Mi, 397–439.
"Rates of convergence for Gibbs sampling in the analysis of almost exchangeable data," B. Gerencsér, A. Ottolini, 440–464.
"Multifractional Hermite processes: Definition and first properties," L. Loosveldt, 465–500.

Bernoulli Society Bulletin e-Briefs

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Editor-in-Chief: A. Caponera

https://www.bernoullisociety.org/publications?id=171

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Have a look at https://www.bernoullisociety.org/publications 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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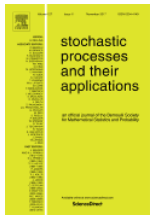

Publications and Meetings

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.

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