

Highlights From the Signal Processing Theory and Methods Technical Committee

The IEEE Signal Processing Theory and Methods Technical Committee (SPTM TC) is one of 13 TCs in the IEEE Signal Processing Society (SPS). Its mission is to support, nourish, and lead scientific and technological development in all theoretical aspects of signal processing. The TC has 42 volunteer members who are elected among leaders from academia and industry.

The SPTM TC promotes activities within the technical areas of digital signal processing and statistical signal processing. As such, its interests span a broad range of topics, from classical fields (signal sampling and reconstruction, digital filtering, multirate signal processing, adaptive signal processing, statistical signal analysis, estimation, and detection) to more recent and currently emerging areas (compressed sensing, signal processing over graphs and networks, and optimization). Due to its breadth and fundamental nature, this TC is often the first home for new directions within the scope of the SPS.

As its name suggests, the SPTM TC is a cross-cutting group that focuses on theory and methods for signal processing applications. The TC is interested in the theoretical aspects of the methods, which are spread across and employed in numerous domains, such as sensor arrays, communication, audio and image processing, and biomedical applications. Theoretical studies that are fundamental to the advancement of these important areas include time–fre-

quency analysis, multirate processing, optimization methods, adaptive filtering, filter design, detection and estimation theory and methods, sampling theory, transforms, algorithm performance analysis, signal and information processing over graphs, learning theory, quantization, tensor theory, signals and systems modeling, distributed processing, sparsity-aware processing, quantum signal processing, and distributed processing over networks.

The SPTM TC sponsors the IEEE Workshop on Statistical Signal Processing (SSP) (Figure 1), which is the most prestigious event for presenting and discussing new research results on statistical methods applied to signal processing (Table 1). The 2018 workshop was held in Freiburg im Breisgau, Germany. It was chaired by Peter Schreier, with Javier Vía and Arie Yeredor as technical program cochairs, and attracted 250 attendees. The 2020 workshop will be held in Rio de Janeiro, Brazil, and chaired by Rodrigo de Lamare, with Vítor Nascimento and José Bermudez as technical program cochairs.

The largest meeting point for the SPTM community is ICASSP. The

SPTM track had 375 paper submissions for ICASSP 2016 in Shanghai, China; 410 submissions for ICASSP 2017 in New Orleans, Louisiana; 331 submissions for ICASSP 2018 in Calgary, Alberta, Canada; and 333 submissions for ICASSP 2019 in Brighton, United Kingdom. The upcoming ICASSP 2020 (Barcelona, Spain) has 411 submissions in the SPTM track, breaking the four-year record established in 2017 and showing the continued importance of the theoretical advances in the SPTM field for the development of new technologies.

The scope of the SPTM TC aligns with that of the European Association for Signal Processing (EURASIP) Theoretical and Methodological Trends in Signal Processing Technical Area Committee, so it is not surprising that there is overlap in topics, activities, and membership. A strong example is the joint cosponsorship of seasonal schools, such as the 2019 IEEE-SPS/EURASIP Summer School on Network- and Data-Driven Learning.

The SPTM TC participates in other technical activities within the IEEE SPS,

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Table 1. The recent SSP Workshop editions.

Year	Location	Chairs	Papers	Attendees
2014	Gold Coast, Australia	Abd-Krim Seghouane and Rob Evans	143	141
2016	Palma de Mallorca, Spain	Antonio Artés-Rodríguez and Joaquín Míguez Arenas	154	193
2018	Freiburg im Breisgau, Germany	Peter Schreier	173	250

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FIGURE 1. Peter Schreier speaking at the 2018 SSP Workshop.

including the Challenges and Data Collections Subcommittee, recently established by the Technical Directions Board to oversee the SPS Challenges Program, and the IEEE SPS Autonomous Systems Initiative, which promotes technical and educational activities in autonomous systems. Other activities of the SPTM TC include the generation of instructional and motivational material in the form of text and video on the practical applications of signal processing theory and the promotion of webinars, online courses, and other educational resources covering topics within the areas of the TC.

The SPTM TC actively participates in the nomination process for major IEEE and SPS awards. Some of the paper awards for which the SPTM TC systematically nominates candidates include those for Signal Processing Best Paper, Best Overview Paper, Signal Processing Magazine Best Paper and Best Column, SPS Best Paper, and SPS Young Author Best Paper. The SPTM TC has established a very careful nomination process, coordinated by the Awards Subcommittee, which involves detailed reviews of several papers nominated by TC members. For the major awards, the TC nominates candidates for the Education Award, Early Career Technical Achievement Award, SPS Award,

and Technical Achievement Award. The SPTM TC also nominates candidates for Distinguished Lecturers and Distinguished Industry Speakers.

Another important objective of the SPTM TC is to identify emerging theoretical areas that are promising for signal processing applications and promote these areas by facilitating the disclosure of relevant research in signal processing conferences and journals. One area that has been recently included in the technical activities of the SPTM TC is graph signal processing, which focuses on the development of tools for processing data defined on irregular graph domains. New theories and methods in this field include a linear discrete signal processing framework to process data sets arising from several types of networks, including social, biological, and physical. Applications, such as health monitoring, banking, traffic control, and marketing, have benefited from the new methods developed under the umbrella of graph signal processing.

More recently, the area of quantum signal processing (QSP) has been incorporated into the SPTM TC technical activities. QSP borrows from the formalism and principles of quantum mechanics to establish a new theory for signal processing with applications in areas such as quantization and sampling methods, detection,

and parametric estimation. QSP establishes a new framework for developing new signal processing algorithms by exploiting the probabilistic nature of quantum mechanics without the need to satisfy the practical requirements dictated by physical implementations based on quantum mechanics.

The SPTM TC maintains a webpage dedicated to TC activities (<https://signalprocessingsociety.org/get-involved/signal-processing-theory-and-methods/sptm-home>), where one can find ways to participate in the TC activities, become an affiliate member, and be nominated for possible election as a TC member.

Authors

José C.M. Bermudez (j.bermudez@ieee.org) received his B.Sc. degree in electronic engineering from the Federal University of Rio de Janeiro (UFRJ), Brazil, in 1978, his M.Sc. degree in electrical engineering from COPPE/UFRJ in 1981, and his Ph.D. degree in electrical engineering from Concordia University, Montréal, Canada, in 1985. He is a professor in the Department of Electrical Engineering, Federal University of Santa Catarina, Florianopolis, Brazil, and the Graduate Program on Electronic Engineering and Computing, Catholic

University of Pelotas, Brazil, as well as a consultant in signal processing. His current research interests include statistical signal processing, including image processing, adaptive filters, hyperspectral image processing, and machine learning. He is senior area editor of *IEEE Transactions on Signal Processing* and chair of the Signal Processing Theory and Methods Technical Committee for the IEEE Signal Processing Society.

Mónica F. Bugallo (monica.bugallo@stonybrook.edu) received her B.S., M.S., and Ph.D. degrees in computer science and engineering from the University of A Coruña, Spain. She is a professor of electrical and computer engineering and associate dean for diversity and outreach of the College of Engineering and Applied Sciences at Stony Brook University, New York. Her current research interests

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are in the field of statistical signal processing, with an emphasis on the theory of Monte Carlo methods and their application to different disciplines, including biomedicine, ecology, sensor networks, and finance. In addition, she has focused on science, technology, engineering, and mathematics education, and she has initiated several successful programs to engage students at all academic stages in the excitement of engineering and research, with a focus on underrepresented groups. She is vice chair of the IEEE Signal Processing Theory and Methods Technical Committee and has served on several technical committees of IEEE conferences and workshops. She is a Senior Member of the IEEE.

Alle-Jan van der Veen (a.j.vanderveen@tudelft.nl) received his M.Sc. degree

(cum laude) in 1989 and his Ph.D. degree (cum laude) in 1993, both from TU Delft, The Netherlands, where he is currently a full professor in signal processing. He is the recipient of the 1994 and 1997 IEEE Signal Processing Society (SPS) Young Author Paper Award. He was chair of the IEEE SPS Signal Processing for Communications Technical Committee and the IEEE SPS Signal Processing Theory and Methods Technical Committee, editor-in-chief of *IEEE Signal Processing Letters* and *IEEE Transactions on Signal Processing*, technical cochair of ICASSP 2011, and chair of the IEEE SPS Fellow Reference Committee and the IEEE Kilby Award Medal Selection Committee. Currently, he is a member of the IEEE SPS Nominations and Appointments Committee and director of publications of the European Association for Signal Processing. He is a Fellow of the IEEE.

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