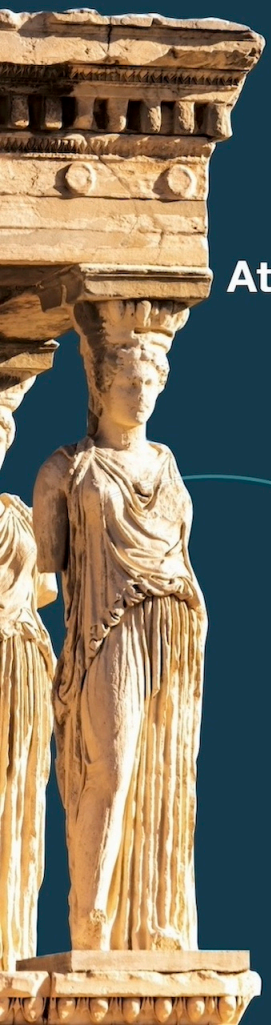
ISIT
ATHENS 2024

2024 IEEE International Symposium on Information Theory

Athens, Greece, July 7 - 12, 2024



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IEEE

Welcome to ISIT 2024 in Athens!

The International Symposium on Information Theory (ISIT) is the annual flagship conference of the IEEE Information Theory Society. In addition to the exceptional technical contributions we have each year, in 2024, we have some new programs. In particular, we invite to you take part in the following events.

- For the first time, we have satellite workshops to be held on Sunday before the symposium starts with a reception to follow.
- The ISIT welcome reception will be held on Monday evening in the architectural gem of the Stavros Niarchos Foundation.
- We will have seminars by leading chess players (including a Grand Master), followed by a simultaneous chess game of 30 ISIT participants against our Grand Master.
- The Bits n Bots competition will have an on site event.

We hope you like these innovations, and we welcome your feedback.

The conference would not have been possible without the dedicated work of the ISIT 2024 volunteer organization, including the Organizing Committee and the Technical Program Committee. In particular, the Technical Program Committee coordinated reviewing of the paper submissions. The three TPC co-chairs, Christina Fragouli, Ioannis Kontoyannis, and Joachim Rosenthal oversaw the entire process and put together our outstanding technical program. The tutorial chairs, Alex Dimakis and Lalitha Sankar, put together an expansive tutorial program of six tutorials. The Student Travel Grant Committee, consisting of George Alexandropoulos, Hye Won Chung, Flavio du Pin Calmon, and Rajesh Sundaresan coordinated the student travel award program. The workshops chairs Stark Draper, Henry Pfister, Osvaldo Simeone managed workshop selection and organization. The Bits n Bots Competition event has been organized by Hyeji Kim, Marco Mondelli, Stefano Rini, Farhad Shirani, Cynthia Rush, and Vincent Tan. The Chess Event has been organized by Lampros Gavalakis and Ioannis Kontoyiannis. The recent results session was coordinated by Yuejie Chi and Petros Elia and had a record number of submissions. Constantinos Papadias headed the sponsorship program, which was robust for ISIT 2024.

There are some positions within the organizing committee that perhaps do not get the recognition they deserve, as these colleagues often work behind the scenes, but we are indebted to their herculean efforts. The Finance chair, Ali Tajer, constructed and shepherded the ISIT 2024 budget, no small feat. The Publications chairs, Tobias Koch and I-Hsiang Wang, were responsible for the conference proceedings, publications and the smooth running of the conference app. The local arrangements chair, Aris Moustakas, helped sort through the complexities of local conference logistics and was our resident gourmet. The ISIT 2024 Webmaster, Christian Senger, handled all aspects of web presence and was a paragon of efficiency and patience.

We wish to also recognize our colleagues at MeetingPlanner. Conferences such as ISIT can no longer be brought to life by volunteers alone and we are grateful for their assistance in navigating the Greek meeting landscape. Special thanks go to Matina Gika, Popi Patsouli, and Michalis Sarris.

The Shannon Lecture this year will be presented by Andrew Barron on “Information Theory and High-Dimensional Bayes Computation”. We are so pleased with the excellent plenary program designed by our TPC chairs. Rebecca Willett will tell us about “Learning Low-rank Functions with Neural Networks”; Gregory Wornell will ask “Will We Ever Learn? A Sensor’s Lament, and other Stories”; Venkatesan Guruswami will talk about “A few options go a long way: List decoding and applications”; and Emina Soljanin will present “Codes: (Always) at Your Service.”

We are very grateful to the organizations who have provided generous financial support, or support in kind, to ISIT 2024. This includes Huawei, Qualcomm, META, The American College of Greece, Samsung, Sentient, Aitomatic, Aegean Airlines and Mitsubishi Electric Research Labs. We also thank Cambridge University Press, NOW publishers, and Entropy for participating as publisher exhibitors. We especially thank the United States National Science Foundation and the US Army Research Office for their generous support of ISIT 2024’s student travel grant program for US based students. The IEEE Information Theory Society Diversity & Inclusion (D&I) Committee and the ISIT 2024 conference both provided meaningful support for student travel for non-US based students.

Finally, we remind everyone about the (now) annual, society-driven events: Alumni in Industry, WITHITS and D&I, meet the Shannon Lecturer, Mentoring and Outreach, Early Career Funding panel as well as a conversation around artificial intelligence and machine learning.

We wish you a fruitful and productive time at ISIT 2024 and an enjoyable visit to Athens!

Urbashi Mitra,
ISIT 2024 General Co-Chair

Leandros Tassiulas,
ISIT 2024 General Co-Chair

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Hyeji Kim
Marco Mondelli
Cynthia Rush
Vincent Tan

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Aris Moustakas

Recent Results
Yuejie Chi
Petros Elia

Chess Event
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ISIT 2024 Program at a Glance

Sunday July 7, 2024

Workshops
8:30-17:15

AM Tutorials Part 1
8:30-10:00

Coffee Break & Snacks
10:00-10:30

AM Tutorials Part 2
10:30-12:00

Lunch Break
12:00-13:30

Sandwich Bar
12:15-13:15
(Level -1 & -2 Lobbies)

PM Tutorials Part 1
13:30-15:00

Coffee Break & Snacks
15:00-15:30

PM Tutorials Part 2
15:30-17:00

Workshops & Tutorials Reception
17:15-19:15
(Level -2 Lobby)

Monday July 8, 2024

Plenary Talk by Rebecca Willett: *Learning Low-rank Functions With Neural Networks*
8:30-9:55
(Ballroom II & III)

Moving Break 9:55-10:05

Session MO1
10:05-11:25

Coffee Break & Snacks
11:25-11:50

Session MO2
11:50-12:50

Lunch Break
12:50-14:35

Sandwich Bar
13:05-14:05
(Level -1 & -2 Lobbies)

Alumni in Industry
12:50-14:35
(Ballroom I)

Session MO3
14:35-15:55

Recent Results Poster
15:25-16:55
(Level -1 Lobby)

Coffee Break & Snacks
15:55-16:25

Session MO4
16:25-17:45

Weclome Reception
19:00-22:30
(Stavros Niarchos Foundation)

Tuesday July 9, 2024

Plenary Talk by Gregory Wornell: *Will We Ever Learn? A Sensor's Lament, and other Stories*
8:30-9:35
(Ballroom II & III)

Moving Break 9:35-9:45

Session TU1
9:45-11:05

Coffee Break & Snacks
11:05-11:30

Session TU2
11:30-12:50

Lunch Break
12:50-14:25

Sandwich Bar
13:05-14:05
(Level -1 & -2 Lobbies)

WITHITS/D&I
12:50-14:25
(Ballroom I)

Session TU3
14:25-15:45

Coffee Break & Snacks
15:45-16:05

Session TU4
16:05-17:25

Unconference: Generative AI and LLMs
16:05-17:25
(Ballroom I)

Awards Session
17:30-18:30
(Ballroom II & III)

Awards Reception
18:30-20:30
(Level -1 & -2 Lobbies)

Wednesday July 10, 2024

Plenary Talk by Venkatesan Guruswami: *A few options go a long way: List decoding and applications*
8:30-9:40
(Ballroom II & III)

Moving Break 9:40-9:50

Session WE1
9:50-11:10

Coffee Break & Snacks
11:10-11:30

Session WE2
11:30-12:50

Chess Event
13:00-18:00
(Ballroom I)

Thursday July 11, 2024

Shannon Lecture by Andrew Barron: *Information Theory and High-Dimensional Bayes Computation*
8:30-9:35
(Ballroom II & III)

Moving Break 9:35-9:45

Session TH1
9:45-11:05

Coffee Break & Snacks
11:05-11:30

Session TH2
11:30-12:50

Lunch Break
12:50-14:35

Sandwich Bar
13:05-14:05
(Level -1 & -2 Lobbies)

Meet the Shannon Lecturer
12:50-14:35
(Ballroom I)

Session TH3
14:35-15:55

Coffee Break & Snacks
15:55-16:25

Session TH4
16:25-17:45

Bits n Bots Solutions Showcase
16:25-17:45
(Ballroom I)

Banquet
19:30-00:30
(Ble Azure)

Friday July 12, 2024

Plenary Talk by Emina Soljanin: *Codes: (Always) at Your Service*
8:30-9:35
(Ballroom II & III)

Moving Break 9:35-9:45

Session FR1
9:45-11:05

Coffee Break & Snacks
11:05-11:30

Session FR2
11:30-12:50

Lunch Break
12:50-14:35

Sandwich Bar
13:05-14:05
(Level -1 & -2 Lobbies)

Mentoring & Outreach
12:50-14:35
(Ballroom I)

Session FR3
14:35-15:55

Coffee Break & Snacks
15:55-16:25

Session FR4
16:25-17:45

Early Career Funding Panel
16:25-17:45
(Ballroom I)

Coffee and beverages will be served every day (except Wednesday) from 8:00 to 16:00.

ISIT 2024 Per-Day Program

Sunday, July 7

Tutorials

8:30–12:00 **AM Tutorials:**

Theory and Methods for Deep Generative Models ..... Lamda
Language Model Inference: Theory and Algorithms ..... Omega
Information-Theoretic, Statistical and Algorithmic Foundations of Reinforcement Learning ..... VIP

13:30–17:00 **PM Tutorials:**

Graph Matching: Fundamental Limits and Efficient Algorithms ..... Lamda
Scaling and Reliability Foundations in Machine Learning ..... Omega
Coding Theory for Modern Exascale Storage Systems ..... VIP

Workshops 8:30–17:15

Coding Theory and Algorithms for DNA-based Data Storage ..... Arcade I-II
NeurIT: Information Theory in Neuroscience and Neuroengineering ..... Omikron I
Learn to Compress ..... Omikron II
Quantum Information Knowledge (QuIK) ..... Ypsilon I-II-III
Information-Theoretic Methods for Trustworthy Machine Learning (IT-TML) ..... Ypsilon IV-V-VI

Other Events

17:15–19:15 **Workshops & Tutorials Reception** ..... Level -2 Lobby

Monday, July 8

Plenary Talk (Ballroom II & III) **8:30–9:55**

Learning Low-rank Functions With Neural Networks

Rebecca Willett, University of Chicago, USA

Neural networks are increasingly prevalent and transformative across domains. Understanding how these networks operate in settings where mistakes can be costly (such as transportation, finance, healthcare, and law) is essential to uncovering potential failure modes. Many of these networks operate in the "overparameterized regime," in which there are far more parameters than training samples, allowing the training data to be fit perfectly. What does this imply about the predictions the network will make on new samples? That is, if we train a neural network to interpolate training samples, what can we say about the interpolant, and how does this depend on the network architecture? In this talk, I will describe insights into the role of network depth using the notion of representation costs – i.e., how much it "costs" for a neural network to represent various functions. Understanding representation costs helps reveal the role of network depth in machine learning and the types of functions learned, relating them to Barron and mixed variation function spaces, such as single- and multi-index models.

Biography

Rebecca Willett is a Professor of Statistics and Computer Science and the Director of AI in the Data Science Institute at the University of Chicago, and she holds a courtesy appointment at the Toyota Technological Institute at Chicago. Her research is focused on the mathematical foundations of machine learning, scientific machine learning, and signal processing. Prof. Willett is the Deputy Director for Research at the NSF-Simons Foundation National Institute for Theory and Mathematics in Biology and a member of the NSF Institute for the Foundations of Data Science Executive Committee. She is the Faculty Director of the Eric and Wendy Schmidt AI in Science Postdoctoral Fellowship at the University of Chicago and helps direct the Air Force Research Lab University Center of Excellence on Machine Learning. Willett received the National Science Foundation CAREER Award in 2007, was a member of the DARPA Computer Science Study Group, received an Air Force Office of Scientific Research Young Investigator Program award in 2010, was named a Fellow of the Society of Industrial and Applied Mathematics in 2021, and was named a Fellow of the IEEE in 2022. Prof. Willett completed her PhD in Electrical and Computer Engineering at Rice University in 2005 and was an Assistant then tenured Associate Professor of Electrical and Computer Engineering at Duke University from 2005 to 2013. She was an Associate Professor of Electrical and Computer Engineering, Harvey D. Spangler Faculty Scholar, and Fellow of the Wisconsin Institutes for Discovery at the University of Wisconsin-Madison from 2013 to 2018. She serves on the advisory boards of the US National Science Foundation's Institute for Mathematical and Statistical Innovation, the US National Science Foundation's Institute for the Foundations of Machine Learning, and the MATH+ Berlin Mathematics Research Center, as well as National Academies of Science, Engineering and Medicine committees.

Sessions

MO1 — 10:05–11:25

MO1.R1: Student Paper Award 1	MO1.R2: Topics in Machine Learning 1	MO1.R3: Topics in Modern Coding Theory 1	MO1.R4: Lossless Source Coding	MO1.R5: Probability and Bounds	MO1.R6: Coding in Biology 1	MO1.R7: Combinatorial Coding Theory 1	MO1.R8: Channel Capacity	MO1.R9: Secure Communication and Computation
Ballroom II & III	Ypsilon I-II-III	Ypsilon IV-V-VI	Omikron II	Omikron I	Sigma/Delta	VIP	Omega	Lamda

MO2 — 11:50–12:50

MO2.R1: Student Paper Award 2	MO2.R2: Binary Classification	MO2.R3: Fairness	MO2.R4: Lossy Compression Applications	MO2.R5: Estimation and Prediction	MO2.R6: Information Theory in NeuroScience	MO2.R7: Reed Muller Codes	MO2.R8: Identification	MO2.R9: Secret Key Schemes
Ballroom II & III	Ypsilon I-II-III	Ypsilon IV-V-VI	Omikron II	Omikron I	Sigma/Delta	VIP	Omega	Lamda

MO3 — 14:35–15:55

MO3.R1: Quantum Information 1	MO3.R2: Classification and Regression	MO3.R3: Differential Privacy in Learning 1	MO3.R4: Rate Distortion Theory 1	MO3.R5: LDPC Codes 1	MO3.R6: Coding in Biology 2	MO3.R7: Reed Solomon Codes	MO3.R8: Channels with Feedback	MO3.R9: Statistical Estimation and Detection
Ballroom II & III	Ypsilon I-II-III	Ypsilon IV-V-VI	Omikron II	Omikron I	Sigma/Delta	VIP	Omega	Lamda

MO4 — 16:25–17:45

MO4.R1: Quantum Information 2	MO4.R2: Topics in Machine Learning 2	MO4.R3: Differential Privacy in Learning 2	MO4.R4: Joint Source-Channel Coding	MO4.R5: LDPC Codes 2	MO4.R6: DNA storage and coding	MO4.R7: Combinatorial Coding Theory 2	MO4.R8: Discrete Channels	MO4.R9: AMP, Sparsity and Sketching
Ballroom II & III	Ypsilon I-II-III	Ypsilon IV-V-VI	Omikron II	Omikron I	Sigma/Delta	VIP	Omega	Lamda

Other Events

12:50–14:35 **Alumni in Industry** ..... Ballroom I

15:25–16:55 **Recent Results Poster** ..... Level -1 Lobby

19:00–22:30 **Welcome Reception** ..... Stavros Niarchos Foundation

Bus Transfer:

18:30 Athenaeum InterContinental Athens → Stavros Niarchos Foundation

from 20:30 Stavros Niarchos Foundation → Athenaeum InterContinental Athens & ISIT 2024 Shuttle Bus Stop

Tuesday, July 9

Plenary Talk (Ballroom II & III) **8:30–9:35**

Will We Ever Learn? A Sensor's Lament, and other Stories

Gregory Wornell, Massachusetts Institute of Technology, USA

Over many decades, information theoretic analysis has proven to be extraordinary useful in reimagining system architecture in diverse applications. Indeed, such analysis clarifies where information is and is not needed, and quantifies the impact of design constraints. Among other examples, this talk will focus on problems of acquisition and digital conversion of sensor data, which straddles the analog/digital interface. The lack of adaptability at this interface often necessitates considerable overprovisioning in contemporary systems, and leads to a significant bottleneck in the information pipeline. Highlighting efforts within and beyond the community, this talk will discuss some of what information theory reveals about what might be possible with respect to addressing these challenges, and about the prospects of learning at the edge.

Biography

Gregory W. Wornell received his Ph.D. from the Massachusetts Institute of Technology (MIT) in electrical engineering and computer science in 1991. Since then he has been on the faculty at MIT, where he is the Sumitomo Professor of Engineering in the department of Electrical Engineering and Computer Science (EECS). At MIT he leads the Signals, Information, and Algorithms Laboratory, and is affiliated with the Research Laboratory of Electronics (RLE), and the Computer Science and Artificial Intelligence Laboratory (CSAIL). He has been involved in the Information Theory and Signal Processing societies in a variety of capacities, and maintains a number of industrial relationships and activities. Among awards for his research and teaching is the 2019 IEEE Leon K. Kirchmayer Graduate Teaching Award.

Sessions

TU1 — 9:45–11:05

TU1.R1: Statistical Learning	TU1.R2: Quantum Information 3	TU1.R3: Codes for Storage 1	TU1.R4: Hypothesis Testing 1	TU1.R5: Rate-Distortion Theory 2	TU1.R6: Biology: Sequence Reconstruction	TU1.R7: Algebraic Decoding	TU1.R8: Privacy in Coded Computing	TU1.R9: Age of Information 1
Ballroom II & III	Ypsilon I-II-III	Ypsilon IV-V-VI	Omikron II	Omikron I	Sigma/Delta	VIP	Omega	Lamda

TU2 — 11:30–12:50

TU2.R1: Bayesian estimation	TU2.R2: Quantum Shannon Theory 1	TU2.R3: Codes for Storage 2	TU2.R4: Change Point Detection	TU2.R5: Rate-Distortion-Perception	TU2.R6: Biology: Insertions and Deletions	TU2.R7: Sequences 1	TU2.R8: Coding and Access for Memory	TU2.R9: Age of Information 2
Ballroom II & III	Ypsilon I-II-III	Ypsilon IV-V-VI	Omikron II	Omikron I	Sigma/Delta	VIP	Omega	Lamda

TU3 — 14:25–15:45

TU3.R1: Deep Learning in Communica-tions	TU3.R2: Quantum Shannon Theory 2	TU3.R3: Codes for Storage 3	TU3.R4: Hypothesis Testing 2	TU3.R5: Error Exponents	TU3.R6: Network Coding 1	TU3.R7: Sequences 2	TU3.R8: Distributed Computing	TU3.R9: Age of Information 3
Ballroom II & III	Ypsilon I-II-III	Ypsilon IV-V-VI	Omikron II	Omikron I	Sigma/Delta	VIP	Omega	Lamda

TU4 — 16:05–17:25

TU4.R1: Deep Learning in Coding	TU4.R2: Quantum Shannon Theory 3	TU4.R3: Codes for Storage 4	TU4.R4: Seq. Hypothesis Testing and Change Detection	TU4.R5: Mismatched and Universal Decoding	TU4.R6: Network Coding 2	TU4.R7: Rank Metric Codes	TU4.R8: Coded Caching	TU4.R9: Energy and Computational Efficiency
Ballroom II & III	Ypsilon I-II-III	Ypsilon IV-V-VI	Omikron II	Omikron I	Sigma/Delta	VIP	Omega	Lamda

Other Events

12:50–14:25	**WITHITS/D&I**	Ballroom I
16:05–17:25	**Unconference: Generative AI and LLMs**	Ballroom I
17:30–18:30	**Awards Session**	Ballroom II & III
18:30–20:30	**Awards Reception**	Level -1 & -2 Lobbies

Wednesday, July 10

Plenary Talk (Ballroom II & III) **8:30–9:40**

A few options go a long way: List decoding and applications

Venkatesan Guruswami, University of California, Berkeley, USA

List decoding allows the error-correction procedure to output a small list of candidate codewords, and the decoding is deemed successful if the list includes the original uncorrupted codeword. List decoding has enjoyed a number of influential consequences. It allows bridging between the Shannon and Hamming worlds and achieving "capacity" even in worst-case error models. It serves as a versatile subroutine in varied error-correction scenarios not directly tied to list decoding. It boasts a diverse array of "extraneous" applications in computational complexity, combinatorics, cryptography, and quantum computing. And it has infused several novel algebraic, probabilistic, combinatorial, and algorithmic techniques and challenges into coding theory.

This talk will provide a glimpse of several facets of list decoding, its origins, evolution, constructions, connections, and applications.

Biography

Venkatesan Guruswami received his Bachelor's degree in Computer Science from the Indian Institute of Technology at Madras in 1997 and his Ph.D. in Computer Science from the Massachusetts Institute of Technology in 2001. He is currently a Chancellor's Professor in the Electrical Engineering and Computer Science Department at the University of California, Berkeley, and a senior scientist at the Simons Institute for the Theory of Computing. He was a Miller Research Fellow at UC Berkeley and held faculty positions at the University of Washington and Carnegie Mellon University prior to his current position. His research interests span many topics such as coding and information theory, approximate optimization, computational complexity, pseudo-randomness, and related mathematics. Prof. Guruswami has served the theoretical computer science community in several leadership roles. He is the current Editor-in-Chief of the Journal of the ACM, and was previously Editor-in-Chief of the ACM Transactions on Computation Theory. He has served as the president of the Computational Complexity Foundation and on the editorial boards of JACM, the SIAM Journal on Computing and the IEEE Transactions on Information Theory. He has been program committee chair for the conferences CCC (2012), FOCS (2015), ISIT (2018, co-chair), FSTTCS (2022), and ITCS (2024). Prof. Guruswami is a recipient of a Guggenheim Fellowship, a Simons Investigator award, the Presburger Award, Packard and Sloan Fellowships, the ACM Doctoral Dissertation Award, an IEEE Information Theory Society Paper Award and a Distinguished Alumnus Award from IIT Madras. He was an invited speaker at the 2010 International Congress of Mathematicians. Prof. Guruswami is a fellow of the ACM, IEEE, and AMS.

Sessions

WE1 — 9:50–11:10

WE1.R1: Symmetric Cryptography	WE1.R2: Federated Learning	WE1.R3: Coded Caching: Privacy and Security	WE1.R4: Multi Terminal Source Coding	WE1.R5: Broadcast Channels	WE1.R6: Coding in Biology 3	WE1.R7: Combinatorics and Information Theory 1	WE1.R8: Convolutional and Streaming Codes 1	WE1.R9: Wireless 1
Ballroom II & III	Ypsilon I-II-III	Ypsilon IV-V-VI	Omikron II	Omikron I	Sigma/Delta	VIP	Omega	Lamda

WE2 — 11:30–12:50

WE2.R1: Code Based Cryptography	WE2.R2: Semi-Supervised and Federated Learning	WE2.R3: Secure Multiparty Computation	WE2.R4: Entropy Coding, Compression and Quantization	WE2.R5: Channel Synthesis and Coordination	WE2.R6: Information Theory in Biology	WE2.R7: Combinatorics and Information Theory 2	WE2.R8: Convolutional and Streaming Codes 2	WE2.R9: Wireless 2
Ballroom II & III	Ypsilon I-II-III	Ypsilon IV-V-VI	Omikron II	Omikron I	Sigma/Delta	VIP	Omega	Lamda

Other Events

13:00–18:00 **Chess Event: Invited Talks and Simultaneous Game** ..... Ballroom I

- 13:00–14:00 Lunch
- 14:00–14:30 “The machine learning tools and ideas behind the top chess engines” by Jonathan Rosenthal
- 14:30–15:00 “How chess engines have transformed the game of chess” by Vasilios Kotronias
- 15:00–15:30 Coffee Break
- 15:30–18:00 Simultaneous Chess Game

Thursday, July 11

Shannon Lecture (Ballroom II & III) **8:30–9:35**

Information Theory and High-Dimensional Bayes Computation

Andrew Barron, Yale University, USA

Information theory provides foundations and links among the problems of model discovery, prediction, compression, estimation and communication of data sequences. Various procedures are available to tackle such problems. Among such, the Bayes procedures are not only average case optimal, they also provide favorable individual case performance. Importantly for engineering and scientific practice, a number of Bayesian modeling developments are associated with providing computationally effective methods for sequence prediction, compression, and channel decoding. Laplace's approximation of Bayes factors, the use of Jeffreys' prior, their relationship to stochastic complexity and to minimax redundancy and to minimax regret, the index of resolvability, the average case optimality of Bayes predictive distributions for relative entropy loss, and the information-theoretic determination minimax statistical risk provide some starting points which we may discuss at the overlap of Bayes theory and information theory.

Models for sequences of discrete outcomes and models for continuous parameter function estimation provide natural playgrounds. For discrete data models, Laplace's rule of succession, the Krichevsky-Trofimov rule, the Shtarkov minimax regret rule, on-line learning with log-loss, the Willems et al. Context Tree Weighting Algorithm, and capacity-achieving LDPC codes with Bayesian belief propagation/message passing are among the important developments we may discuss. Colleagues are exploring the impact of some of these models considerably beyond their originally intended context.

Particular attention will be given to continuous data models. We start with the Bayesian interpretation of the development of least squares by Gauss and the Bayesian and information theory implications of the extensions to recursive least squares, linear predictive coding, Kalman filtering, and online learning with squared error loss. As with certain discrete models, these continuous models permit explicit determination of procedures that are Bayes optimal and nearly pointwise regret optimal for arbitrary sequences. For log-concave distributions the critical development of information-theoretic characterization of rapid mixing, initiated by Bakry and Emery and carried forward by various prominent scholars, brings many other Bayesian prediction and estimation problems into the computationally feasible playground, even in high dimensions. We may discuss various such problems. These include the class of all the location estimation problems and linear regression problems with log-concave error distributions, for which the uniform prior is provably minimax for cumulative Kullback loss and minimax for data compression given initial data. Also included are Cover's universal portfolios which are log-concave integrations that become computable even with a large number of stocks. For Gaussian channel communication via superposition codes (also called regression codes), adaptive successive decoders and approximate message passing algorithms for approximate computation of Bayes optimal decoders are provably computationally feasible and capacity achieving.

However, the lack of provably effective optimization or sampling methods plague the important classes of high-dimensional nonlinear function modeling problems, including modern artificial neural networks via deep learning. These network models can be proven to be information-theoretically, statistically, and approximation-theoretically accurate even in high-dimensional settings for suitable classes of functions. These artificial neural networks models have multimodal posterior distributions. Nevertheless, we show, in joint work with Curtis McDonald, how to overcome the computation-theoretic challenge by the introduction of certain auxiliary parameters for which the conditional distribution of the network parameters given the data and the auxiliary parameters are always log-concave. Importantly, when the network parameter dimension exceeds the sample size to the 1.5 power, we show that the distribution of the auxiliary parameters becomes log-concave. Accordingly, we can first sample the auxiliary parameters and then conditionally sample the network parameters to computationally efficiently produce Bayes optimal Monte Carlo neural net estimates, appealing to the above-mentioned information-theoretic results. These provide the first demonstration of computational learnability of accurate statistical estimates for such neural networks, in particular for the class of functions with bounded variation with respect to the neural network class.

Biography

Andrew R Barron, Professor of Statistics and Data Science at Yale University, has made outstanding contributions at the overlap of Information Theory with Probability and Statistics. Prior to joining Yale University in 1992, Barron was a faculty member in Statistics and Electrical and Computer Engineering at the University of Illinois at Urbana Champaign. Barron received his MS and PhD degrees from Stanford University in Electrical Engineering in 1985 under the direction of Tom Cover and a Bachelor's degree in the fields of Mathematical Science and Electrical Engineering from Rice University in 1981. Barron is a Fellow of the IEEE, a Medallion Prize winner of the Institute of Mathematical Statistics, and a winner along with Bertrand Clarke of the IEEE Thompson Prize. Andrew Barron has served as a Secretary of the Board of Governors of the IEEE Information Theory Society and several terms as an elected member of this Board. He has been an associate editor of the IEEE Transactions on Information Theory and the Annals of Statistics. Barron has served on and subsequently chaired the Thomas M. Cover Dissertation Prize Committee. At Yale University, Barron regularly teaches courses in Information Theory, Theory of Statistics, High-Dimensional Function Estimation and Artificial Neural Networks. Barron has served terms as department chair, director of graduate studies, director of undergraduate studies in Statistics, director of undergraduate studies in Applied Mathematics, and courtesy appointee as Professor of Electrical Engineering. Barron has proudly mentored 20 PhD students. Often working with these students and other colleagues, Barron is known for several specific research accomplishments: in particular, for generalizing the

AEP to continuous-valued ergodic processes, for proving an information-theoretic Central Limit Theorem, for determining information-theoretic aspects of portfolio estimation, for formulating the index of resolvability and providing an associated characterization of performance of Minimum Description Length estimators, for determining the asymptotics of universal data compression in parametric families, for characterizing the concentration of Bayesian posteriors in the vicinity of parameters in the information support of the prior, for an information-theoretic determination of the minimax rates of function estimation, for providing information-theoretic characterization of statistical efficiency, for providing an early unifying view of statistical learning networks, for developing approximation and estimation bounds for artificial neural networks and recent extensions to deep learning, for advancing greedy algorithms for training neural networks, for information-theoretic aggregation of least squares regressions, and for formulating and proving capacity-achieving sparse regression codes for Gaussian noise communication channels. Barron maintains homes in New Haven, Connecticut and in Osijek, Croatia with his wife Lidija. Barron is also a distinguished FAI free flight model glider competitor in the F1A class, as a five time U.S. National Champion, a four time U.S. National Team Member at World Championships (most recently in 2023), as a two time America's Cup Champion, and as a co-manager and co-owner with family members of Barron Field, LLC.

Sessions

TH1 — 9:45–11:05

TH1.R1: Language Models	TH1.R2: Quantum Data and Computation	TH1.R3: Multi-Armed Bandits 1	TH1.R4: Information Measures 1	TH1.R5: Repair Codes 1	TH1.R6: MIMO 1	TH1.R7: Lattice Codes	TH1.R8: Polar Codes 1	TH1.R9: Coding Over Networks
Ballroom II & III	Ypsilon I-II-III	Ypsilon IV-V-VI	Omikron II	Omikron I	Sigma/Delta	VIP	Omega	Lamda

TH2 — 11:30–12:50

TH2.R1: Sampling and Samplers	TH2.R2: Quantum Coding Theory 1	TH2.R3: Multi-Armed Bandits 2	TH2.R4: Information Measures and Randomness	TH2.R5: Repair Codes 2	TH2.R6: MIMO 2	TH2.R7: Subspace Codes	TH2.R8: Polar Codes 2	TH2.R9: Scheduling and Networking
Ballroom II & III	Ypsilon I-II-III	Ypsilon IV-V-VI	Omikron II	Omikron I	Sigma/Delta	VIP	Omega	Lamda

TH3 — 14:35–15:55

TH3.R1: Information Bottleneck	TH3.R2: Quantum Coding Theory 2	TH3.R3: Secure Federated Learning	TH3.R4: Information Measures II	TH3.R5: Distributed Computing: Matrix Multiplication	TH3.R6: Integrated Sensing and Communication 1	TH3.R7: Algebraic Aspects of Coding Theory 1	TH3.R8: Topics in Modern Coding Theory 2	TH3.R9: Private Information Retrieval 1
Ballroom II & III	Ypsilon I-II-III	Ypsilon IV-V-VI	Omikron II	Omikron I	Sigma/Delta	VIP	Omega	Lamda

TH4 — 16:25–17:45

TH4.R1: Generalization Bounds	TH4.R2: Quantum Coding Theory 3	TH4.R3: Secure Aggregation in Federated Learning	TH4.R4: Maximal Leakage	TH4.R5: Coded and Distributed Computing	TH4.R6: Integrated Sensing and Communication 2	TH4.R7: Algebraic Aspects of Coding Theory 2	TH4.R8: Topics in Modern Coding Theory 3	TH4.R9: Private Information Retrieval 2
Ballroom II & III	Ypsilon I-II-III	Ypsilon IV-V-VI	Omikron II	Omikron I	Sigma/Delta	VIP	Omega	Lamda

Other Events

12:50–14:35 **Meet the Shannon Lecturer** ..... Ballroom I

16:25–17:45 **Bits n Bots Solutions Showcase** ..... Ballroom I

19:30–00:30 **Banquet** ..... Ble Azure

Bus Transfer:

18:40 Athenaeum InterContinental Athens → Ble Azure

18:45 ISIT 2024 Shuttle Bus Stop → Ble Azure

from 22:30 Ble Azure → Athenaeum InterContinental Athens & ISIT 2024 Shuttle Bus Stop

Friday, July 12

Plenary Talk (Ballroom II & III) **8:30–9:35**

Codes: (Always) at Your Service

Emina Soljanin, Rutgers University, USA

Error control coding is essential in many scientific disciplines and nearly all telecommunication systems. Proposals for new codes and new roles of codes in communications and computing systems continue to appear. Each new proposal initially faces (justified) skepticism and pushback by practitioners until discarded or adopted as a necessary evil. Coding performance metrics have become hard to define and even harder to evaluate. The first part of this talk considers the service rate region of a code, a new performance metric of a distributed system that stores data redundantly using the code. It measures the storage system's ability to serve multiple users requesting different data objects. The second part of the talk asks if there is a coding gain in adding redundancy to distributed computing and how we can evaluate and achieve it.

Biography

Emina Soljanin is a Distinguished Professor of Electrical and Computer Engineering at Rutgers University. Before moving to Rutgers in January 2016, she was a (Distinguished) Member of Technical Staff for 21 years in Bell Labs Math Research. She received her Ph.D. and M.Sc. from Texas A & M University and her B.S. from the University of Sarajevo, all in Electrical Engineering. Prof. Soljanin's research interests and expertise are broad. She has participated in numerous research and business projects. These projects include designing the first distance-enhancing codes implemented in commercial magnetic storage devices, the first forward error correction for Bell Labs optical transmission devices, color space quantization for image processing, link error prediction methods for Hybrid ARQ wireless standards, network and rateless coding, and network data security and user anonymity. Her most recent activities are in distributed computing systems and quantum information science. Prof. Soljanin has served as an Associate Editor for Coding Techniques for the IEEE Transactions on Information Theory and has had various roles in other journal editorial boards, special workshop organizing, and conference program committees. She is an IEEE Fellow, an outstanding alumnus of the Texas A & M School of Engineering, the 2011 Padovani Lecturer, a 2016/17 Distinguished Lecturer, and the 2019 IEEE Information Theory Society President. Prof. Soljanin's favorite recognition is the 2023 Aaron D. Wyner Distinguished Service Award.

Sessions

FR1 — 9:45–11:05

FR1.R1: Post-Quantum Cryptography	FR1.R2: Hypothesis Testing 3	FR1.R3: Polar Codes 3	FR1.R4: Capacity and Guessing	FR1.R5: Multiple Access	FR1.R6: Group Testing 1	FR1.R7: Information Theory and Computer Science	FR1.R8: Differential Privacy	FR1.R9: Complexity and Computation Theory 1
Ballroom II & III	Ypsilon I-II-III	Ypsilon IV-V-VI	Omikron II	Omikron I	Sigma/Delta	VIP	Omega	Lamda

FR2 — 11:30–12:50

FR2.R1: Quantum Cryptography	FR2.R2: Network Information Theory 1	FR2.R3: Combinatorial Coding Theory 3	FR2.R4: Information Inequalities 1	FR2.R5: Unsourced Random Access	FR2.R6: Group Testing 2	FR2.R7: Information-theoretic Control	FR2.R8: Privacy and Security in Computing	FR2.R9: Complexity and Computation Theory 2
Ballroom II & III	Ypsilon I-II-III	Ypsilon IV-V-VI	Omikron II	Omikron I	Sigma/Delta	VIP	Omega	Lamda

FR3 — 14:35–15:55

FR3.R1: Quantum Security and Privacy	FR3.R2: Network Information Theory 2	FR3.R3: Iterative Decoding	FR3.R4: Information Inequalities 2	FR3.R5: Estimation 1	FR3.R6: Capacity of Biological Channels	FR3.R7: Graph Theory and Analytics	FR3.R8: Privacy in Communication and Computation	FR3.R9: Signal Processing 1
Ballroom II & III	Ypsilon I-II-III	Ypsilon IV-V-VI	Omikron II	Omikron I	Sigma/Delta	VIP	Omega	Lamda

FR4 — 16:25–17:45

FR4.R1: Cryptographic Protocols	FR4.R2: MDL and Prediction	FR4.R3: List Decoding	FR4.R4: Entropy Power Inequalities	FR4.R5: Estimation 2	FR4.R6: Information and Coding in Biology	FR4.R7: Distributed Learning	FR4.R8: Private Information Retrieval 3	FR4.R9: Signal Processing 2
Ballroom II & III	Ypsilon I-II-III	Ypsilon IV-V-VI	Omikron II	Omikron I	Sigma/Delta	VIP	Omega	Lamda

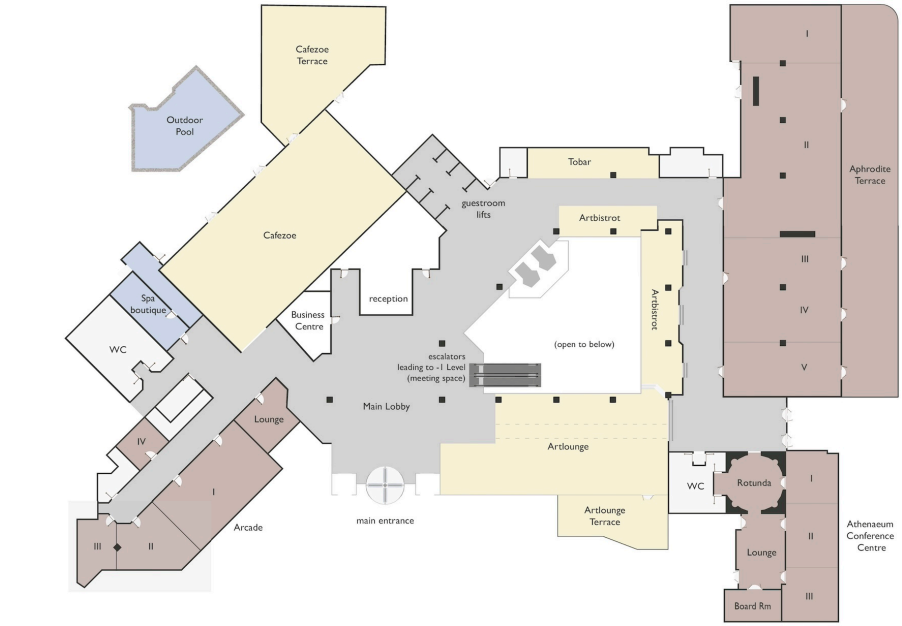
Other Events

12:50–14:35 **Mentoring & Outreach** ..... Ballroom I

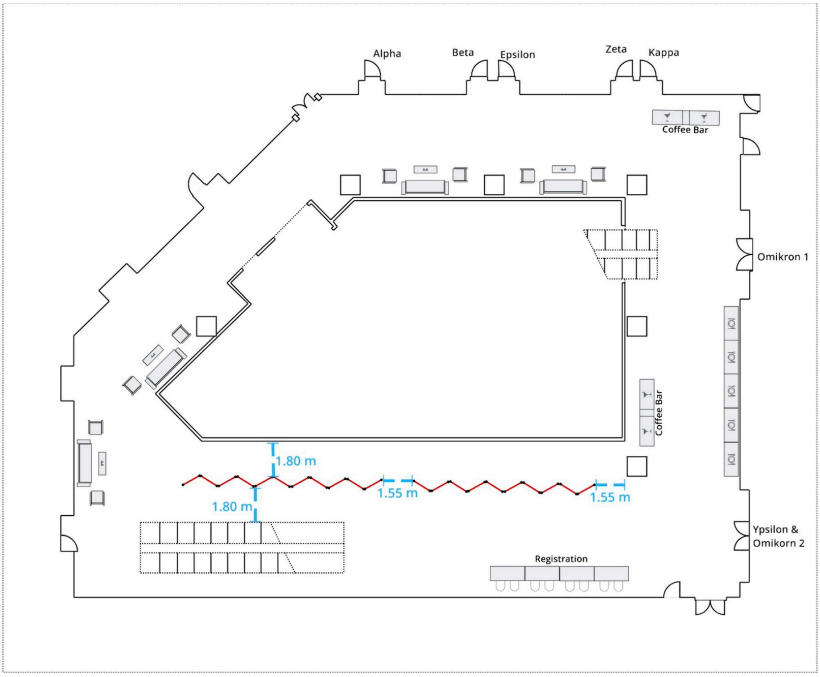
16:25–17:45 **Early Career Funding Panel (NSF/ERC)** ..... Ballroom I

Floor Plans

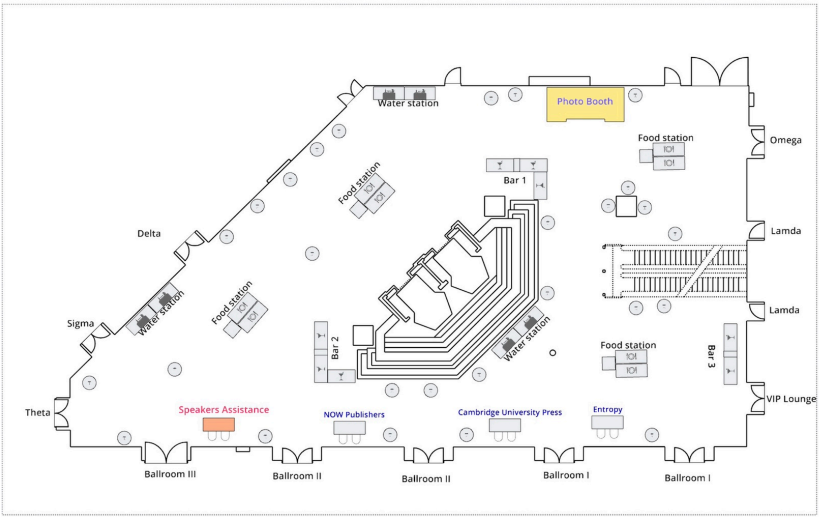
Ground Level



Level -1



Level -2


Water station
Photo Booth
Food station
Omega
Bar 1
Food station
Delta
Lamda
Food station
Sigma
Water station
Lamda
Bar 2
Water station
Food station
Bar 3
VIP Lounge
Theta
Speakers Assistance
NOW Publishers
Cambridge University Press
Entropy
Ballroom III
Ballroom II
Ballroom II
Ballroom I
Ballroom I
2 Meters

Addresses

Conference Venue

InterContinental Athenaeum
Leof. Andrea Siggrou 89-93
Athina, 11745

Welcome Reception Venue

Stavros Niarchos Foundation Cultural Center
Leof. Andrea Siggrou 364
Kallithea, 17674

Banquet Venue

Ble Azure
Leof. Posidonos 70
Alimos, 17455

ISIT Shuttle Bus Stop

Leof. Amalias 18
Syntagma Square, Athens

Wifi Information

Network Name

IHG ONE REWARDS

Access Code

INTER

Emergency Contacts

Emergency Registration Desk Number

+30 2109206000 (ext. 8059)

Emergency State Number

112