Final Report on the Second Women's Workshop on Communications and Signal Processing

Shalinee Kishore, Sarah Kate Wilson, Octavia Dobre, Zahra Ahmadian, Kelly Andronicos, Arsenia Chorti, Ubli Mitra, Leslie Rusch, and Laura Toni

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1 Introduction

The goal of the **Second Women's Workshop on Communication and Signal Processing** [4] was to provide *a technical, research-focused event* that enables mentoring and networking opportunities for junior women researchers in the disciplines of communication, signal processing, and information theory. More broadly, the workshop aims to help diversify the communications, signal processing, and information theory research communities. The workshop was held July 16-18, 2014 at Princeton University. The following document overviews the workshop structure, program, participants, and feedback. Our aim is to use the outcomes of this workshop to help shape the next Women's Workshop on Communications and Signal Processing that will be held in 2016.

2 Workshop Motivation and Structure

The significant disparity between the number of men and women in the Electrical Engineering has been long-standing [1, 2]. The subfields of Communications and Signal Processing are no exception, where women currently make up roughly 7.3% and 6.6% of the total membership, respectively, within their associated IEEE societies. Not surprisingly, this underrepresentation perpetuates at all levels but is more severe at higher ranks and in leadership positions. For example, there are very few women in tenured or full professor ranks [3]; only about 3-4% of the fellows in the IEEE Communications Society are women. At the same time, there has been an increase in the percentage of women members over the past decade and that is greatly due to more women members joining at the junior levels. Given this status quo, it is clear that the communications and signal processing research areas will see more successful women at senior levels in the future by successfully mentoring and integrating incoming junior researchers into the broader community.

While a variety of recruitment and retention approaches can be taken to improve overall participation of women in these research disciplines, targeted mentoring and networking can be particularly impactful in increasing the number of women in leadership positions. The small but very active and successful cohort of senior women can serve as excellent technical and professional mentors and make a difference in a budding career. While technical conferences and workshops can serve as venues for such senior women to interact with junior women, the resulting mentoring can be at best rushed and *ad hoc*. A more meaningful engagement would require more time and focus towards the goals of mentoring and networking that fosters early careers towards leadership roles; such engagements can then be further nurtured into long term mentoring relationships. The goal of the Second Women's Workshop on Communications and Signal Processing was to enable exactly such interactions by bringing together senior and junior women researchers in a close, friendly environment. We also wanted to prioritize technical contributions of women in communications and signal processing. Technical presentations were therefore a key part of the workshop for several reasons:

- The participants are foremost technical people.
- We want to emphasize that women can be successful technical contributors.
- We want a forum where women, both junior and senior, can find new avenues for research and collaboration.

The main objective of the Second Women's Workshop on Communications and Signal Processing is to boost the involvement of women within these societies by creating and strengthening networking between researchers. Our concrete long-term goal for the outcomes of this workshop are an increase in: 1) the number of women members in our research fields; and 2) the involvement of junior and senior attendees in leadership roles within IEEE societies, e.g., within Board of Governors, research and steering committees, journal editorial boards, conference organization teams, IEEE Fellows, and IEEE Distinguished Lecturers.

To reach this goal, the workshop brought together junior and senior women researchers to present and discuss recent developments in their discipline. The format of the workshop will facilitate in-depth technical discussions regarding current and future research efforts but also life aspect conversations to facilitate professional and career development. Thus, the structure for the workshop included technical talks that were given by the senior women attendees and poster presentations that were given by junior women attendees. We also allowed for breakout sessions based on research themes that allowed participants to connect and discuss collaborative opportunities within and across themes. Several of the presentations and poster sessions were cross-disciplinary in nature, which supports earlier findings that women are more likely to engage in cross-disciplinary research [5]. This also points to the benefits of cross-disciplinary workshops such as this to foster both technical and mentorship discussions amongst women researchers. For example, cutting edge research results were presented from a variety of areas including wireless communications, smart grids, video compression, information theory, visible light communications, data storage, applications of signal processing to marine life, structural engineering, astronomy, and several others.

Besides the technical sessions, we included social components to the agenda so that both formal and informal mentoring and networking can be facilitated between the junior and senior attendees. One discussion focused on educating junior attendees about role of women in STEM and IEEE Communication Society and was delivered by Prof. Sirin Tekinay. Another was a panel discussion tentatively titled "Where do I go from here?" This discussion was driven by junior attendees to address their questions regarding career development both in industry and academia. We hosted another panel discussion titled "What to expect," which was driven by senior attendees and comprised advice from senior attendees regarding how to develop a long, successful career in communication engineering and signal processing. This panel's aim was to provide guidance to junior attendees but also enabled mentoring of those senior attendees who are recently tenured and looking for guidance in shaping the next phase of their careers, e.g., advice on promotion to full professor, balancing service work, serving in major administrative positions, etc. The panel was driven by Prof. Pamela Cosman, who kicked off the discussion with a presentation on her personal advice on work-life balance. Through these discussions, as well as more informal engagements during the workshop, junior participants were able to share questions, comments, or results in a more relaxed fashion than they would in a mixed-gender workshop.

There have been many workshops devoted to women in engineering, but they have mainly focused on the mechanics of being a women in engineering. For example, they concentrate on gender differences, how women can advance, work-life balance, children, etc. The organization Networking Networking Women (N2Women) [6] has hosted such workshops targeting women working on communication networks and networking theory, who come from primarily a computer science background. They also have a workshop that is technical in nature and co-located with an existing IEEE/ACM conference, InfoCom. Our goal was also a technical workshop but one where women could bond outside the technical discussions. As such, we targeted a stand-alone workshop.

We note that the Second Women's Workshop on Communications and Signal Processing will build on the successes and lessons-learned from the first workshop [7, 8]. Similarly, we hope that the next workshop will use the findings from this event to improve in its ability to reach out to the broader community of researchers in the areas of communication, signal processing, and information theory.

3 Workshop Sponsorship

The Second Women's Workshop was held at Princeton University with the generous support of Princeton's School of Engineering and Applied Sciences. Travel grants were awarded to each junior attendee, which were

provided by IEEE Communication Society, Center for Discrete Mathematics and Theoretical Computer Science (DIMACS), Center for Science of Information (CSoI), IEEE Information Theory Society, and Princeton University's School of Engineering and Applied Sciences.

4 Workshop Program

The full workshop program is provided in the Table below. The majority of the workshop's sessions focused on technical presentations and posters. The junior attendees were based their application, which will be comprised of a 2 page abstract describing their poster, their CV, and the names of two references. We dedicated two sessions to the work of junior researchers and we would like to increase the number of talks from experienced researchers. There were three sessions in which the senior researchers gave technical presentations. Additionally, we held two breakout sessions so that participants could brainstorm possible collaborations.

We also included some key mentoring aspects to the workshop. Through special sessions on life-aspect issues and bonding events (like group hikes), we hoped to provide plenty of opportunities for attendees to connect outside of technical sessions. Additionally, we held two panels for the purpose of mentoring junior attendees. Such events provided the young researchers with opportunities to address practical, career-development questions and for senior researchers to introduce the younger women to advancement and leadership opportunities in the research community. In particular, younger researchers are usually unaware of the breadth of roles that a researcher may take within the IEEE Communication and Signal Processing Societies; the importance of participating in steering committee meetings during conferences; or at times, even details regarding publishing in top-quality journals are not clear. Thus, the friendly workshop environment should be exploited to address such questions and doubts which do not usually find answers during other major conferences or traditional workshops.

Additionally, we were fortunate to have Elena Neira who is the Vice-Chair of Marketing and Industry Relations in IEEE ComSoc. She along with Ting Qian, from IEEE ComSoc, gave a presentation to the both senior and junior participants on how the assembled researchers could employ social media tools to become leaders and influencers in the broader communities. Social media can play a key role in propelling a junior researcher's research career and can help an established researcher have a greater audience.

The workshop events was held primarily at Princeton University's Friend Center, where we had access to a large lecture hall, a large meeting room, and two smaller meeting rooms for breakout sessions. Accommodations for attendees was provided on campus at Scully Hall. A workshop registration fee was charged to each participant of 150 U.S. Dollars. This helped offset the cost of lodging and meals. All meals were catered by Princeton University's catering service. A banquet dinner was held on July 16 and a group hike was conducted around Lake Carnegie which is part of the university campus. In addition, we worked with Princeton University to avail childcare for workshop attendees with such needs; in the end, no attendee request childcare.

5 Workshop Participants

In total 19 junior participants, 14 senior participants, and 2 ComSoc staff attended the workshop. Both the junior and senior attendees came from diverse backgrounds within the disciplines of communication, signal processing, and information theory. In contrast to the First Women's Workshop on Communication and Signal Processing, where most of the senior attendees were academics, four of the senior women this time around came from industry. This is to particularly address the questions and concerns of graduate student participants who are interested in understanding a broader range of future career opportunities. We sought out leading, internationally-renowned senior researchers to engage and motivate young researchers and provide them with a living, breathing examples of successful futures. These speakers were drawn primarily from a new pool compared to the previous workshop; new speakers will help bring more word of mouth advertising and help expand participation. And just as last time, we focused on drawing talented young researchers, ranging from senior Ph.D. students to early pre-tenure faculty. The junior attendees were comprised of 13 graduate students, 4 postdocs, and 2 pre-tenure Assistant Professors. In the end, this workshop had roughly 25% more attendees compared

Date	Time	Event
July 15, 2014	12pm-5pm	Check-in
	6pm-8pm	Pizza Dinner and "Where do I go from here?" Panel
July 16, 2014	9am-12pm	Welcome and Invited Talks by Senior Attendees, Session 1
	12pm-2pm	Lunch
	2pm-4pm	Poster Session 1
	4pm-5pm	Breakout Session 1
	6pm-7pm	Group Hike, Lake Carnegie
	7pm-9pm	Dinner
July 17, 2014	9am-11am	Poster Session 2
	11am-12pm	IEEE Society Functions, Opportunities, and Leadership Roles
	12pm-1:30pm	Lunch and "What to expect" Panel
	1:30pm-2pm	Social Media Presentation
	2pm-5pm	Invited Talks by Senior Attendees, Session 2
	5pm-6pm	Breakout Session 2
	7pm-9pm	Banquet Dinner
July 18, 2014	9am-12pm	Invited Talks Session 3
	12pm-2pm	Lunch and Breakout Session 3
	2pm-3pm	Feedback Discussion & Wrap-Up

Table 1: Workshop Schedule

to last time. The names, affiliations, and presentation titles of the senior attendees is summarized in Table 2, while Table 3 summarizes the names, affiliations, and poster titles of the junior participants.

Name (Affiliation)	Presentation Title
Emina Soljanin (Bell Labs)	A Coding Tale of a Tail at Scale
Maite Brandt-Pearce (U. of Virginia)	Wireless Connectivity through Lighting: Techniques and Applications of Visible Light Communications
Brenda Connor (Ericsson)	Research Update from Ericsson
Sirin Tekinay (Kadir Has U.)	Women in Communications Engineering - an International Perspective, and the Role of IEEE
Eve Riskin (U. of Washington)	Compression of ASL Video: A Human-Centered Approach
Daniela Tuninetti (U. of Illinois-Chicago)	Information Theoretic Limits of Cooperative Interference Networks
Antonia Tulino (Bell Labs)	Beyond IID Gaussian Matrices in Compressed Sensing
Tara Javidi (UCSD)	Information Acquisition in Face of Partial Observations and Acquisition Costs
Elena Neira (Verizon Wireless)	Social Media Presentation
Anna Scaglione (UC-Davis)	A Decision Model Based on Encoding Load Flexibility for Demand Response
Pamela Cosman (UCSD)	Unequal Error Protection for Transmission of 3D Video
Sarah Kate Wilson (Santa Clara U.)	The Beacon Comes of Age: Intensity-Modulated Optical Wireless Communications
Octavia Dobre (Memorial U.)	Blind Signal Identification for Emerging Intelligent Radio Systems
Shalinee Kishore (Lehigh U.)	Did not present, Lead Organizer

Table 2: Senior Attendees

6 Best Poster Award

Thanks to support from IEEE ComSoc Member Relations, the IEEE ComSoc Women in Communication Engineering (WICE) Committee was able to provide $500 towards a Best Poster Award for the workshop. Using the abstracts that were originally submitted by the junior attendees, the workshop organization committee identified five finalists for this award. An Awards Committee, comprised of three senior attendees, assessed these five posters during the workshop and chose Laura Vertatschitsch's poster titled "Digital Signal Processing for Event

Name (Affiliation)	Poster Title
Qi Wang (U. of Delaware)	Single-User Versus Multi-User for Downlink MIMO in LTE-A
Hanan Al-Tou (U. of UAE)	A Low Complexity Algorithm for Selective DF-OFDM System
O.J. Femi-Jemilohun (U. of Essex)	Feasibility Study of 24 GHz Gigabit Indoor WLAN Links
Basak Guler (Penn State)	Communicating with Semantic Sources
Anu Merican (Arizona State)	Long-Range Passive Optical Networks and Hybrid PON Access Networks
Beatrice Tomasic (Woods Hole)	Energy-Efficient Transmissions for Delay Constrained Wireless Communications
Pirathayini Srikantha (U. of Toronto)	Power Dispatch in Distributed Generation Systems via Bifurcation Control
Nicole Nichols (U. of Washington)	Weakly Supervised Click Models for Odontocete Species Classification
Liang Zheng (Princeton)	Smart Spectrum Access Algorithms in Mobile TV White Space Networks
Hina Tabassum (U. of Manitoba)	On the Performance of Channel-Allocation Aware User Association in Cellular Networks
Gireeja Ranade (UC-Berkeley)	Information Flows in Universal Control Systems
Mai Vu (Tufts University)	Uplink M2M Cooperation for Cellular Communications
My Chinh (Blekinge Institute of Tech.)	Hybrid Interweave-Underlay Spectrum Access for Cognitive Radio Networks
Mahi Abdelbar (Virginia Tech)	Cooperative Classification of Wireless Signals in Future Wireless Cognitive Networks
Laura Vertatschitsch (Harvard)	Digital Signal Processing for Event Horizon Telescope
Parastoo Qarabaqi (UCSD)	Underwater Acoustic Channel Modeling and Simulation
Nasim Arianpoo (U. of BC)	A Distributed Learning Mechanism to Improve TCP Fairness in Wi-Multi-Hop Nets
Ruigen Yao (Lehigh)	Strain and Acceleration Data Fusion for Damage Diagnosis in Truss Bridge
Ilknur Aydin (Farmingdale State)	Alternative ACK Policy for SCTP-Based Concurrent Multipath Transfer for Wi-Nets

Table 3: Junior Attendees

Horizon Telescope" as the winner for this first WICE Best Poster Award. Our plan is continue with this award in future workshops.

7 Feedback and Outcomes of Workshop

On the last afternoon of the workshop, junior and senior attendees filled out feedback forms to provide guidance for organizers of future workshops in this series. Two separate feedback forms were provided, one for junior and one for senior attendees. There was a lot of positive feedback regarding the event; these comments included:

- "Great atmosphere. I really enjoyed meeting people from different research backgrounds and appreciated the technical focus of the presentations."
- "A great opportunity to meet with other junior and professors, who are inspiring examples of ways of being women in engineering."
- "Excellent all around - powerful messages, good technical program. Thank you for providing this wonderful venue."
- "Workshop has a very warm environment."
- "Netowrking with other junior and senior women was fun, inspiring, and beneficial"

The event also provided several "lessons learned," which we plan to integrate into the next such workshop. Broadly speaking, the suggestions for future workshops were to

- Draw from a larger and more diverse talent pool;
- Use more outlets to advertise the event;
- Increase the number of junior attendees while ensuring a small, warm environment;
- Include additional sessions on practical concerns, such as negotiation, time management, job hunt, etc.; and
- Hold the workshop in geographically diverse settings to facilitate travel and participation.

Figure 1: Group photo from the Women's Workshop

8 Workshop Funding

The Second Women's Workshop will be hosted at Princeton University, whose School of Engineering and Applied Science has generously donated conference meeting space, administrative support, reduced-rate accommodations, and funds for travel grants to support the event. Through a fund raising effort over the past six months, we secured funding from a number of additional sources, all of which will also be used towards travel grants for attendees. A full list of contributors and their committed funds for travel grants are provided in Table 4.

Source	Funds for Travel Grants
Princeton University College of Engineering and Applied Science	$7,500
IEEE Communication Society (for travel grants)	$5,000
IEEE Communication Society (for Best Poster Award)	$500
Center for Discrete Mathematics and Theoretical Computer Science (DIMACS)	$5,000
Center for Science of Information (CSoI)	$2,500
IEEE Information Theory Society	$500
Total Funds for Travel Grants	**$21,000**

Table 4: Funds Secured for Workshop

9 Plans for Future Workshops

Lessons learned from the First Women's Workshop has helped strengthen our plans for the Second Workshop held this July. Similarly, we plan to use feedback collected from the Second Women's Workshop to help refine and develop future workshops. To keep with the spirit of inclusion and broader diversity, we will continue to improve our outreach and advertising efforts for future workshops. Additionally, we will most likely seek an international (Europe, Asia, or Middle East) locale for the next event.

For this workshop, we sought to obtain funds for travel grants from a variety of sources, including industry but discovered starting fund raising six months prior was perhaps too late. Based on this lesson, our focus

for the 2016 Women's Workshop (as well as future workshops) will be a more prolonged and strategic effort towards securing funds for travel grants. The IEEE Communications Society Women in Communication Engineering (WICE) Committee will play a key role in this funding raising effort. To improve our successes, WICE could partner with sister organizations like Women in the Information Theory Society (WITHITS) [9] and N2Women [6], and nurture industrial connections to secure corporate sponsorship of the event. Based on feedback we received from senior attendees, we could also try to get each senior attendee to try to reach out to at least one funding source (government or industry) to seek funding for travel grants for junior attendees. We could also ask Deans of various Engineering Schools to provide funds for their graduate students, postdocs, and pre-tenure faculty to attend. in the long term, we hope that as the strong reputation of the workshop spreads and that by keeping the workshop focus as primarily technical, we will be able to attract attendees to future workshops who are supported by travel grants from their institutions and research projects. In such cases, the amount of funds we require for travel grants could be reduced and brought to a sustainable level.

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