



InterCoML
Control Theory & Machine Learning

COST Action 24136

Interactions between Control Theory and Machine Learning



Working Group 1: Control Theory for Machine Learning

Kick-Off Workshop

Topics

- Introduction to COST Action InterCoML
- Scientific talks on topics of WG 1
- Future Activities of WG 1

Find out more on the webpage:

<https://cost-intercoml.unidu.hr/news/wg1kickoff.html>

Jan 16th

13:30 – 16:00

CET

via Zoom

Leon Bungert &
Tatiana Guy
(WG1 Leaders)



Kick-Off Workshop WG 1: Control Theory for Machine Learning

Leon Bungert & Tatiana V. Guy



Funded by
the European Union

- 13:30 - 14:00 Welcome, information on the COST Action and on WG 1,
getting to know each other
- 14:00 - 14:30 Scientific talk **Patricia Pauli (TU Eindhoven)**
- 14:30 - 15:00 Scientific talk **Domènec Ruiz-Balet (Universitat de Barcelona)**
- 15:00 - 16:00 Discussion on future working group activities and conclusion

Welcome

Working group leaders



Leon Bungert

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Learning
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Tatiana V. Guy

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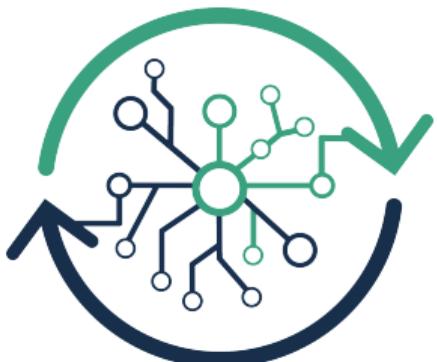
COST Action CA24136

Interactions between Control Theory and Machine Learning (InterCoML)



- COST (European Cooperation in Science and Technology): **funding organisation** for research and innovation networks
- **connect** research initiatives across Europe and beyond
- COST Actions are **bottom-up networks** with a duration of four years that boost research, innovation and careers.¹

¹[www.cost.eu](https://www.cost.eu/actions/CA24136/)



InterCoML
Control Theory & Machine Learning

- start date 10/10/2025
- end date 09/10/2029

Organization

- Action chair:
Martin Lazar
Professor of Applied Mathematics,
University of Dubrovnik, Croatia
- Management Committee: representatives from countries
- Core group: handling every-day business
- Working groups
- Coordinators for Science communication, Grant Awarding, and Equal Opportunities

InterCoML: Objectives

Aim

Foster synergy between Control Theory (CT) and Machine Learning (ML)

- **Strengthen control-theoretic foundations of ML**
 - Apply ML tools to complex, high-dimensional CT problems
 - Develop hybrid and data-driven models for real-world applications from, e.g., energy systems, healthcare, robotics, and smart infrastructure
 - Transform theoretical results into practical solutions
 - Transfer of knowledge and ideas between academia and industry
 - Disseminate insights and findings to the research community and the general public
- for details, see our Memorandum of Understanding²

²https://e-services.cost.eu/files/domain_files/CA/Action_CA24136/mou/CA24136-e.pdf

- Reduce fragmentation and communication barriers between the ML and CT
- Create common language between CT and ML communities
- Organize seminars, workshops, and training schools
- Empower young researchers through STSMs (short-term scientific missions) and internships
- Promote gender and geographical balance

Short-term scientific missions (STSMs)

Goals and format:

- Short term visit financed by the COST Action
- Joint work on a project with other COST partner; gaining new knowledge; access to equipment/techniques
- **Important:** STSMs are not restricted to the topics presented today → If you have an idea for an interesting project, please apply!
- **Important:** Visiting and hosting researcher should dedicate most of the time during the STSM on a joint research project

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Requirements for application:

- **Before the application:** Contact a potential host for the STSM and develop a working plan together indicating milestones and goals
- **Before the application:** Receive a confirmation by the hosting/supervising researcher
- **After the STSM:** Write a report on the work developed, main achievements, and planned follow-up activities.

Working Groups and Structure

- WG1: Control Theory for Machine Learning
- WG2: Machine Learning for Control Theory
- WG3: Hybrid and data-driven modeling
- WG4: Transformation into practical solutions
- WG5: Dissemination and outreach

Working Groups and Structure

- **WG1: Control Theory for Machine Learning**
- WG2: Machine Learning for Control Theory
- WG3: Hybrid and data-driven modeling
- WG4: Transformation into practical solutions
- WG5: Dissemination and outreach

Working Group 1: Control Theory for Machine Learning

Aim:

- 1 Obtaining error estimates for ML surrogates
- 2 Theoretical guarantees for physics-informed neural networks
- 3 Application of Game Theory to ML
- 4 Kalman filters in statistical ML
- 5 Analysis of high-dimensional deep neural networks and transformers using CT tools

Activities planned by Working Group 1

- 1 Dedicated session and plenary talks related to Working Group 1 at conference in Prague, April 27-30, 2026
- 2 Initiation of smaller subgroups tackling specific problems
- 3 Short Term Scientific Missions – STSMs
- 4 Creation of lists of open problems and questions related to WG1
- 5 Training schools, minisymposia, etc.

Communication within Working Group 1

- 1 Via **email** for communication WG leads → WG members
- 2 InterCoML **slack** channel
- 3 InterCoML **webpage**: <https://cost-intercoml.unidu.hr/>

Getting to know each other

Short questionnaire

<https://forms.cloud.microsoft/e/2M9q6H18Wy>

WG 1: Kick-Off



Scientific Talk

Lipschitz-bounded convolutional neural networks

Patricia Pauli

- Assistant Professor at TU Eindhoven
- Control Systems Technology section of the Department of Mechanical Engineering
- PhD *summa cum laude* in 2025 at the University of Stuttgart (Frank Allgöwer)
- Research areas
 - Applications of control theory for ML
 - AI-driven controllers
 - Robustness in machine learning

Scientific Talk

Self-Attention and Frank–Wolfe

Domènec Ruiz-Balet

- Assistant Professor at Universitat de Barcelona
- Department of Mathematics at the Faculty of Mathematics and Computer Science
- Research areas
 - Mean-field games and game theory
 - Theory of generative models
 - Applications of control theory for ML

Future working group activities

General InterCoML Conference in Prague, Czech Republic, on April 27-30, 2026

- plenaries, contributed talks and poster sessions
- round table discussions
- details will be announced in early 2026 via the COST Action channels (= email, slack)

How to actively participate

- join us at the 1st InterCoML Conference in Prague, April 27-30, 2026.
- apply for WG 1 membership (if you haven't yet)
- **@ young researchers:** consider Short-Term Scientific Missions (STSM) on WG1 topics
- share ideas for future WG 1 activities (training/summer schools, online seminars,...)

Thank you for your attendance!

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