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STADIUS
Center for Dynamical Systems, Signal Processing and Data Analytics

STADIUS Newsletter

November 2024

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

Welcome

Welcome to the November edition of the STADIUS Newsletter.
We hope you enjoy the read!



Welcome Christmas Tree reception

With Christmas around the corner, let's come together for our yearly tradition of welcoming the Christmas tree with an informal reception.

📅 Date: Monday, December 9
🕒 Time: 3:30 PM
📍 Place: Coffee Corner

We look forward to celebrating this festive moment with you!

Research of the month by Mohit Sharma

"A Generalized Weighted Overlap-Add (WOLA) Filter Bank for Improved Subband System Identification"

Work under the supervision of Marc Moonen

Acoustic propagation channels are characterized by their long impulse responses, making time-domain adaptive filtering for identifying these responses challenging due to large computational complexity and slow convergence rates. To address this, block processing techniques such as frequency-domain adaptive filter (FDAF) have been introduced. However,

when these frequency-domain block processing techniques are designed to correspond exactly to time-domain linear adaptive filtering operations, their design becomes highly restrictive, leaving very little degree of freedom for optimization. In contrast, short-time Fourier transform (STFT) domain subband processing techniques, offer additional degrees of freedom. These include control over the selectivity of each subband and the order of filters within each subband, among others, allowing for optimized filter design based on signal or system properties. However, in **STFT domain subband processing** is known to be **limited in its modeling accuracy** of full-band systems.

This work addresses the challenges in STFT domain subband adaptive filtering, in particular, subband system identification. Previous studies in this area have primarily focused on setups with subband filtering at a downsampled rate, implemented using the weighted overlap-add **(WOLA) filter bank**, popular in audio and speech-processing for its reduced complexity. However, this traditional approach imposes constraints on the subband filters when transformed to their full-rate representation.

This work makes three **key contributions. First**, it introduces a **generalized WOLA filter bank** that repositions subband filters before the downsampling operation, eliminating the constraints on subband filters inherent in the conventional WOLA filter bank as shown in Figure 1.

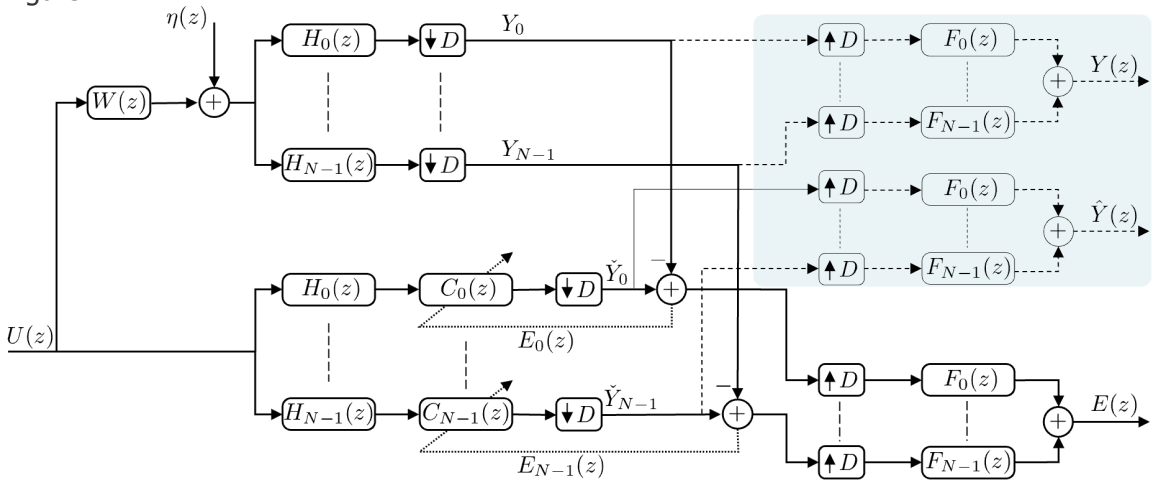


FIGURE 1. Generalized weighted overlap-add (WOLA) filter bank based subband system identification.

Second, it investigates the mean square error **(MSE) performance** of the generalized WOLA filter bank for full-band system identification, **establishing analytical ties** between the order of subband filters, the full-band system impulse response length, the decimation factor, and the prototype filters.

Third, to address the increased computational complexity of the generalized WOLA, the paper proposes a low-complexity implementation termed **per-tone weighted overlap-add (PT-WOLA)**, shown in Figure 2, which maintains computational complexity on par with conventional WOLA.

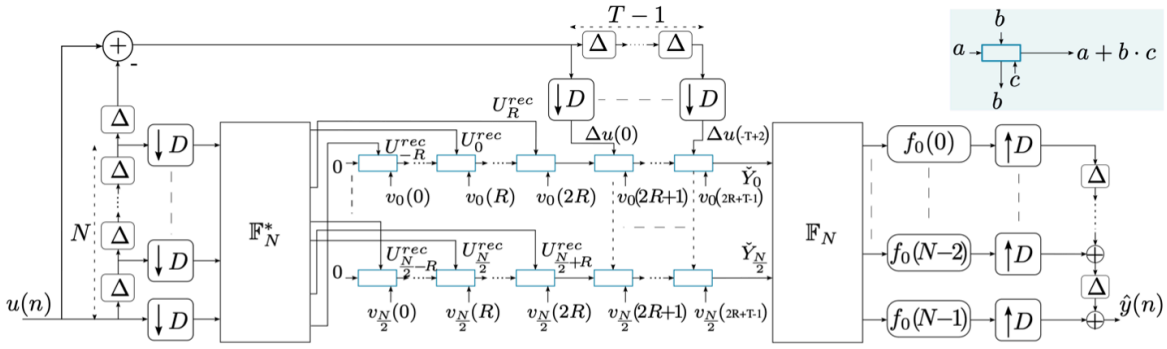


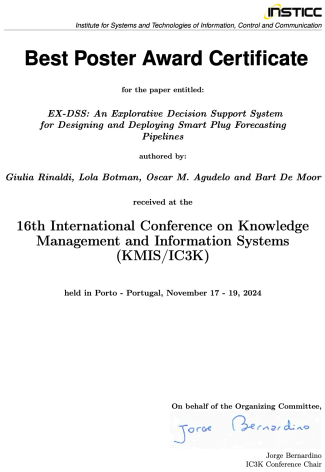
Figure 2. Per-tone weighted overlap-add (PT-WOLA) filter bank.

Analytical and empirical evidence demonstrates that the proposed generalized WOLA filter bank significantly enhances the performance of subband system identification.

If you are interested to read more, you will find the full report on the STADIUS pubengine soon.

Awards





INSTICC
Institute for Systems and Technologies of Information, Control and Communication

Best Poster Award Certificate

for the paper entitled:

EX-DSS: An Explorative Decision Support System for Designing and Deploying Smart Plug Forecasting Pipelines

authored by:

Giulia Rinaldi, Lola Botman, Oscar M. Agudelo and Bart De Moor

received at the

16th International Conference on Knowledge Management and Information Systems (KMIS/IC3K)

held in Porto - Portugal, November 17 - 19, 2024

On behalf of the Organizing Committee,

Jorge Bernardino
IC3K Conference Chair

Giulia Rinaldi Wins Best Poster Award

We are proud to announce that our STADIUS colleague, **Giulia Rinaldi**, has received the **Best Poster Award** at the 16th International Conference on Knowledge Management and Information Systems **(KMIS/IC3K)**, held in Porto from November 17-19, 2024.
Her award-winning poster, titled "*EX-DSS: An Explorative Decision Support System for Designing and Deploying Smart Plug Forecasting Pipelines*" showcases research co-authored with **Lola Botman**, **Oscar M. Agudelo,** and **Bart De Moor.**
The KMIS conference is organized by the Institute for Systems and Technologies of Information, Control and Communication, and provides an excellent platform to share and discuss ideas in knowledge management and information systems.

Congratulations to Giulia and her team for this achievement!



Prof. Lieven De Lathauwer Receives Prestigious Award at Inaugural Tensor Methods Conference

It is a pleasure to inform you about another award this month: STADIUS Professor **Lieven De Lathauwer**, has been honored at the First School-Conference on Tensor Methods in Mathematics and Data Science, held in Shenzhen, China, from November 10–21, 2024.
Prof. De Lathauwer received the award for his outstanding talk titled: "**From Tensor-Based Blind Source Separation to Tensor-Based Blind Source Matching.**" This recognition underscores his contributions to tensor methods and their applications in data science.

Congratulations!

News

Unveiling the Secrets of the Leuven Chansonnier - new series of movies



The **Alamire Foundation** (chaired by prof. **Bart De Moor**) discovered some years ago an extremely rare booklet with songs from the 15th century, now called '**the Leuven Chansonnier**'. From the 52 songs, 12 were completely unknown and can be patroned by 'donors' (contact the Foundation if you are interested).

After years of scientific research that has been published in books and articles, there is now a **series of 3 min movies** on the website of Alamire (a new one every Thursday), in which committed and enthusiastic experts explain their discoveries for a general audience.

Enjoy the watch here!!

STADIUS Colloquium Series

- **4/12/2024 Dr. John Veitch "Analysing Black Hole and Neutron Star Merger Signals**
  - Wednesday: 4/12/2024, 15:00 - 16:00
  - Location: Aula C

Other events @ STADIUS

PhD defense - Lyse Naomi Wamba Momo
When: **2/12/2024, 17:00**
Where: **00.E20-Aula Emma Vorlat,** AGOR 114-01 - Leercentrum AGORA- Edward Van Evenstraat 4, 3000 Leuven.

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 of courses on (aspects of) AI: www.vaia.be

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We wish the best of luck to the researchers who are leaving STADIUS

Best of luck!

- **Zhenxiang Cao** (a researcher supervised by Alexander Bertrand): Defended his PhD on 28/11/2024 and will be joining OMP as a data science consultant in the new year.
- **Qiang Fu** (a postdoctoral researcher from the group of Yves Moreau): Leaving for new opportunities.
- **Naomi Wamba Momo** (a PhD researcher supervised by Bart De Moor): Joined EORTC in November as a Biostatistician. She will defend her PhD thesis next week.
- **Giulia Rinaldi** (a PhD researcher from Bart De Moor's group): Departing in December to start as a Cyber Data Engineer at Thales Belgium while finalizing her PhD.
- **Hannes Rosseel** (a researcher supervised by Toon van Waterschoot): Starting next month as Senior DSP Engineer at Cochlear.

- **Meixi Wang** (a PhD researcher from the group of Johan Suykens): Will defend her thesis in December and plans to start a new professional chapter in January.
- **Jingwei Zhang** (researcher in the group of Maarten De Vos): defended his PhD on 07/11/2024 and joines Clario as an AI engineer.

Good luck to all of you!

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Recently defended PhDs

07/11/2024 - Jingwei Zhang "Multimodal Seizure Detection: Robustness and Generalization Properties", supervised by Maarten De Vos

15/11/2024 - Mohit Sharma "Digital signal processing algorithms for long-reach DSL deployment and speech and audio enhancement" supervised by Marc Moonen

15/11/2024 - Charles Hovine "Distributed adaptive spatial filtering in resource-constrained sensor networks" supervised by Alexander Bertrand

28/11/2024 - Zhenxiang Cao "Change point detection based on time-invariant modeling of time series" supervised by Alexander Bertrand

29/11/2024 - Ashkan Pirmani "From Centralized to Federated: The Journey of Data in Healthcare" supervised by Yves Moreau

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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.

24-149
Lorenzen K.P., Heremans E., De Vos M., Mikkelsen K.B., ``Personalization of automatic sleep scoring : How best to adapt models to personal domains in wearable EEG", *IEEE Journal of Biomedical and Health Informatics*, vol. 28, no. 10, Oct. 2024, pp. 5804-5815.
Lirias number: 4192303.

24-150
Schott J., Gransier R., Moonen M., Wouters J., ``Enhanced detection of envelope-following responses for objective fitting of cochlear-implant users'', Technical Report 24-150, ESAT-STADIUS, KU Leuven (Leuven, Belgium), 2024.

24-151
Rinaldi G., Theodorakos K., Crema Garcia F., Agudelo O. M., De Moor B., ``DSS4EX: A Decision Support System Framework to Explore Artificial Intelligence Pipelines with an Application in Time Series Forecasting'', Technical Report 24-151, ESAT-STADIUS, KU Leuven (Leuven, Belgium), 2024.

24-152

Bodard A., Oikonomidis K., Laude E., Patrinos P., ``The inexact power augmented Lagrangian method for constrained nonconvex optimization'', Technical Report 24-152, ESAT-STADIUS, KU Leuven (Leuven, Belgium), 2024.

24-153

Quan J., Evens B., Sepulchre R., Patrinos P., ``Scaled Relative Graphs for Nonmonotone Operators with Applications in Circuit Theory'', Technical Report 24-153, ESAT-STADIUS, KU Leuven (Leuven, Belgium), 2024.

24-154

Van Calster B., Timmerman S., Geysels A., Verbakel J.Y., Froyman W., ``A deep-learning-enabled diagnosis of ovarian cancer'', *Lancet Digital Health*, vol. 4, no. 9, Sep. 2022, pp. e630.
Lirias number: 3791737.

24-155

Garofalo G., Geysels A., Timmerman S., Barrenada L., De Moor B., Timmerman D., Froyman W. and Van Calster B., ``OP03.02: Artificial intelligence applied to ultrasound diagnosis of pelvic gynecological tumours: a systematic scoping review and meta-analysis'', *ISUOG World Congress on Ultrasound in Obstetrics and Gynecology 2024 (ISUOG24)*, Budapest, Hungary, Sep. 2024.
Lirias number: 4201594.

24-156

Geysels A., Garofalo G., Timmerman S., Ceusters J., FischerovÃi D., Testa A.C., Moro F., Buonomo F., Valentin L., Sladkevicius P., Van Holsbeke C., Kudla M.J., Czekierdowski A., Epstein E., Groszmann Y., Blaschko M., De Moor B., Van Calster B., Timmerman D. and Froyman W., ``OC05.03: *Deep learning-enabled ovarian cancer detection with ADNEX-AI: a prospective, multicentre study'', *ISUOG World Congress on Ultrasound in Obstetrics and Gynecology 2024 (ISUOG24)*, Budapest, Hungary, Sep. 2024.
Lirias number: 4201595.

24-157

Wang R., Acerbo F., Son T., Patrinos P., ``Imitation Learning from Observations: An Autoregressive Mixture of Experts Approach'', Technical Report 24-157, ESAT-STADIUS, KU Leuven (Leuven, Belgium), 2024.

24-158

Rosseel H., van Waterschoot T., ``On Time Delay Interpolation for Improved Acoustic Reflection Localization'', Technical Report 24-158, ESAT-STADIUS, KU Leuven (Leuven, Belgium), 2024.

24-159

Rosseel H., van Waterschoot T., ``A State-of-the-Art Review of Acoustic Preservation of Historical Worship Spaces through Auralization'', Technical Report 24-159, ESAT-STADIUS, KU Leuven (Leuven, Belgium), 2024.

24-160

Winant D., Achten S., Suykens J., ``Generative Kernel Spectral Clustering'', Technical Report 24-160, ESAT-STADIUS, KU Leuven (Leuven, Belgium), 2024.

24-161

Behmandpoor P., Moonen M., Patrinos P., ``Asynchronous message-passing and zeroth-order optimization based distributed learning with a use-case in resource allocation in communication networks'', Technical Report 24-161, ESAT-STADIUS, KU Leuven (Leuven, Belgium), 2024. Accepted for publication in *IEEE Transactions on Signal and Information Processing over Networks*.
Lirias number: 4202556.

24-162

Heremans E., Van den Bulcke L., Seedat N., Devulder A., Borzee P., Buyse B., Testelmans D., Van Den Bossche M., van der Schaar M., De Vos M., ``Automated remote sleep monitoring needs uncertainty quantification'', Technical Report 24-162, ESAT-STADIUS, KU Leuven (Leuven, Belgium), 2024. Accepted for publication in *Journal of Sleep Research, 2024*.
Lirias number: 4170926.

24-163

Zhang J., *Multimodal Seizure Detection: Robustness and Generalization Properties*, PhD thesis, Faculty of Engineering, KU Leuven (Leuven, Belgium), Nov. 2024
Lirias number: 4186958.

24-164

Sharma M., *Digital signal processing algorithms for long-reach DSL deployment and speech and audio enhancement*, PhD thesis, Faculty of Engineering, KU Leuven (Leuven, Belgium), Nov. 2024
Lirias number: 4188724.

24-165

Cao Z., *Change point detection based on time-invariant modeling of time series*, PhD thesis, Faculty of Engineering, KU Leuven (Leuven, Belgium), Nov. 2024
Lirias number: 4190554.

24-166

Schott J., Gransier R., Moonen M., Wouters J., ``Electrically evoked auditory steady-state response and stimulation artifact estimation using Kalman Filtering'', *Conference on Implantable Auditory Prostheses (CIAP) (CIAP)*, Tahoe City, California, Jul. 2021.
Lirias number: 4203493.

24-167

Schott J., Gransier R., Moonen M., Wouters J., ``Electrically evoked auditory steady-state response detection in cochlear implant recipients using a system identification approach'', *ARCHES (Audiological Research Cores in Europe) meeting (ARCHES)*, Oldenburg, Germany, Nov. 2022.
Lirias number: 4203499.

24-168

Schott J., Gransier R., Moonen M., Wouters J., ``The potential of objective T-level determination in CI recipients using envelope following responses'', *Conference on Implantable Auditory Prostheses (CIAP) (CIAP)*, Tahoe City, Californiania, Jul. 2023.
Lirias number: 4203551.

24-170

Heyndrickx W., Arany A., Simm J., Pentina A., Sturm N., Humbeck L., Mervin L., Zalewski A., Oldenhof M., Schmidtke P., Friedrich L., Loeb R., Afanasyeva A., Schuffenhauer A., Moreau Y., Ceulemans H., ``Conformal efficiency as a metric for comparative model assessment befitting federated learning'', *Artificial Intelligence in the Life Sciences*, vol. 3, no. *, 2023, pp. 1000-70.
Lirias number: 4199498.

24-171

Pirmani A., *From Centralized to Federated: The Journey of Data in Healthcare*, PhD thesis, Faculty of Engineering, KU Leuven (Leuven, Belgium), Nov. 2024
Lirias number: 4192330.

24-172

Hovine C., *Distributed adaptive spatial filtering in resource-constrained sensor networks*, PhD thesis, Faculty of Engineering, KU Leuven (Leuven, Belgium), Nov. 2024, 186 p.
Lirias number: 4186957.

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