Call for Papers: ML-DE Workshop 2025

24.02.2025

The **second Workshop on "*Machine Learning Meets Differential Equations: From Theory to Applications*" (ML-DE), co-located with ECAI 2025**, is designed to spotlight the dynamic interplay between Machine Learning (ML) and Differential Equations (DE), two fields at the heart of numerous technological and scientific breakthroughs. This workshop aims to delve into how DEs, foundational in modelling complex systems across various domains, can be ingeniously coupled with ML to unlock new potentials, from enhancing prediction accuracies to fostering advancements in explainable AI. It is motivated by the emerging need to transcend traditional boundaries, leveraging the predictive power of ML to tackle DE-driven challenges in novel ways, thereby catalyzing a deeper understanding and innovative solutions to problems that were once considered intractable. By emphasizing energy-efficient algorithms and aiming to reduce the computational footprint of ML, the workshop underscores a commitment to sustainable AI practices. Participants will explore the integration of DEs into ML architectures, the application of ML in solving intricate DE problems, and the potential of these convergences to revolutionize fields as diverse as physics, biology, and beyond. Our purpose is to forge a community that not only shares insights but actively contributes to expanding the frontiers of what's possible at the intersection of ML and DE, setting a new paradigm for research and application in the era of intelligent technologies.

For more information, visit our website: ML-DE Workshop ECAI 2025.

Highlight

Full-Length Papers will be in a volume by the Proceedings of Machine Learning Research (PMLR) similar to last years version (Volume 255: 1st ECAI Workshop on "Machine Learning Meets Differential Equations: From Theory to Applications"). Authors can opt-in or opt-out.

Publication Types

We invite submissions in the following formats:

- **Full-Length Papers:** Maximum of 8 pages, excluding references and supplementary material.
- **Extended Abstracts:** Limited to 2 pages, including references, designed for poster sessions and brief elevator pitches (approximately 5 minutes). This format provides a snapshot of your research, perfect for generating interest and discussion.

- **Presentation Only:** Authors of papers recently published in top-tier conferences and journals (JMLR, JAIR, MLJ, PAMI, IJCAI, NeurIPS, ICLR, AISTATS, ICML, AAAI) are encouraged to submit a 2-page extended abstract, including references, for presentation. Please indicate the original publication venue in your submission form.
- **Reproducibility Track:** Contributions that enhance the reproducibility of research findings are crucial. We invite interactive tutorials, demos, libraries, packages or datasets (e.g., Jupyter notebooks) and their respective 2-page extended abstracts. This track emphasizes the practical application and implementation of research, facilitating a deeper understanding and broader use of ML-DE techniques. Demo code (e.g. Jupyter notebooks etc.) will be published jointly at our Github together with a link to the paper.

Topics of Interest

We encourage submissions across a broad range of topics, including, but not limited to:

- Embedding differential equations into machine learning (Neural ODEs, normalising flows, ...).
- Solving differential equations using machine learning (PINNs, Neural Operators, ...).
- Machine Learning-augmented numerical methods for solving differential equations (hybrid solvers, ...).
- Analysis of numerical methods for incorporating differential equations' solvers into machine learning algorithms (trade-offs, benchmarks, ...).
- Incorporation of expert-knowledge given by differential equations into machine learning algorithms (physics-inspired machine learning, ...).
- Applications of the above to modelling/predicting real-world systems in science and engineering (finance, biology, physics, chemistry, engineering, ...).
- Use of machine learning to model systems described by differential equations (finance, biology, physics, chemistry, engineering, ...).
- Approaches to extract physical knowledge out of learned differential equations for explainable AI (SINDy, ...).
- Computational efficiency of DE solvers involved in ML algorithms (ODE solvers, ...).

Submission Guidelines

- **Format:** Use the prefilled version on Overleaf or the official PMLR Template.
- **Length:** As specified by the submission format.
- **Double-Blind Review:** Submissions should not include identifiable information. Repositories must be anonymized, for example using Anonymous Github.
- **Submission Link:** TBD

Join Us in Person!

We warmly invite you to present your work in person, fostering a vibrant exchange of ideas. Note: We reserve the right to withdraw papers from our program and the PMLR for those that do not intend to present in person.

Important Dates

- **Submission Deadline:** 15th of June 2025, 23:59 CEST
- **Notification of Acceptance:** 15th of July 2025
- **Workshop Date:** either 25th or 26th of October, Full day

Please keep updated on https://mlde-ecai-2025.github.io/. For more details and submission instructions, please contact us at MLDEWorkshopECAI25@hsu-hh.de

We eagerly await your submissions and hope to see you in Bologna!