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Reflections on the Poland Chapter Celebration

My end of term as IEEE Signal Processing Society (SPS) president is fast approaching. It has been an incredible experience that has provided me with so many opportunities to engage with our members around the globe, forge relationships with other IEEE Societies, and meet a diverse range of people that I hope will become active members of our Society in the future. It has been a great privilege to be at the helm of a Society that garners such a high level of worldwide respect and recognition. It has also provided me with the chance to learn, identify the challenges we still face, anticipate future challenges, and work to find solutions that will make our Society, and the world, a better place.

The SPS has a unique dual role. We strive to grow and advance technological innovation and problem-solve at the scientific level—from the bench to the applications of these technologies in the real world. We need to be mindful that our scientific pursuits don't exist in a vacuum, that they have many social, political, and ethical implications, and that their very existence is often shaped by an uneven playing field—for scientists that are isolated within their research silos or by geopolitical events, for women and ethnic minorities, for citizens of so-called low-income countries, and for young people with economic or cultural restraints.

Our Society has made many strides to level that playing field by providing many initiatives to grow and diversify our membership. I've discussed these initiatives in my past messages, and I'll detail some recent programs below, but there are still many questions that require novel solutions.

War and peace

This past September, I had the privilege of visiting Poland to commemorate the 20th anniversary of the IEEE SPS Poland Chapter. During this event, I presented the history of the SPS and its impactful role in signal processing. Additionally, I had the opportunity to learn about the journey of the Poland Chapter and its various activities. The anniversary celebration coincided with the Signal Processing Symposium (SPSympo). Since its inception in 2003, SPSympo has consistently attracted attendees from Poland and neighboring countries, particularly Ukraine. Unfortunately, due to geopolitical events, researchers from Ukraine were unable to travel abroad. It begs the question: Can we find innovative methods to help our members and nonmembers in countries in the midst of conflict, warfare, and humanitarian crises? Perhaps we could implement humanitarian programs or grants for accessing conferences via online attendance or open access to postconference transcripts and other options to help them overcome these barriers?

During discussions at the Poland Chapter meeting, some wondered why

one should join the SPS in an era with abundant freely available information, numerous platforms for sharing scientific work, and a multitude of conference options? Some argued for the significance of in-person networking and professional development, underlining the importance of providing conference discounts and travel grants. Ultimately, the paramount value that the SPS provides is the assurance of high quality—in publications, conferences, technical activities, educational offerings, and high ethical standards and guidelines.

Attracting young minds

There was also a discussion on how to engage students and young professionals in SPS initiatives. While older generations viewed Society membership as their only option to be connected with the outside scientific community, today's students may need special encouragement to become members.

The SPS is providing several events designed to spark the interest of younger generations and foster visibility and growth. Those include the Signal Processing Cup, the Video and Image Processing Cup, the 5-Minute Video Clip Contest, hackathons, and society level awards in the areas of Best PhD Dissertation Awards and Young Author Best Paper Awards and at the conference level there are and best student paper awards, all of which bring recognition to students and generate a lot of excitement. There are also opportunities

designed to empower students and enhance their professional growth. Students benefit from job opportunities through events like the Student Job Fair and Luncheon, creating a bridge between academia and industry. The low-cost membership fee of just US\$1 for IEEE Student and Graduate Student Members further opens the door to a wealth of resources. Networking takes center stage through events at SPS conferences, fostering connections with industry professionals. Additionally, students gain access to webinars, career and soft skills training, and mentorship opportunities, contributing to their holistic development. The SPS also provides travel grants to students in developing countries on a competitive basis and based on need to support to travel to ICASSP and ICIP.

Also important are the SPS Scholarship and Seasonal Schools Programs. The Scholarship Program offers financial assistance to undergraduate and graduate students who are dedicated to pursuing education and careers in signal processing. Eligibility is open to students with a minimum B grade point average (or international equivalent). Over a span of three years, recipients have the opportunity to receive a total prize of up to US\$7,000. This initiative aims to support and encourage students with a strong academic commitment to signal processing, providing a financial boost to their educational journey.

Seasonal Schools primary objectives are development of students interested in signal processing, organizing opportunities to network with professors and established practitioners, and engage in hands-on tutorials in signal processing.

The SPS Academy

Another interesting topic discussed at the Poland Chapter meeting delved into the difficult mathematical concepts that arise in signal processing and finding ways to convey them in an easily digestible form. This is indeed a very important issue, and it was the moti-

vation behind looking into expanding the educational offerings of the SPS. A couple of years ago, the SPS Education Board conceived the idea of the SPS Academy. The SPS would deliver education-oriented short courses, providing deep understanding of critical topics in the field. Unlike traditional tutorials, the SPS's education-oriented short courses delve into subjects with more depth, starting from the basics and providing a comprehensive and multisided perspective on each topic. The courses are already being offered at ICASSP and ICIP and have proved very popular. They consist of parallel tracks of 10-h sessions conducted in three segments, offering participants an immersive learning experience. Upon successful completion of the course and quiz, participants are awarded professional development hours and continuing education unit certificates, recognizing their commitment to continuous learning and growth in their respective fields. The SPS Education Board is taking additional steps to make available those short courses to wider audiences, and it is working with a professional company to enhance these educational courses. The Society also offers free access to the SPS Resource Center for SPS members; this is an online library of tutorials, lectures, presentations, and more, and it spans the breadth of signal processing field.

The gender gap

The low numbers of women among students and faculty at the Poland Signal Processing Conference SPSympo was quite evident, as was the feeling of isolation and hopelessness among the women attendees. In speaking with women faculty and students, there was a consensus that women shoulder more caregiving responsibilities than their male counterparts, impacting their career choices. It came as a shock to me when I asked a bright young graduate student in Signal Processing if she was interested in an academic position after graduation, and she answered that women are too emotional and cannot pursue high-responsi-

bility careers. When I asked her if she really believed such a bias, she said she did not, but the society does, and who was she to go against the society? The student was not aware of the SPS initiatives that disavow such perceptions, and I spoke to her about our efforts to reach out to women students, with several empowering opportunities.

That conversation was a stark reminder that SPS still has a long way to go in our continuing efforts to foster diversity and inclusivity. I am now more confident than ever that our initiatives are addressing critical problems. Women in Signal Processing (WISP) provides mentoring opportunities and networking events, where women from around the world can share experiences and strategies in balancing family and career.

As in Poland, the presence of women and minorities on the faculties of universities around the world is very small, and this deprives students of diverse role models and also limits the diversity of perspectives in academic research. Role models play a crucial role in inspiring students, instilling confidence in their abilities, and demonstrating the potential for success in their chosen fields. The SPS Promoting Diversity in Signal Processing (PROGRESS) Workshop recognizes the significance of diverse representation and seeks to bridge this gap through its empowering initiatives. Since its inception in 2020, the PROGRESS Workshop has gained substantial momentum. It is now part of ICASSP and ICIP conferences. The seventh PROGRESS Workshop took place at ICIP 2023 in Kuala Lumpur, Malaysia, and was successfully led by Dr. Zaid Omar, of the Universiti Teknologi Malaysia.

The PROGRESS Workshop offers an online participation option, recognizing that travel expenses may pose economic challenges for some students. The SPS provides financial support to students who choose to attend in person. For instance, at the 2023 PROGRESS meeting during ICASSP, the SPS granted eight travel awards of US\$1,000 each on a reimbursement basis. Similarly, the 2023 PROGRESS at ICIP offered 20 travel grants of US\$500

each. These funds do not mandate SPS membership in an effort to reach out to students who do not traditionally attend SPS conferences.

Other diversity and inclusion initiatives include the Mentoring Experiences for Underrepresented Young Researchers Program (ME-UYR) [1] and K-12 Outreach Initiatives [2]. ME-UYR provides mentoring experiences in the form of a nine-month collaboration for young researchers from underrepresented groups together with an established researcher in signal processing from a different institute, and typically another country.

The K-12 Outreach Initiatives Program strives to increase the visibility of SPS and the signal processing discipline to K-12 students worldwide by developing exciting, impactful educational programs that utilize tools and applications with hands-on signal processing experiences. The program is intended to bring the awareness of signal processing to students who belong to groups that are underrepresented in STEM fields regionally and/or globally.

Inter-Society initiatives

The world is facing complex problems whose solutions require cross-disciplinary approaches, and strengthening inter-Society initiatives is another key goal of the SPS. During SPSympo, I had the opportunity to meet with Mark Davis, the president of the IEEE Aerospace and Electronic Systems Society (AESS) who was also in attendance. We both delivered plenary talks on the topic of integrated sensing and communication (ISAC) systems. We had the opportunity to discuss the need to enhance and integrate opportunities for inter-Society engagement.

ISAC is a naturally cross-disciplinary topic, encompassing technologies that combine sensing and communication systems to utilize wireless resources efficiently, realize wide area environment sensing, and even pursue mutual benefits. Realizing the great potential for research developments and standardization opportunities, the ISAC Technical Working Group (TWG) has been established to bring together academic and industrial researchers in the SPS and related

Societies to educate members and jointly address technical challenges.

The SPS is forging strategic partnerships among multiple IEEE Societies in the ISAC area. Initial activities include the first 2023 Summer School on ISAC, sponsored jointly by the SPS, the AESS, and the European Association for Signal Processing, which took place in June 2023, in Baiona, Spain. The event was led by Nuria Gonzalez Prelcic, of North Carolina State University, and attracted 50 students, and was also supported by Qualcomm, Remcom, and Gradient. Another was the 2023 SPS–IEEE Communications Society (ComSoc) Summer School on ISAC, which was held in Shenzhen, China, and led by the SPS ISAC TWG in cooperation with the ComSoc. This was organized by Tsung-Hui Chang, Feng Yin, and Jie Xu, from the Chinese University of Hong Kong–Shenzhen; Fan Liu, from the Southern University of Science and Technology; and Xiao Han, from Huawei Technologies. The event attracted 180 students and researchers from mainland China, while the online streaming of the event reached 10,000 viewers.

Another area that cuts across multiple areas is brain research. SPS is one of four core member societies of IEEE Brain Technical Community (TC), which is an IEEE-wide effort that unites engineering and computing expertise across IEEE Societies and Councils relevant to neuroscience. IEEE Brain facilitates cross-disciplinary collaboration and coordination to advance research, standardization, and development of engineering and technology to improve understanding of the brain in order to treat diseases and improve the human condition. As core member, the SPS is responsible for chairing the TC along with other core members, and this year Tulay Adali, former SPS Technical Activities Vice President, is the chair.

This year, at ICASSP, a satellite workshop was organized on the topic of Unravelling the Brain, which was very well attended and introduced new blood in the area to ICASSP.

The SPS partnered with IEEE EMBS to offer the 2023 IEEE EMBS-SPS ISBI

Summer School on Biomedical Imaging, which covered applications of deep learning and AI in medical imaging. This event was organized by Jean-Christophe Olivio-Marin, Elsa Angelini, and Arrate Munoz Barrutia in Cartagena, Colombia, this past April.

In Poland, I also participated on a panel discussion, which posed another interesting question related to the contrast of model-based signal processing to data-driven machine learning (ML), which seems to be in the center of discussions in signal processing events. Despite ML's success in various applications, it falls short in offering performance guarantees and lacks transparency in revealing how solutions are derived. This limitation has hindered its application in several key areas, including medical diagnosis. Research showcased in SPS venues concentrates on leveraging models and domain knowledge to design ML algorithms that are both reliable and explainable. Thus, greater synergies between SPS and EMBS has the potential to unlock more dependable applications of ML and AI in the field of medicine.

Developing novel technologies: Synthetic apertures

Diversity is also key to scientific innovation and progress, and our Society is continually forging expertise in various new and evolving technological fields. On that note, I would like to share my excitement about the developments in synthetic apertures (SAs) led by the SA TWG, establishing the SPS as the pole of attraction of research in the critical SA area. SAs work by moving an antenna along a predetermined path via mechanical means. As the antenna moves, it measures the strength and direction of signals. This information helps reconstruct various properties of the scattered electromagnetic waves, like power, arrival directions, delays, and polarization. SAs can measure signals over a very wide frequency bandwidth and with an almost arbitrarily large aperture size, enabling high angular and delay resolution to resolve closely spaced scatterers. Further, SAs are



SPS President Athina Petropulu joining the Poland SPS Chapter chair, Konrad Jędrzejewski, past chair Piotr Augustyniak, IEEE AEES President Mark E. Davis, and other Chapter members in marking the 20th Anniversary of the Poland SPS Chapter.

cost-effective compared to digital multi-channel phased arrays while delivering comparable estimation performance. The two-pronged goal of the SA TWG is to support theoretical and empirical techniques that underpin the estimation of parameters of propagating waves through various media using SAs and also identify novel applications for SAs that are enabled by the precise measurement and estimation of environmental parameters. The SA TWG, under the leadership of Dr. Peter Vouras, is working on developing IEEE standards on SAs, establishing a shared repository for data and algorithms, delivering webinars on the topic, organizing special issues in journals, and providing challenges and competitions that promote the adoption of SAs in engineering school curricula as well as job training for graduating students.

In an exciting development this year, the SA TWG, working with the IEEE Synthetic Aperture Standards Committee, will offer the inaugural NIST-IEEE Conference on Computational Imaging Using Synthetic Apertures. The conference will be held 20–23 May 2024, at the scenic campus of the National Institute of Standards and Technology, in Boulder, CO, USA.

Ethical standards

In my tenure as the SPS president, it has been amazing to experience firsthand that people around the world have such high levels of respect and recognition

for the SPS. Going forward, we need to make extra efforts to safeguard that quality and the climate that holds the SPS to such high standards.

Alongside the need to continually grow inclusivity, diversity, and interconnectedness in our membership and in our scientific pursuits, we must continually adapt and promote high ethical standards and guidelines with both our technological innovations and within the SPS leadership.

As innovation advances at an exponential rate, ethical concerns surrounding current and emerging technologies grow proportionally. It is crucial to confront the impact of technology on privacy, security, and the environment. The urgency to cultivate researchers and engineers with strong ethical foundations has never been greater; they may serve as a crucial line of defense in navigating these complex challenges.

Another challenge involves leadership. In an effort to energize the members, our Society has embraced a member-driven election for the president-elect. Yet the strength and agility of this approach requires a continued effort to increase membership diversity by growing our global appeal. We should also put policies into place to safeguard the election process and help prevent negative electioneering campaigns that increase internal divisiveness. If unchecked, electioneering can lead to the same behaviors observed in the political climate of the

United States and some other countries, which features negative ads and disinformation.

Despite the many challenges, SPS membership growth has been strong throughout 2023. In October 2023, the membership of SPS soared past our goal of 20,000, reaching the highest point in SPS history. This underscores the enduring relevance and value that SPS has to offer.

With my term as SPS president concluding this year, I'm optimistic that the SPS will strive to turn challenges into opportunities, so that we can grow and diversify our membership, and provide even more value to our members and our communities.

Acknowledgment

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