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STADIUS
Center for Dynamical Systems, Signal Processing and Data Analytics

STADIUS Newsletter

October 2023

RESEARCH ▪ NEWS ▪ AWARDS ▪ EVENTS ▪ STAFF UPDATE ▪ PUBLICATIONS

Welcome to the October edition of the STADIUS Newsletter!

This newsletter features the latest news and introduces you to new colleagues at STADIUS.

We would like to remind you that the **Newcomers Seminar and Reception** is approaching (Wednesday 22/11). Do not miss it!!!

Enjoy the read.

Research of the month by Santiago Ruiz

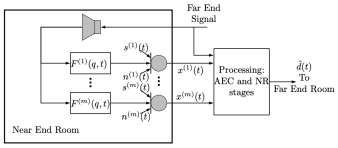


Figure 1: Multi-microphone single-loudspeaker AEC and NR problem.

Distributed algorithms for combined noise reduction and acoustic echo cancellation

Work under supervision of prof. Marc Moonen

The quality of a speech signal recorded through multiple microphones can be compromised by various undesired signals, including noise and reverberation, leading to diminished intelligibility. Some of these undesired signals may be generated by loudspeakers within the same acoustic environment, potentially generating acoustic echoes and/or feedback. Figure 1 shows a scenario where

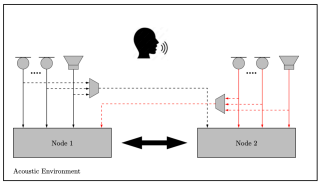


Figure 2: Example of distributed processing using fused signals obtained by filter-and-sum operations, reducing the communication cost in the WASAN

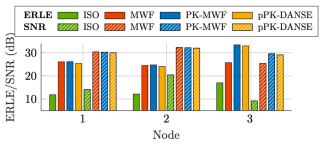


Figure 3: Average ERLE and SNR computed at the first microphone of each node in a WASAN.

algorithms for combined noise reduction (NR) and acoustic echo cancellation (AEC) are required.

Our work has focused on the development of distributed algorithms for com- bined NR and acoustic echo and feedback cancellation in wireless acoustic sensor and actuator networks (WASANs). Specifically, as opposed to collecting all sen- sor (microphone) and actuator (loudspeaker) signals in one common place, e.g., in a fusion center, novel distributed signal processing algorithms are proposed. In these kinds of algorithms, nodes compress or fuse their local sensor and ac- tuator signals, and exchange them with the other nodes in the network to share the computational burden of centralized processing using in-network processing (see Figure 2).

Figure 3 shows the performance of three algorithms, two centralized algo- rithms, the MWF and PK-MWF, and one distributed algorithm, the pPK- DANSE, for combined noise reduction and acoustic echo cancelation in a WASAN. The performance of a node working using only its local microphone and loud- speaker signals is also shown (ISO), i.e., no cooperation with other nodes. The performance is quantified in terms of the echo return loss enhancement (ERLE) and the signal-to-noise ratio (SNR). It can be seen that pPK-DANSE performs similarly to its corresponding centralized algorithm (PK-MWF), however, pPK- DANSE has lower communication requirements and computational complexity at each node. Furthermore, pPK-DANSE outperforms a node working in isola- tion (ISO) in all the nodes.

Read more: Ruiz, S., T. van Waterschoot, and M. Moonen, "Distributed Combined Acoustic Echo Cancellation and Noise Reduction in Wireless Acoustic Sensor and Actuator Networks," IEEE/ACM Transactions on Audio, Speech and Language Processing, vol. 30, 2022, pp. 534-547.

News



Honorary Doctorate for Joos Vandewalle

We are proud to announce that on Wednesday 11 October **Joos Vandewalle**, emeritus professor of STADIUS KU Leuven received an **honorary doctorate** from the Peter Paszman Catholic University of Budapest that was started in 1635. The citation is "For outstanding achievements in the theory of linear and non-linear systems, in the theory of electric circuits, in the theory of signal processing, and in the theory of neural networks".

Maarten De Vos named the Laureate of the KVAB

We are delighted to share the news that Maarten De Vos, a professor at STADIUS, has been named the **2023 Laureate of the Royal Flemish Academy of Belgium for Sciences and Arts** (KVAB) in the Class of Technical Sciences.

The award, which is one of the most important prizes awarded by the Academy, will be presented to the Laureate at a public meeting of the Academy on December 9, 2023.

Click here to read more about the KVAB.



Yves Moreau about human genetic data and privacy

The privacy concerns voiced by stadius Professor **Yves Moreau** about the use of human genetic data have been **quoted** by major news outlets **around the world.**

In a recent article published by The Washington Post in September 2023, Moreau warned about the potential for China to use the COVID-19 pandemic as an opportunity to collect the genetic data of people around the world.

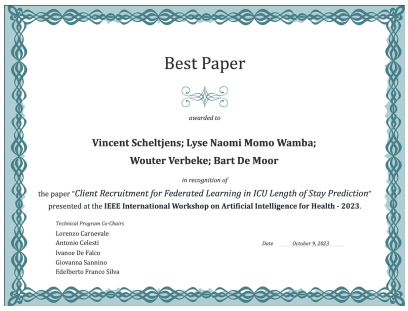
This all links to the research and awareness campaign of **Yves Moreau on the abuse of police forces and governments of genetic databases**.

Awards

Best Conference Paper for Angeliki Karaiskou

Angeliki Karaiskou received the **Best Conference Paper Award** at the IEEE MetroXRAINE 2023 Conference for her paper titled "Cross-Subject Mindfulness Meditation EEG Decoding." This work was conducted under the supervision of **Maarten De Vos**, Kaat Alaerts, and Carolina Varon.

Congratulations!


Best Paper

awarded to

Vincent Scheltjens; Lyse Naomi Momo Wamba; Wouter Verbeke; Bart De Moor

in recognition of

the paper "*Client Recruitment for Federated Learning in ICU Length of Stay Prediction*" presented at the **IEEE International Workshop on Artificial Intelligence for Health - 2023.**

Technical Program Co-Chairs
Lorenzo Carnevale
Antonio Celesti
Ivanoe De Falco
Giovanna Sannino
Edelberto Franco Silva

Date October 9, 2023

Best Paper Award in the group of Bart De Moor

In October 2023, a paper authored by Vincent Scheltjens, Lyse Naomi Momo Wamba, and Bart De Moor titled "Client Recruitment for Federated Learning in ICU Length of Stay Prediction" was honored with the Best Paper Award at the IEEE International Workshop on Artificial Intelligence for Health - 2023.

Congratulations!

Events @ STADIUS

E-DUALITY seminars and progress meeting
Part 1, Part 2 and Part 3
When: **14 & 15/11/2023**
Where: **B00.35 and B01.35**
Organised by: **Johan Suykens**

PhD defense: Cem Musluoglu
When: **15/11/2023, 16:00**

For more information about STADIUS events please visit the STADIUS Event webpages.

Don't forget to check the website of VAIA for a wide choice in courses on (aspects of) AI: www.vaia.be

Where: **Auditorium Arenbergkasteel**
By: **Cem Musluoglu**

ERC Seminar: Prof. Michiel Hochstenbach
When: **16/11/2023, 16:00**
Where: **ELEC 00.54 - Aula R**
Organised by: **Bart De Moor**

STADIUS Newcomers Seminar
When: **22/11/2023, 14:30 - 20:00**
Where: **B91.100 and ESAT Cafeteria**
By: **Toon van Waterschoot** and **Newcomers**

ERC Seminar : Prof. Yuji Nakatsukasa
When: **28/11/2023, 17:00**
Where: **ELEC 00.54 - Aula R**
Organised by: **Bart De Moor**

SOCN Course: Mixed feedback systems
When: **29/11 - 30/11/2023, 10:00 - 16:30**
Where: **Kasteelpark Arenberg**
By: **Rodolphe Sepulchre** (STADIUS) and Tom Chaffey, (University of Cambridge)

PhD defense - Thomas Strypsteen
When: **7/12/2023, 17:00**
Where: **Auditorium Arenbergkasteel**
Organised by: **Thomas Strypsteen**

ERC Seminar: Prof. Lieven De Lathauwer
When: **12/12/2023, 17:00**
Where: **ELEC B91.300 - aula C**
Organised by: **Bart De Moor**

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New colleagues

A warm welcome to new researchers and personnel at STADIUS!

Hello!

I am **Davina Van den Broek** and I have a master's degree in educational sciences. I recently started my PhD in the Parenting and Special Education Research Unit in the group of Prof. Bert De Smedt. Together with the group of Prof. Alexander Bertrand we will be working on measuring auditory attention to an educational stimulus with EEG in (individual) learners (eventually in a real-world classroom). In my free time, I enjoy going to the 'Chiro', where we try to give children a fun Saturday afternoon.

Davina



Hi everyone,

My name is **Thomas Vanhemel** and I recently graduated from KU Leuven with a Master's degree in Mathematical Engineering. I just started my PhD journey under the supervision of Prof. Bart De Moor. The topic of my PhD is the analysis of Mass Spectrometry Imaging data using Topological Data Analysis. In my free time, I am an active leader at Scouts Bolderberg and enjoy playing padel.

Thomas

Hello,

I am **Ahmed Elmahy**, and I have recently started my PhD journey, under the supervision of Prof. Maarten De Vos. I am delighted to be part of the STADIUS team. I have a medical degree followed by a master's degree in information technology with specialization in artificial intelligence in Medicine. I bring with me four years of professional experience as a data scientist, including a year at ArtiQ NV, a KUL spinoff that specializes in AI for respiratory medicine. During my time there, I discovered a deep passion for expanding the applications of AI in the field of respiratory medicine, particularly in the analysis of longitudinal lung function measurements (aka. lung function trajectories), which is now the focus of my PhD research. I am excited about the opportunity to collaborate with you.

Ahmed

Hello,

I'm **Lennert Beeckmans**, and I've recently embarked on my Ph.D. journey under the guidance of Professor Maarten De Vos. My research resides at the intriguing crossroads of Machine Learning and Ophthalmology, with a primary emphasis on Computer Vision and the examination of time series data derived from diverse ophthalmological sources. Just last year, I successfully earned my Master's degree in Computer Science with a specialization in Artificial Intelligence from KULeuven. Beyond academia, I have a genuine passion for sports of all kinds, and I'm currently dedicating my free time to learning the Spanish language.

Lennert

Hi!
My name is **Robin Wroblowski**, the newest addition to Prof. Rodolphe Sepulchre's research group where I'm researching Neuromorphic Control and its applications. I graduated in Mathematical Engineering at the KU Leuven and I'm very excited to start my PhD at STADIUS! I look forward to meeting you all. Don't hesitate if you ever want to talk about music, sports or anything at all!

See you around,
Robin



Hello,
My name is **Xinjie Zeng**, and I recently graduated from KU Leuven with a Master's degree in AI. I just started my PhD in the group of Prof. Johan Suykens. My project is about tensor-related kernel machines and deep learning. I am so excited to work with you.
In my free time, I enjoy playing badminton and also video games.

Xinjie

New Projects @STADIUS

We are excited about new projects starting now:

- **ERC PoC :** *DisPatch EEG- Distributed wireless EEG sensor patches for auditory attention*
  - PI: **A. Bertrand**
  - Start: 1/10/2023

- **EU MSCA DN:** *BioacAI Bioacoustic AI for wildlife protect*
  - PI: **T. van Waterschoot**
  - Coordination: Stichting Naturalis Biodiversity Center Netherlands
  - Start 1/10/2023

- **EU HORIZON HLTH:** *PHASE IV AI - Privacy compliant health data as a service for AI development*
  - PI: **M. De Vos**
  - Coordination: TURUN YLIOPISTO
  - Start 1/10/2023

- **FWO SBO Projects** (starting 1/10)
  - Supporting the development of self-regulation in infants: a promising strategy in preventive mental health care
    - PIs: **M. De Vos**, B.Boets
  - Enhancer-AI: AI-driven modelling and design of cell type specific enhancers for gene therapy
    - PI: **Y. Moreau**, S. Aerts
  - RevalExo: A wearable lower- limb exoskeleton that assists activities of daily living and enables data-driven remote rehabilitation
    - PIs: **B. Vanrumste,** T. Verstraten

- **FWO Scholarships** (starting 1/11)

- **Milan Wils** (Fundamental) *Design of novel signal processing algorithms for the detection and reconstruction of gravitational waves emitted by core-collapse supernoval*
  - (Co)Promotor: **M. Moonen**
- **Arnout Roebben** (Fundamental) *An integrated approach to the design of digital signal processing algorithms for hearing instruments*
  - (Co)Promotor: **M. Moonen**
- **Brent Sterckx** (SB) Personalised stimulation strategies for cochlear implants using EEG source analysis
  - (Co)Promotor: **M. Moonen**
- **Simon Geirnaert** (Postdoc) *Signal processing algorithms for attention decoding of brain responses to natural stimuli in brain-computer interfaces*
  - (Co)Promotor: **A. Bertrand**

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Publication Digest

Here's the monthly STADIUS Publications Digest, including new reports that have been added to the publications database.
Please remember to have your own reports added in the publications database and make sure your entries are kept up to date (status submitted/accepted/published) at all times.

Contact Ida for new additions and updates, do not add/update database content yourself.

23-126
De Plaen H., Suykens J.A.K., ``A Dual Formulation for Probabilistic Principal Component Analysis'', in *ICML 2023 Workshop on Duality Principles for Modern Machine Learning (DP4ML)*, Honolulu, Hawai, Jul. 2023, pp. 1-13.
Lirias number: 4113994.

23-127
Verplaetse N., Passemiers A., Arany A., Moreau Y., Raimondi D., ``Large sample size and nonlinear sparse models outline epistatic effects in inflammatory bowel disease'', *Genome Biology*, vol. 24, Oct. 2023, 224 p.
Lirias number: 4113990.

23-128
Shi Z., Fan J., Song L., Zhou D.-X., Suykens J.A.K., ``Nonlinear functional regression by functional deep neural network with kernel embedding'', Technical Report 23-128, ESAT-STADIUS, KU Leuven (Leuven, Belgium), 2023.

23-129
De Meulemeester H., De Smet F., Van Dorst J., Derroitte E., De Moor B., ``Unsupervised Anomaly Detection for Healthcare Insurance'', Technical Report 23-129, ESAT-STADIUS, KU Leuven (Leuven, Belgium), 2023.

23-130
Heintz N., Francart T., Bertrand A., ``Minimally Informed Linear Discriminant Analysis: training an LDA model with unlabelled data'', Technical Report 23-130, ESAT-STADIUS, KU Leuven (Leuven, Belgium), 2023.

23-131
Heyndrickx W., Mervin L., Morawietz T., Sturm N., Friedrich L., Zalewski A., Pentina A., Humbeck L., Oldenhof M., Niwayama R., ``MELLODDY : Cross-pharma Federated Learning at Unprecedented Scale Unlocks Benefits in QSAR without Compromising Proprietary Information'', *Journal of Chemical Information and Modeling*, Aug. 2023, 14 p.
Lirias number: 4108251.

23-132

Van den Bulcke L., Peeters A.M., Heremans E., Davidoff H., Borzee P., De Vos M., Emsell L., Van den Stock J., De Roo M., Tournoy J., ``Acoustic stimulation as a promising technique to enhance slow-wave sleep in Alzheimer's disease: results of a pilot study'', *J. Clin. Sleep Med*, Aug. 2023.
Lirias number: 4100646.

23-133

Hermans T., Khazazei M., Raeisi K., Croce P., Tamburro G., Dereymaeker A., De Vos M., Zappasodi F., Comani S., ``Microstate analysis reflects maturation of the preterm brain'', *Brain Topography*, Oct. 2023, pp. 1-14.
Lirias number: 4116210.

23-134

Chen O.Y., Lipsmeier F., Phan H., Dondelinger F., Creagh A., Gossens C., Lindemann M., De Vos M., ``Personalized longitudinal assessment of multiple sclerosis using smarthphones'', *IEEE Journal of Biomedical and Health Informatics*, vol. 27, no. 7, Jul. 2023, pp. 3633-3644.
Lirias number: 4103058.

23-135

Dendooven A., Styanidis A., Raes L., Van Craenenbroeck A., Maeyens M., Kotras K., De Vos M., ``Automatic segmentation of glomerular substructures by deep learning'', in *Proc. of the NEPHROLOGY DIALYSIS TRANSPLANTATION (0th ERA Congress)*, Milan, Italy, Jun. 2023, I260 p.
Lirias number: 4106271.

23-136

Chen O.Y., Vu D.T., Greub G., Cao H., He X., Muller Y., Petrovas C., Shou H., Nguyen V.D., Zhi B., Perez L., Raisaro J.L., Nagels G., De Vos M., He W., Gottardo R., Smart P., Munafo M., Pantaleo G., ``The statistical Analysis of the Varying Brain'', in *Proc. of the 2023 IEEE Statistical Signal Processing Workshop (SSP)*, Hanoi, Vietnam, Jul. 2023, 5 p.
Lirias number: 4119075.

23-137

Gagliardi G., Alfeo A.L., Catrambone V., Cimino M.G.C.A., De Vos M., Valenza G., ``Fine-grained emotion recognition using brain-heart interplay measurements and eXplainable convolutional neural networks'', in *Proc. of the 11th IEEE/EMBS Conference on Neural Engineering (NER)*, Baltimore, USA, Apr. 2023, 4 p.
Lirias number: 4108542.

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