COST Action 24136

Interactions between Control Theory and Machine Learning

InterCoML
Control Theory & Machine Learning

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Working Group 1:
Control Theory for Machine Learning

Kick-Off Workshop

Jan 16th
13:30 – 16:00 CET
via Zoom

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

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

Agenda

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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Institute of Mathematics, CAIDAS
University of Würzburg, Germany

Tatiana V. Guy
Associate Professor of Systems Engineering & Informatics
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Department of Adaptive Systems
Institute of Information Theory and Automation, Czech Academy of Sciences

COST Action CA24136

Interactions between Control Theory and Machine Learning (InterCoML)

COST Actions

- 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

- 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 Understanding[2]

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

InterCoML: Capacity Building

- 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

WG 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 Groupu 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

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

Conference in Prague, April 2026

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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