CASPR Summer School on Signal Processing for Hearing Assistive Devices

Aalborg University, Fredrik Bajers Vej 7B, 9220 Aalborg, Denmark **17.05.2021 – 21.05.2021**

Building on the success of our previous Centre for Acoustic Signal Processing (CASPR) Winter School in 2017, we are happy to announce that there will be a CASPR Summer School on Signal Processing for Hearing Assistive Devices in May 2021. The Summer School is open for PhDs, Postdocs, and Industry, and it will be held *physically* at Aalborg University (it will not be possible to participate online). The Summer School will be given following the guidelines of the Danish Health Authorities on the COVID-19.

Description:
Hearing assistive devices (HADs) are ubiquitous. They include, for example, devices such as headsets for speech communication in noisy environments (air plane crews, emergency/rescue teams, combat soldiers, police forces, etc.), headsets for office use, gaming, etc., and hearing care systems, e.g. hearing aids and cochlear implants.

The course consists of lectures and hands-on exercises, which allow the course participants to understand in-depth the technical problems related to HADs and their potential solutions. The course is multi-disciplinary, with a focus on application of theoretical results to real-world problems, and practical do's and don'ts.

The course has three main parts. The first part is a short introductory part, which lays the foundation for the rest of the course, covering fundamental topics such as auditory perception (normal and impaired hearing) and a discussion of the basic principles of HADs. The second part provides an overview of fundamental signal processing problems encountered in HADs, and an in-depth treatment of state-of-the-art solutions. These include methods for beamforming and noise reduction, direction-of-arrival estimation, voice activity detection, feedback control, hearing loss compensation, etc. Furthermore, an overview is given of methodologies for evaluating HADs with a particular focus on methods for intelligibility assessment and estimation. The third part of the course presents emerging technologies for hearing assistive devices, including techniques for processing of speech in noise, audio-visual signal processing, intelligibility prediction, EEG-based techniques, methods for assessing listening effort, and novel methods for a more personalized hearing aid prescription. While the course focuses on HAD applications, many of the discussed techniques are general and find use in the much broader field of general sound processing.

The course also bridges the gap between theoretical background and practical/robust application. The course is a one-week concentrated course to be held during the Summer 2021. The course involves course preparation (approximately 1 ECTS), course presence (1 ECTS), assignment finalization and hand-in (1 ECTS)

Prerequisites: Basic knowledge of statistical signal processing, stochastic processes, and linear algebra. Familiarity/handy with Matlab/Python. The course assignment / hands-on exercise will be given in Matlab.

Important: Due to the covid-19 situation, we restrict the number of participants to at most 30. Only if the covid-19 situation prevents the CASPR Summer School from being held physically, an online version will be established. A hybrid (part of the audience physically present and part of the audience online) will NOT be offered.

Preliminary program (subject to change):

	Mon 17/5	Tue 18/5	Wed 19/5	Thu 20/5	Fri 21/5
8:30	Registration				
9:00	Welcome and Intro: Hearing Assistive Devices (HADs) **Jesper Jensen**	Acoustic Transfer Function (DOA) Estimation I * **Jesper Jensen**	Single-Microphone Noise Reduction **Jesper Jensen**	EEG and Audio Quality **Payam Shahsavari** Conversation based speech enh. **Poul Hoang**	Deep Representation Learning **Zheng-Hua Tan**
10:00	Basic: Auditory Perception **Jesper Jensen**	Acoustic Transfer Function (DOA) Estimation II * **Jesper Jensen**	Speech Intelligibility Prediction (SIP) **Asger Heidemann Andersen**	Ressource-constrained. Neural Networks **Morten Østergaard Nielsen**	Feedback Control **Meng Guo**
11:00	Hearing Loss Compensation **Jesper Jensen**	Voice Activity Detection (VAD) **Zheng-Hua Tan**	Voice Controlled HADs **Iván López Espejo**	Listening Effort and the Impact on Hearing Device Signal Proc. **Dorothea Wendt**	Feedback Control **Meng Guo**
11:45	Lunch	Lunch	Lunch	Lunch	Lunch
12:30	Intro to Hands-on Exercise **Jesper Jensen / Poul Hoang**	Bayesian Beamforming * **Jesper Jensen**	Deep Learning and Audio-Visual Speech Processing I **Daniel Michelsanti**	Using a spectro-temporal modulation test to predict aided speech reception performance **Johannes Zaar**	Brain Controlled HADs **Carina Graversen**
13:30	Beamforming I * **Jesper Jensen**	Speech Enh. for Headsets **Andreas Fuglsig**	Deep Learning and Audio-Visual Speech Processing II **Daniel Michelsanti**	Information Loss in the Human Auditory System **Jan Østergaard**	Brain Controlled HADs **Carina Graversen**
14:30	Beamforming II * **Jesper Jensen**	Hands-on Exercise	Hands-on Exercise	Hands-on Exercise	Hands-on Exercise / Last-Minute Questions
15:30	Bonus Time * **Jesper Jensen**	Hands-on Exercise	Hands-on Exercise	Hands-on Exercise	Wrap-up
17:00					

: Introductory
: Fundamental / State-of-the-art
: Emerging
: Hands-on Ex.
: Other

* : Lectures that support hands-on exercise

Each lecture is 45 min, followed by 15min break

Lecturers at the Summer School (subject to change):

Prof. Jesper Jensen, Oticon and AAU	Dr. Meng Guo, Oticon (invited talk)
Prof. Zheng-Hua Tan, AAU	Dr. Asger Heidemann Andersen, Oticon (invited talk)
Prof. Jan Østergaard, AAU	Dr. Carina Graversen, Eriksholm (invited talk)
Poul Hoang, Oticon and AAU	Dr. Johannes Zaar, Eriksholm (invited talk)
Payam Shahsavari, AAU	Dr. Dorothea Wendt (invited talk)
Morten Ø. Nielsen, AAU	Andreas Fuglsig, RTX and AAU
Dr. Daniel Michelsanti, AAU	Dr. Iván López Espejo, AAU

For more information about the Summer School, feel free to contact the organizers:
Prof. Jesper Jensen (jje@es.aau.dk), Prof. Zheng-Hua Tan (zt@es.aau.dk), and Prof. Jan Østergaard (jo@es.aau.dk).

Registration fees: (deadline April 30th, 2021)
PhD students/postdocs: FREE
Industry 7500 DKK (€1000)

To register for the Summer School please use the following link:
https://phd.moodle.aau.dk/course/index.php?categoryid=222

Important: The link to payment can be found under the section Course Fee on the course page, which is accessible after finishing the course registration via the link above. Due to the Corona situation, we restrict the number of participants to at most 30.