

Workshop

“Advancing Scientific Machine Learning in Industry”

October 15-16, 2024

TU München – Institute for Advanced Study
Lichtenbergstrasse 2a, 85748 Garching

Scientific machine learning (SciML) has been taking the academic world by storm as an interesting blend of traditional scientific modelling with machine learning (ML) methodologies like deep learning. While traditional machine learning methodologies have difficulties with scientific issues like interpretability, and enforcing physical constraints, the blend of ML with numerical analysis and differential equations has evolved into a novel field of research which overcome these problems while adding the data-driven automatic learning features of modern machine learning. Many successes have already been demonstrated, with tools like physics-informed neural networks, universal differential equations, deep backward stochastic differential equation solvers for high dimensional partial differential equations, and neural surrogates showcasing how deep learning can greatly improve scientific modelling practice. Consequently, SciML holds promise for versatile application across a wide spectrum of scientific disciplines, ranging from the investigation of subatomic particles to the comprehension of macroscopic systems like economies and climates.

However, despite notable strides in enhancing the speed and accuracy of these methodologies, their utility in practical and specifically industrial settings remain constrained. Many domains within the scientific community still lack comprehensive validation and robustness testing of SciML approaches. This limitation is particularly pronounced when confronted with complex, real-world datasets emanating from interactions between machinery and environmental sensors as usually addressed in industry. Still if appropriately addressed, SciML with its promise to accelerate innovations and scientific discoveries by orders of magnitudes, offers unique opportunities to address the insatiable desire for faster and more accurate predictions in many fields.

This workshop is dedicated to exploring recent advancements in the implementation of SciML techniques. It convenes leading experts who are actively engaged in refining these methodologies to ensure their practical viability and scalability, particularly in industrial sectors where digital and physical components converge. Goal of the workshop is to produce a research roadmap for advancing scientific machine learning in industry, addressing application/industrialization challenges.

Organisers

This workshop is organized by TUM-IAS Hans Fischer senior fellow Wil Schilders and Siemens top innovator Dirk Hartmann.

Registration and information

Participation is free of charge, but registration is mandatory. It is possible to present a poster, this can be indicated on the registration form. Use this link to register:

<https://nextcloud.in.tum.de/index.php/apps/forms/s/jbKNZedJBtjABd54ktWB33TH>

On the next page, a preliminary program is provided. For up-to-date information as well as registration, please consult the web page of the Focus Group “Scientific Machine Learning”.

Monday, October 14, the ECMI Special Interest Group “Mathematics for Big Data and artificial intelligence” will organise a workshop at Siemens in Garching. See separate announcement.

Provisional program
“Advancing Scientific Machine Learning in Industry”

Tuesday, October 15

10.00-10.30 Opening

Michael Molls (TUM-IAS), Hans Bungartz (TUM School of Computation, Information and Technology), Dirk Hartmann (Siemens) and Wil Schilders (TUM-IAS)

10.30-12.30 Industry presentations and challenges

- Dirk Hartmann (Siemens)
- David Heiny (Simscale)
- Stefan Kurz (Robert Bosch GmbH)
- tba

12.30-13.30 Lunch

13.30-15.00 Round of workshops

The challenges presented by industry in the morning, as well as additional challenges, will be discussed. The findings will be presented and discussed during the dinner.

15.00-15.30 Break

15.30-16.45 Keynote talks

- Victorita Dolean (TU Eindhoven)
- Yannis Kevrekidis (DARPA)
- tba

16.45-17.30 Panel discussion

Panellists: George Karniadakis (Brown University), Sjoerd Verduyn Lunel (ASML), Yannis Kevrekidis (DARPA), Gitta Kutinyok (LMU), Johannes Brandstetter (JKU Linz), Thomas Runkler (Siemens)

17.30-18.00 Drinks

18.00-21.00 Dinner + discussion of workshop findings

Wednesday, October 16

09.00-10.25 Keynote talks

- Felix Dietrich (TUM)
- Diana Malvenyan (Siemens)
- Elizabeth Qian (Georgia Tech – TUM-IAS)

10.25-10.35 Poster pitches

10.35-11.15 Break/poster session

11.15-12.30 Industrial success stories

- Andras Poppe (BME Budapest) and Susan Zhao (Signify)
- tba

12.30-13.30 Lunch

13.30-14.30 Discussion of final report for those interested

COST ACTION

The findings in the final report will also be used as input to a proposal for a COST Action that will be submitted soon after the workshop. During the workshop, we will share a link that can be used by participants to support this COST Action.

COST is one of the oldest subsidy programs in Europe, mainly for networking. It stands for "Cooperation in Science and Technology". COST Actions usually have participants from all over Europe, and workshops can be organised during 4 years. COST Actions are a cradle for other collaborative projects, such as MSCA or industry-led projects in ECSEL, ITEA and more.