2019 IEEE SPS/EURASIP/ISIF SUMMER SCHOOL ON SIGNAL PROCESSING (S3P-2019), SEPTEMBER 8–13, 2019, ARENZANO, ITALY

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The 2019 Institute of Electrical and Electronics Engineers (IEEE) Signal Processing Society (SPS)/European Association for Signal Processing (EURASIP)/ International Society of Information Fusion (ISIF) Summer School on Signal Processing (S3P-2019)/Signal Processing for Autonomous Systems (SP-AS) was the seventh edition of the event, technically cosponsored by the IEEE SPS via the Seasonal Schools in Signal Processing (S3P) initiative and by the SPS Italy Chapter. This Summer School was also the first Summer School related to the IEEE SPS Autonomous Systems Initiative (ASI). The ASI initiative is a volunteer activity of several members of the IEEE SPS who are trying to highlight the signal processing related aspects of autonomous systems. The school took place in Arenzano, Genoa, Italy, from September 8–13, 2019 and involved almost 40 students and 10 lecturers on topics related to signal processing and information fusion for autonomous systems. Several initiatives such as panel discussions, the best poster and demo award, and industrial days were organized to maximize the participation of students, and they have been extremely satisfied with the experience.

The Summer School SP-AS focused on providing an updated state-of-the-art of the most advanced signal processing and information fusion theories and techniques that are relevant for developing autonomous systems. Lectures focused on novel algorithms and technologies but also on in-depth reviewing of state-of-the-art for autonomous systems. Summer school participants had the opportunity to learn and study innovative algorithms and systems for artificial interaction and cognition, to apply these concepts for building real working autonomous systems components, and to cooperate with other students for designing self-aware related modules.

KEY ORGANIZERS

The Summer School on autonomous systems was directed by Carlo Regazzoni, Full Professor, Senior Member IEEE and Lucio Marcenaro, Assistant Professor, Member IEEE.

The school was held under the framework of the IEEE SPS Italy Chapter. The Summer School was cosponsored by the EURASIP and the ISIF. The school was also supported by the Italian Group for Telecommunication and Information Technology (GTTI).

The Summer School Steering Board was composed of the following professors:

- Prof. Stefano Tubaro, Politecnico di Milano
- Prof. Mauro Barni, Università degli Studi di Siena
- Prof. Francesco G. B. De Natale, Università degli Studi di Trento
- Prof. Alessandro Piva, Università degli Studi di Firenze
- Prof. Giovanni Poggi, Università degli Studi di Napoli Federico II
- Prof. Riccardo Leonardi, Università degli Studi Brescia

THE VENUE

The program was held at a hotel in Arenzano Punta San Martino, located in a quiet and privileged position overlooking the sea, with beautiful views over the Gulf of Genoa and the Ligurian Riviera di Ponente in Italy.

ACTIVITIES AND LECTURES

The Summer School proposed different types of lectures: standard lectures introduced novel signal processing and information fusion algorithms and techniques as enablers for autonomous systems; application lectures presented state-of-the-art self-aware autonomous systems, describing how their concepts can be applied in real scenarios.

Several events were organized for deep involvement of the students in the Summer School activities such as: a full day dedicated to the presentation and exhibition of students' research activities and a best poster and demo award, two panel sessions directly involving lecturers and students with discussions about signal processing for autonomous systems, a full industrial day, with presentations from company representatives, and social events when participants visited Genoa's historical city center and the aquarium.

PROGRAM

On Monday, September 9, the first lecture of the Summer School was given by Prof. Walter Kellermann about "Audio Processing for Autonomous Systems". Walter Kellermann has been Professor of Communications at the University of Erlangen-Nuremberg, Germany since 1999.

In the afternoon of the first day, Prof. Ioannis Pitas from the Department of Informatics of the University of Thessaloniki, gave a lecture titled "Deep Learning for Multiple Drone Vision Systems".

On September 10, Prof. Karl Friston discussed "Bayesian Mechanics and the Free Energy Principle". Karl Friston (Scientific Director of the Wellcome Trust Centre for Neuroimaging at the Institute of Neurology, University College London)

The view from the hotel Punta San Martino in Arenzano, Genoa.

is a theoretical neuroscientist and authority on brain imaging. He invented statistical parametric mapping (SPM), voxel-based morphometry (VBM), and dynamic causal modelling (DCM). On the same day, Letizia Marchegiani from Aalborg University gave a lecture about "Sound as an Exteroceptive and Proprioceptive Sensing Modality for Autonomous Driving". A panel discussion about "Representation and Inference in Cognitive Systems: Human and Artificial Autonomous Agents" concluded the second day of the School.

Wednesday, September 11 was the SPS Italy Chapter day and highlighted the IEEE Distinguished Lecturer Prof. Anna Scaglione, a Professor at Ira A. Fulton Schools of Engineering, School of Electrical Computer and Energy Engineering, Arizona State University, Tempe, Arizona (USA). Her lecture was titled "Distributed Learning and Signal Processing Algorithms" and discussed how artificial intelligence today is about developing the capability of a single node to make an inference or to respond to its surroundings with the appropriate action.

On the same day, a poster and demo session was organized in which all the participating students were given the opportunity to present their research. After the evaluation phase, Ali Krayani (University of Genoa), Sara Baldoni (Roma Tre University), and Mohamad Baydoun (University of Genoa) received the third, second, and first prizes, respectively. The first prize of 500€ was fully sponsored by the International Society of Information Fusion. On Wednesday afternoon, the social event was organized, with a guided tour of the aquarium in Genoa and the social dinner at Grand Hotel Savoia.

Prof. K. Friston lecture on "Bayesian Mechanics and the Free Energy Principle".

Thursday, September 12 was the industrial day: three researchers from industry described their research experiences in the autonomous systems field. Gian Luca Mariottini, Principal Member at Draper Laboratories, Cambridge, Massachusetts (USA) gave a lecture titled "Assistive Autonomy". Stefano Coraluppi, Chief Scientist at Systems & Technology Research (STR), Woburn, Massachusetts (USA) discussed "Advances in Multi-Target Tracking". Finally, Alfonso Farina, a consultant from Italy, described "40 years of Cooperation Between Industry and Academia on Radar Tracking Systems".

On the morning of Friday, September 13, there were two "application lectures" by Antoine Deleforge, Research Scientist at Inria Nancy, France and David Martín Gómez, Universidad Carlos III de Madrid, Spain. The titles of the two lectures were "Taking the Best of Physics and Machine Learning in Robot Audition" and "Intelligent Transportation Systems: From Environment Understanding to Autonomous Vehicles", respectively.

IMPACT AND FEEDBACK FROM PARTICIPANTS

The students who attended the Summer School developed the capability to evaluate, understand, design, and develop technologies for self-aware autonomous systems. They were trained in the design and implementation of autonomous systems where users are usually involved in everyday tasks. As in the previous editions of the School, students were informed at the beginning of the event about the initiatives of the IEEE SPS Italy Chapter, IEEE SPS, EURASIP, and ISIF, and how to be active members in these associations. The fees of the school provided significant advantages for SPS, EURASIP, and ISIF registered students and nonstudents. Moreover, IEEE-SPS Italy Chapter Best poster and demo award was granted to the top student presenting research so as to enhance their feeling of being an active part of the Society. All lectures have been recorded and made available on the web.

Feedback from the 38 participants was, in general, extremely positive. The overall satisfaction for the Summer School was 3.5/4, and 93% of the attendees will be interested in attending a follow-up Summer School next year on a related topic. Free comments from the participants were grouped into strengths, weaknesses, and suggestions. In general, comments about the overall organization and venue were very positive. Most of the weaknesses and suggestions were related to the poster and demo session (too short and practically impossible for students to see other participants' contributions) and panel sessions (should have been organized in a more interactive way). For the future editions of the school, a few more "hands-on" activities should be considered as well, to give participants the opportunity to try experimentally the illustrated theoretical approaches.