



Friedrich-Alexander-Universität
Research Center for
Mathematics of Data | MoD

Hosted by our FAU MoD, the **#MLPDES25 workshop** is an international event that brings together researchers from Europe and the United States to explore the deepening connection between Machine Learning (ML) and Partial Differential Equations (PDEs). With participants from diverse backgrounds, this event aims to establish a collaborative platform for experts to network, share insights, and drive progress in these exciting fields.

We will dive into recent theoretical advancements and applications, while also discussing ongoing challenges in areas such as:

- Control and PDE methods for universal approximation and data classification
- Mean field analysis of Neural Networks
- ML applications in traffic flow modeling and autonomous driving
- ML and numerical simulation in bio-mechanics and micro-fluidics



Machine Learning and PDEs

#MLPDES25 WORKSHOP

April 28 - 30, 2025

ERLANGEN - BAVARIA, GERMANY



WHEN

Mon.-Wed. April 28 - 30, 2025

09:30H - 17:00H

WHERE

Onsite. FAU, Friedrich-Alexander-Universität Erlangen-Nürnberg
Senatssaal (Senate Hall) im Kollegienhaus
Universitätsstraße 15, 91054 Erlangen - Bavaria, Germany

Online (live streaming): <https://www.fau.tv/fau-mod-livestream-2025>

REGISTRATION

Free but mandatory.

Registration form: www.dcn.nat.fau.eu/mlpdes25-registration



www.mod.fau.eu/mlpdes25

SCIENTIFIC COMMITTEE

- Giuseppe Maria Coclite. Politecnico di Bari
- Enrique Zuazua. FAU, Friedrich-Alexander-Universität Erlangen-Nürnberg

ORGANIZING COMMITTEE

- Darlis Bracho Tudares. FAU, Friedrich-Alexander-Universität Erlangen-Nürnberg
- Nicola De Nitti. Università di Pisa
- Lorenzo Liverani. FAU, Friedrich-Alexander-Universität Erlangen-Nürnberg

AUDIENCE

This international workshop is open to: Public, Students, Postdocs, Professors, Faculty, Alumni and the scientific community all around the world.



Friedrich-Alexander-Universität
DYNAMICS, CONTROL,
MACHINE LEARNING
AND NUMERICS



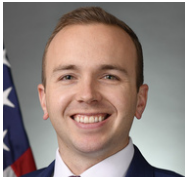
Politecnico
di Bari

Machine Learning and PDEs
#MLPDES25 WORKSHOP**April 28 - 30, 2025****ERLANGEN - BAVARIA
GERMANY****#MLPDES25 Schedule • Time table**

	MON. APRIL 28, 2025	TUE. APRIL 29, 2025	WED. APRIL 30, 2025
09:30H 10:00H	Registration Opening ceremony	Gabriel Peyré. CNRS, ENS-PSL Transformers are universal in-context learners	Juncheng Wei. CUHK On Brezis's first open problem: A complete solution
10:00H 10:30H	Paola Antonietti. Polimi Machine Learning enhanced polytopal finite element methods for neurodegenerative disorder modeling	Gianluca Orlando. Poliba Replicator dynamics as the large-population limit of a multi- strategy discrete Moran process	Francesco Regazzoni. Polimi Discovering the hidden low- dimensional dynamics of time- dependent PDEs with latent dynamics networks
10:30H	COFFEE / TEA BREAK		
11:00H 11:30H	Daniel Tenbrinck. FAU Eigenvalue problems on graphs and hypergraphs	Alessandro Coclite. Poliba Replicator dynamics on a network	Daniela Tonon. UNIPD Hamilton-Jacobi equations on infinite dimensional spaces
11:30H 12:00H	Camilla Nobili. Surrey Quantification of enhanced dissipation and mixing for time-dependent shear flows	Borjan Geshkovski. Inria S. Many-particle systems perspective on Transformers	Shi Jin. SJTU Allen-Cahn message passing in graph neural networks and fast Sinkhorn for Wasserstein-1 metric
12:00H	LUNCH BREAK		
14:30H 15:00H	Paola Goatin. Inria S.A. Modern calibration strategies for macroscopic traffic flow models	Domènec Ruiz-Balet. Imperial Some remarks on matching measures with Machine Learning architectures	Anne Koelewijn. FAU SSPINNpose: Self-supervised learning of biomechanical variables without ground truth
15:00H 15:30H	Michele Palladino. UAQ Handling uncertainty in optimal control	Alessio Porretta. UNIROMA2 Diffusion effects in optimal transport and mean-field planning models	Wei Zhu. Georgia Tech Structure-Preserving Machine Learning and Data-Driven structure discovery
15:30H	COFFEE / TEA BREAK		
16:00H 16:30H	Alexander Keimer. Rostock Optimal control of nonlocal conservation laws and the singular limit	Yaoyu Zhang. SJTU The condensation phenomenon of Deep Neural Networks	Giovanni Fantuzzi. FAU Data-driven system analysis: Polynomial optimization meets Koopman
16:30H 17:00H	Fariba Fahroo. AFOSR Felix J. Knutson. AFOSR International grant opportunities and research interests of the AFOSR	Günter Leugering. FAU The Speinshart Scientific Center for AI and Supertech	Closing ceremony
17:00H	Lorenzo Liverani. FAU Projects and opportunities at the Chair for Dynamics, Control, Machine Learning and Numerics	20:00H SOCIAL DINNER	

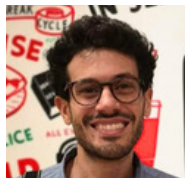
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Nicola De Nitti. UniPi
Lorenzo Liverani. FAU**WHERE****Onsite.** FAU Senatssaal (Senate Hall) im
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www.dcn.nat.fau.eu/mlpdes25-registrationwww.mod.fau.eu/mlpdes25

Machine Learning and PDEs
#MLPDES25 WORKSHOP**Program DAY 1 • Mon. April 28, 2025**

09:30H	Registration. Opening ceremony	
10:00H 10:30H		Paola Antonietti Politecnico di Milano Machine learning enhanced polytopal finite element methods for neurodegenerative disorder modeling
10:30H	COFFEE / TEA BREAK	
11:00H 11:30H		Daniel Tenbrinck FAU, Friedrich-Alexander-Universität Erlangen-Nürnberg Eigenvalue problems on graphs and hypergraphs
11:30H 12:00H		Camilla Nobili University of Surrey Quantification of enhanced dissipation and mixing for time-dependent shear flows
12:00H	LUNCH BREAK	
14:30H 15:00H		Paola Goatin Inria Sophia-Antipolis Modern calibration strategies for macroscopic traffic flow models
15:00H 15:30H		Michele Palladino Università degli Studi dell'Aquila Handling uncertainty in optimal control
15:30H	COFFEE / TEA BREAK	
16:00H 16:30H		Alexander Keimer Universität Rostock Optimal control of nonlocal conservation laws and the singular limit
16:30H 17:00H	 	Fariba Fahroo • Felix J. Knutson AFOSR, Air Force Office of Scientific Research International grant opportunities and research interests of the AFOSR
17:00H		Lorenzo Liverani FAU, Friedrich-Alexander-Universität Erlangen-Nürnberg Projects and opportunities at the Chair for Dynamics, Control, Machine Learning and Numerics

Machine Learning and PDEs
#MLPDES25 WORKSHOP**Program DAY 2 • Tue. April 29, 2025**09:30H
10:00H**Gabriel Peyré****CNRS, ENS-PSL**

Transformers are universal in-context learners

10:00H
10:30H**Gianluca Orlando****Politecnico di Bari**

Replicator dynamics as the large-population limit of a multi-strategy discrete Moran process

10:30H

COFFEE / TEA BREAK

11:00H
11:30H**Alessandro Coclite****Politecnico di Bari**

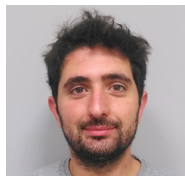
Replicator dynamics on a network

11:30H
12:00H**Borjan Geshkovski****Inria, Sorbonne Université**

Many-particle systems perspective on Transformers

12:00H

LUNCH BREAK

14:30H
15:00H**Domènec Ruiz-Balet****Imperial College London**

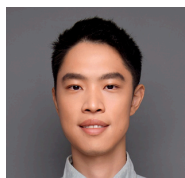
Some remarks on matching measures with Machine Learning architectures

15:00H
15:30H**Alessio Porretta****Università di Roma Tor Vergata**

Diffusion effects in optimal transport and mean-field planning models

15:30H

COFFEE / TEA BREAK

16:00H
16:30H**Yaoyu Zhang****Shanghai Jiao Tong University**

The condensation phenomenon of Deep Neural Networks

16:30H
17:00H**Günter Leugering****FAU, Friedrich-Alexander-Universität Erlangen-Nürnberg**

The Speinshart Scientific Center for AI and Supertech

20:00H

SOCIAL DINNER

Machine Learning and PDEs

#MLPDES25 WORKSHOP

Program DAY 3 • Wed. April 30, 2025

09:30H
10:00H**Juncheng Wei****Chinese University of Hong Kong**

On Brezis's first open problem: A complete solution

10:00H
10:30H**Francesco Regazzoni****Politecnico di Milano**

Discovering the hidden low-dimensional dynamics of time-dependent PDEs with latent dynamics networks

10:30H

COFFEE / TEA BREAK

11:00H
11:30H**Daniela Tonon****Università di Padova**

Hamilton-Jacobi equations on infinite dimensional spaces

11:30H
12:00H**Shi Jin****SJTU, Shanghai Jiao Tong University**

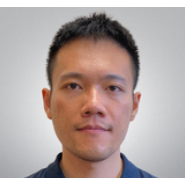
Allen-Cahn message passing in graph neural networks and fast Sinkhorn for Wasserstein-1 metric

12:00H

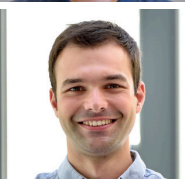
LUNCH BREAK

14:30H
15:00H**Anne Koelewijn****FAU, Friedrich-Alexander-Universität Erlangen-Nürnberg**

SSPINNpose: Self-supervised learning of biomechanical variables without ground truth

15:00H
15:30H**Wei Zhu****Georgia Institute of Technology**

Structure-Preserving Machine Learning and Data-Driven structure discovery

15:30H
16:00H**Giovanni Fantuzzi****FAU, Friedrich-Alexander-Universität Erlangen-Nürnberg**

Data-driven system analysis: Polynomial optimization meets Koopman

16:00H

Closing ceremony

Quick-info



Cauerstraße 11, 91058 Erlangen



Office: Felix Klein building. 3rd. floor



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dcn-avh@fau.de



+49 174 198-9775 (urgencies)

#MLPDES25 website

www.mod.fau.eu/events/mlpdes25

Registration #MLPDES25

www.dcn.nat.fau.eu/mlpdes25-registration

How to get to Erlangen?

-  **By taxi.** The best choice. Expect to pay: 35 EUR – 40 EUR approx. for one trip (Duration: 15 mins.)
-  **By bus.** Take Bus N° 30. Frequency: 20-30 mins. Expect to pay: 02 EUR – 04 EUR (Duration: 30 mins.)
Tickets for local public transportation can be purchased at the Customer Service Offices of the transportation companies or from ticket machines at major stops.

How to get to our FAU DCN-AvH Chair office?

From the main train station (in the center of Erlangen) you can get to our office at Cauerstrasse:

-  **By taxi.** 15EUR–20EUR approx. (one trip, from center to the FAU's Department Mathematik
Duration: 10-15 mins.)
-  **By bike/car.** Coming by bike/car? In front of the building you will find a huge parking lot available!
([gMaps directions](#))
-  **By foot.** Distance: 4Kms. approx. from the downtown to our building. Expect to walk: 45 mins.
-  **By bus.** Please take **bus N° 20** at the Erlangen Arcaden center (3 mins by walk from the main train station).
Go off the bus at "Technische Fakultät" stop. (11 stops later)
Frequency: 20 mins. Expect to pay: 02 EUR – 02.50 EUR (Duration: 15mins)
Other options (bus): Taking N° 287 or N° 293 from the main bus station (Bahnhofplatz 1, city center).
Frequency: 20 – 30 mins (Duration: 25 – 30mins.)

Hotels

-  [Hotel Altmanns Stube](#)
-  [A.B. Hotel](#)
-  [NIU Cure](#)

Apartments

-  [Zeitwohnhaus](#)
-  [NIU Cure – Hipster Studio](#)
-  [Hotel Kral – Wohnen auf Zeit](#)

Restaurants

-  [Steinbachbräu \(Brewhouse\).](#)
-  [Alter Simpl \(Franconian\).](#)
-  [Spezerei \(Franconian\).](#)



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UNTERSTÜTZT VON / SUPPORTED BY



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HUMBOLDT
STIFTUNG



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di Bari