



LAMARR

INSTITUTE FOR
MACHINE LEARNING
AND ARTIFICIAL
INTELLIGENCE

Lab Visits 2026 Hybrid Machine Learning

Ramsés J. Sánchez

Partner institutions:



Institutionally funded by:

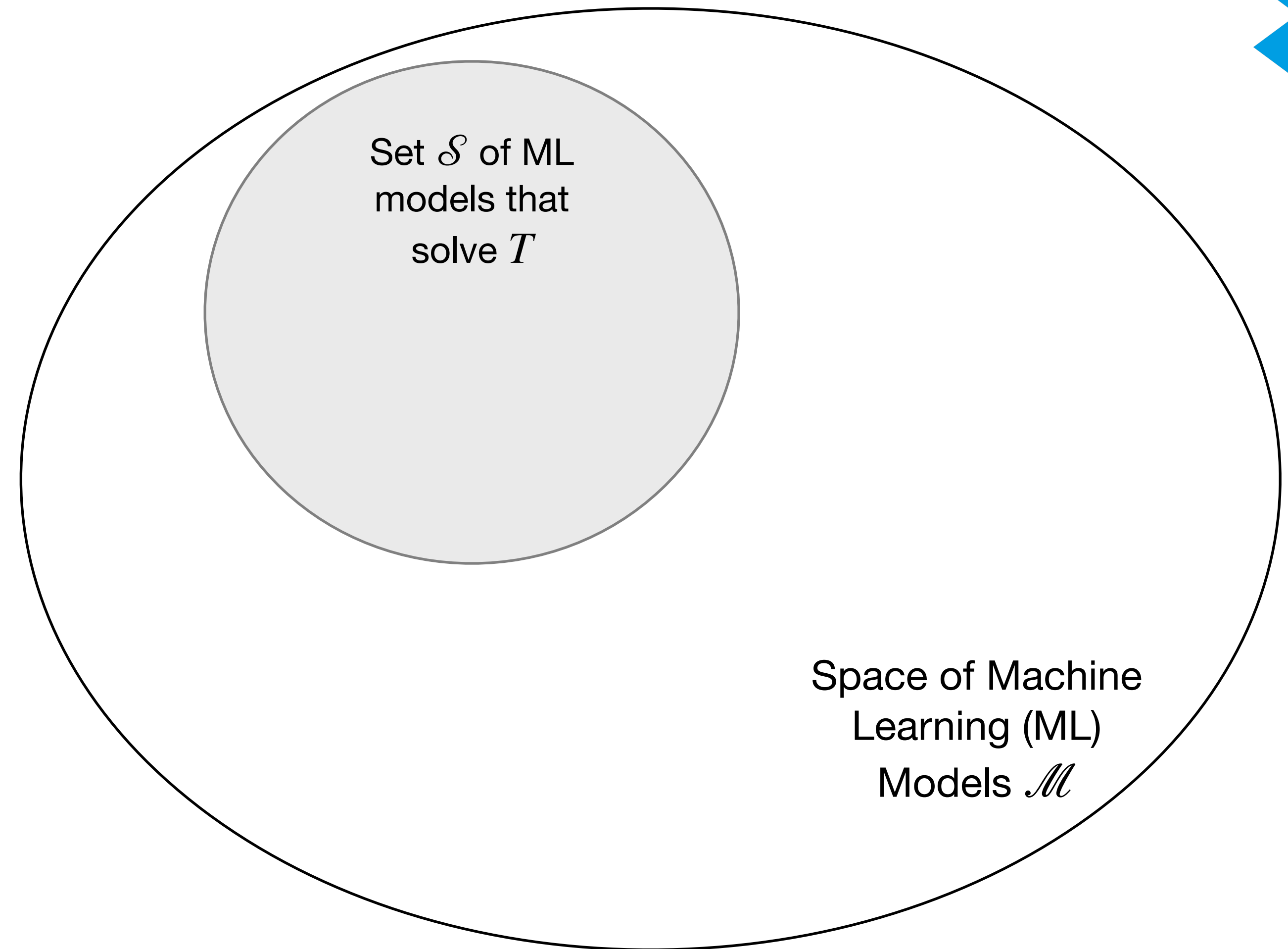


Ministerium für
Kultur und Wissenschaft
des Landes Nordrhein-Westfalen



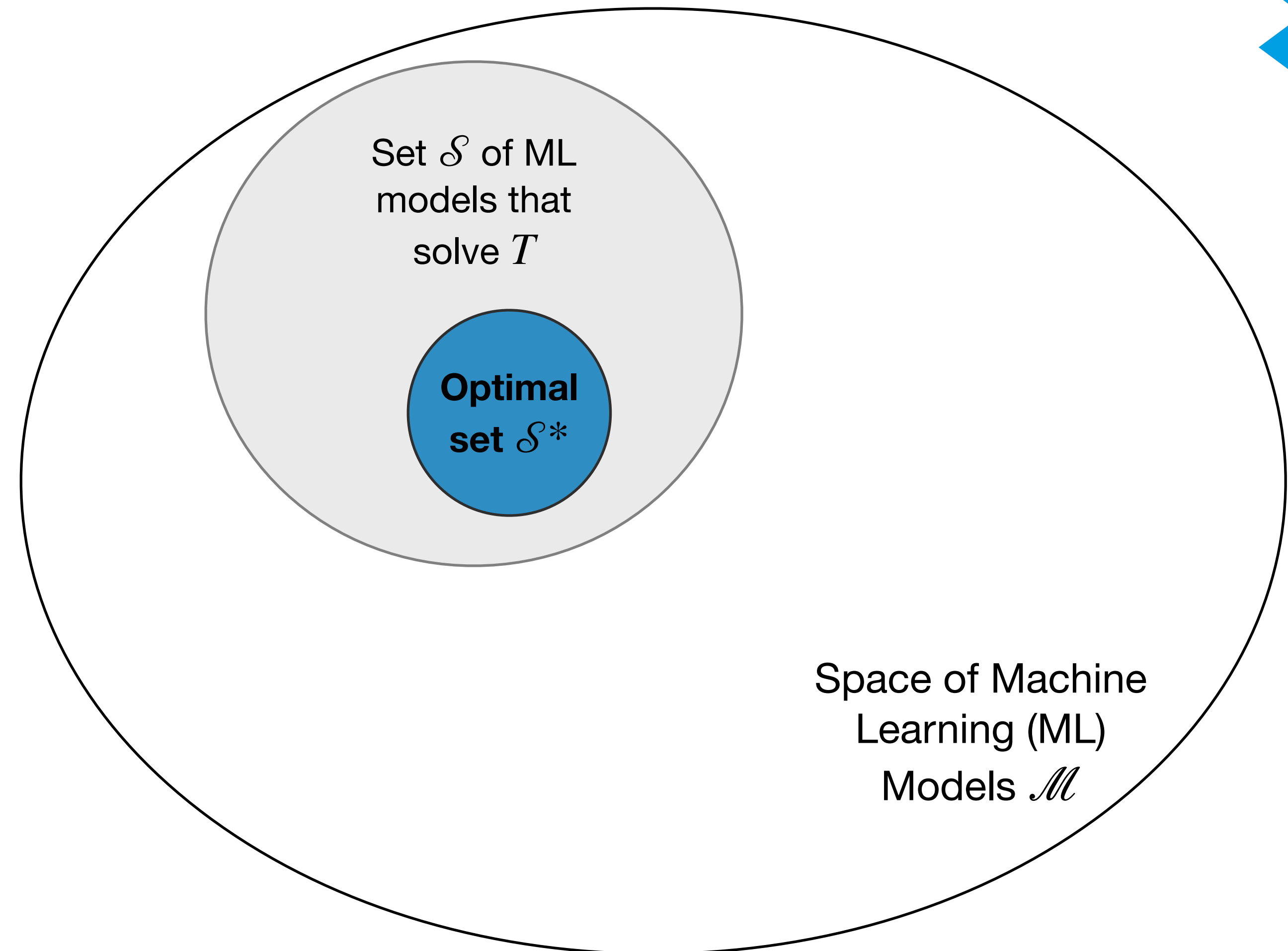
Hybrid Machine Learning Research

Assume we are given a task T



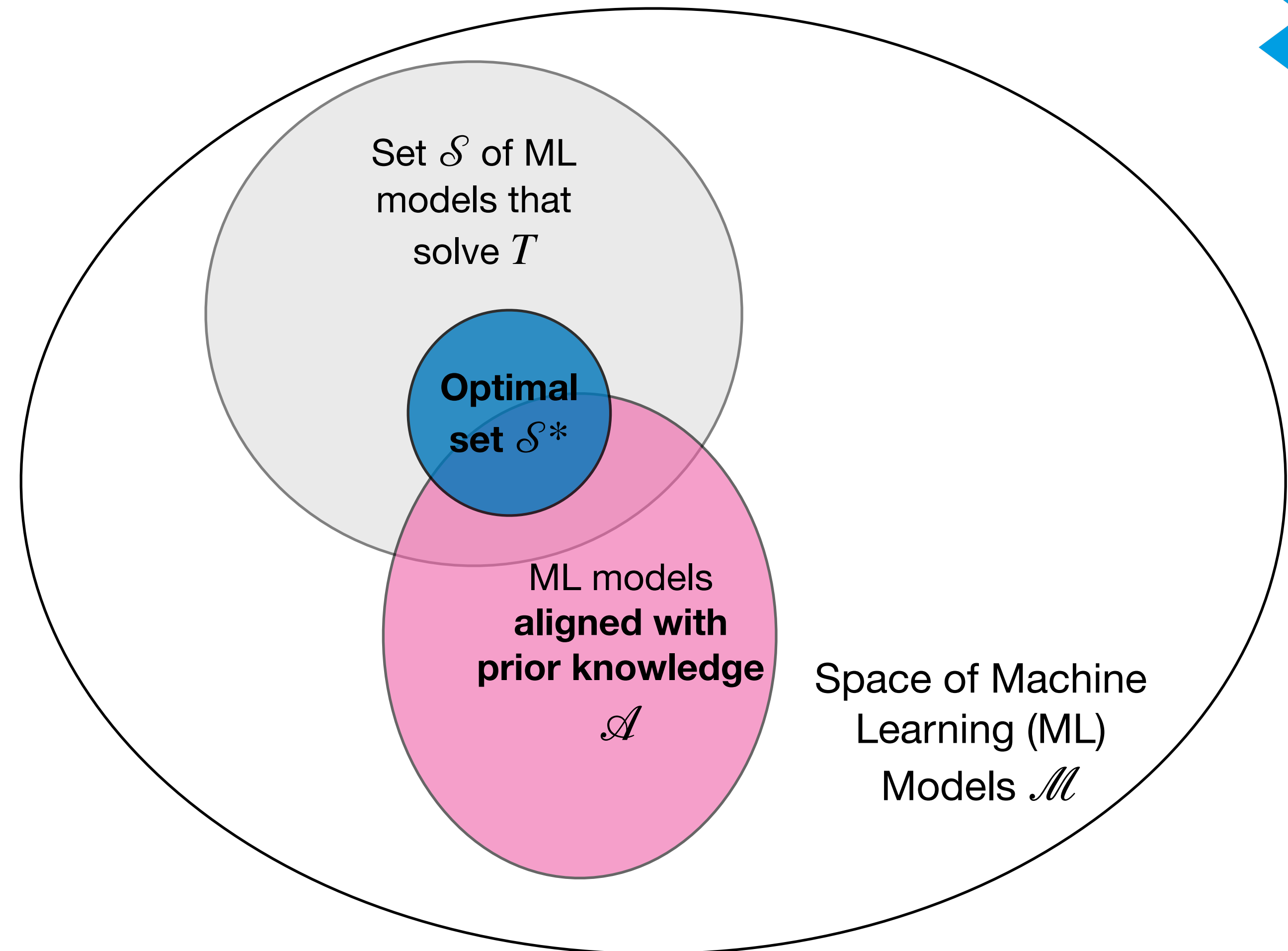
Hybrid Machine Learning Research

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Hybrid Machine Learning Research

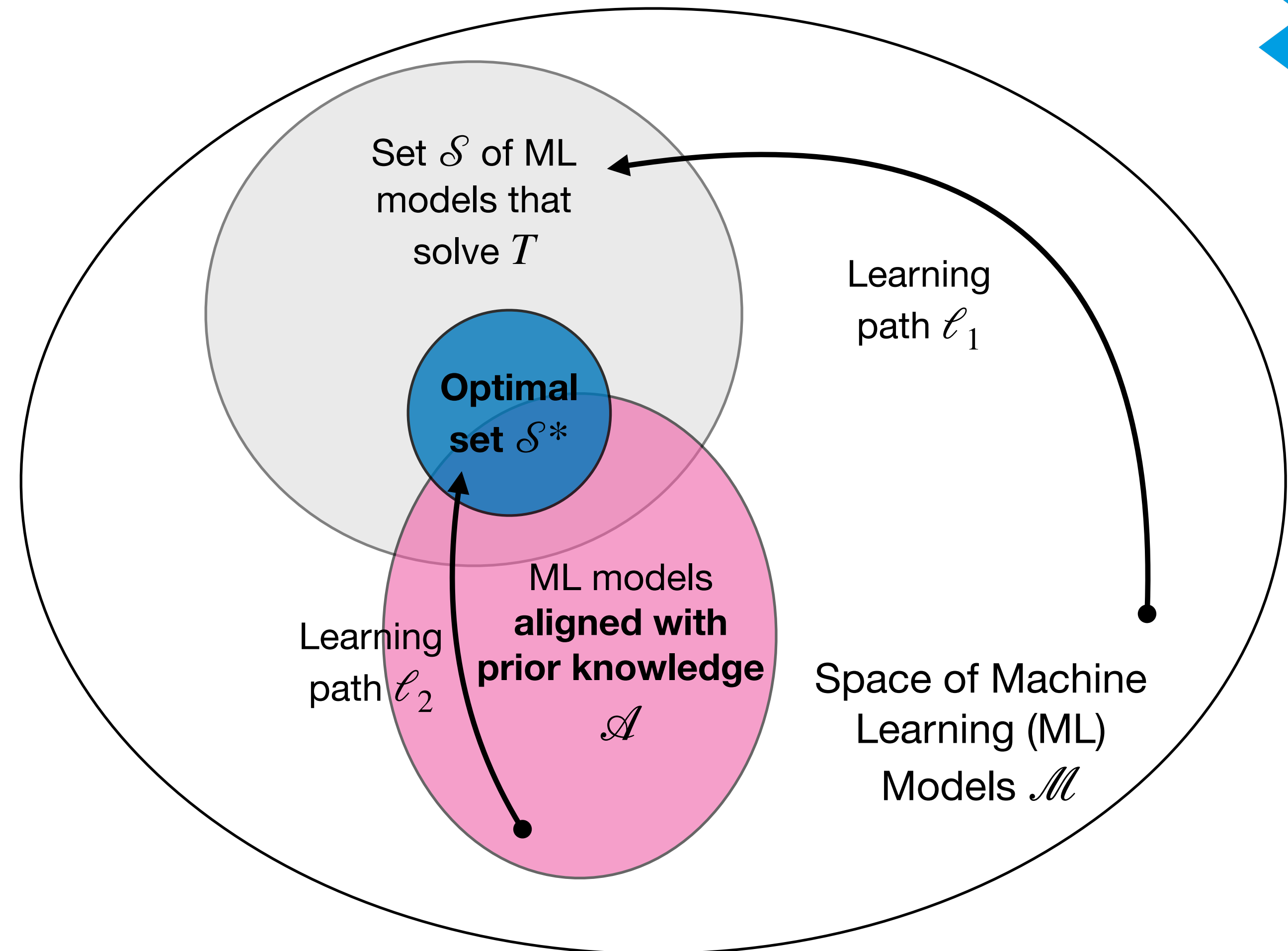
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Hypothesis 1: $\mathcal{A} \cap \mathcal{S}^* \neq \emptyset$

Hybrid Machine Learning Research

Assume we are given a task T



Hypothesis 1: $\mathcal{A} \cap \mathcal{S}^* \neq \emptyset$

Hypothesis 2: ℓ_2 is more easily “travelled” than ℓ_1



Hybrid Machine Learning Research

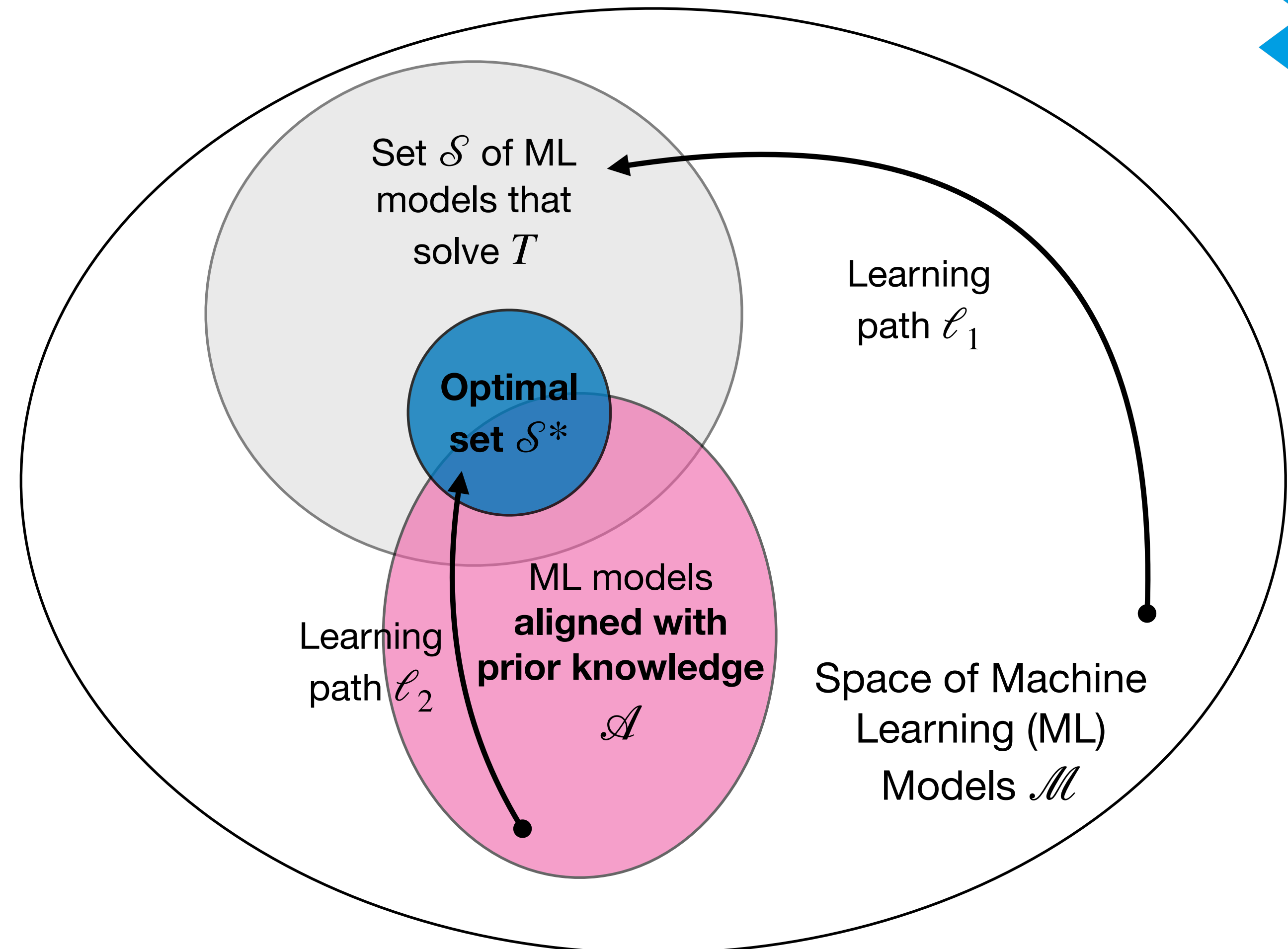
Applied Machine Learning

Research Direction 1: *Align* machine learning representations with *prior structured knowledge* (i.e. *compressed representations* from mathematics and the sciences)

Theoretical Machine Learning

Research Direction 2: Ground representation learning in *discrete mathematics, geometry, group theory, probability theory, information theory, and statistical mechanics*

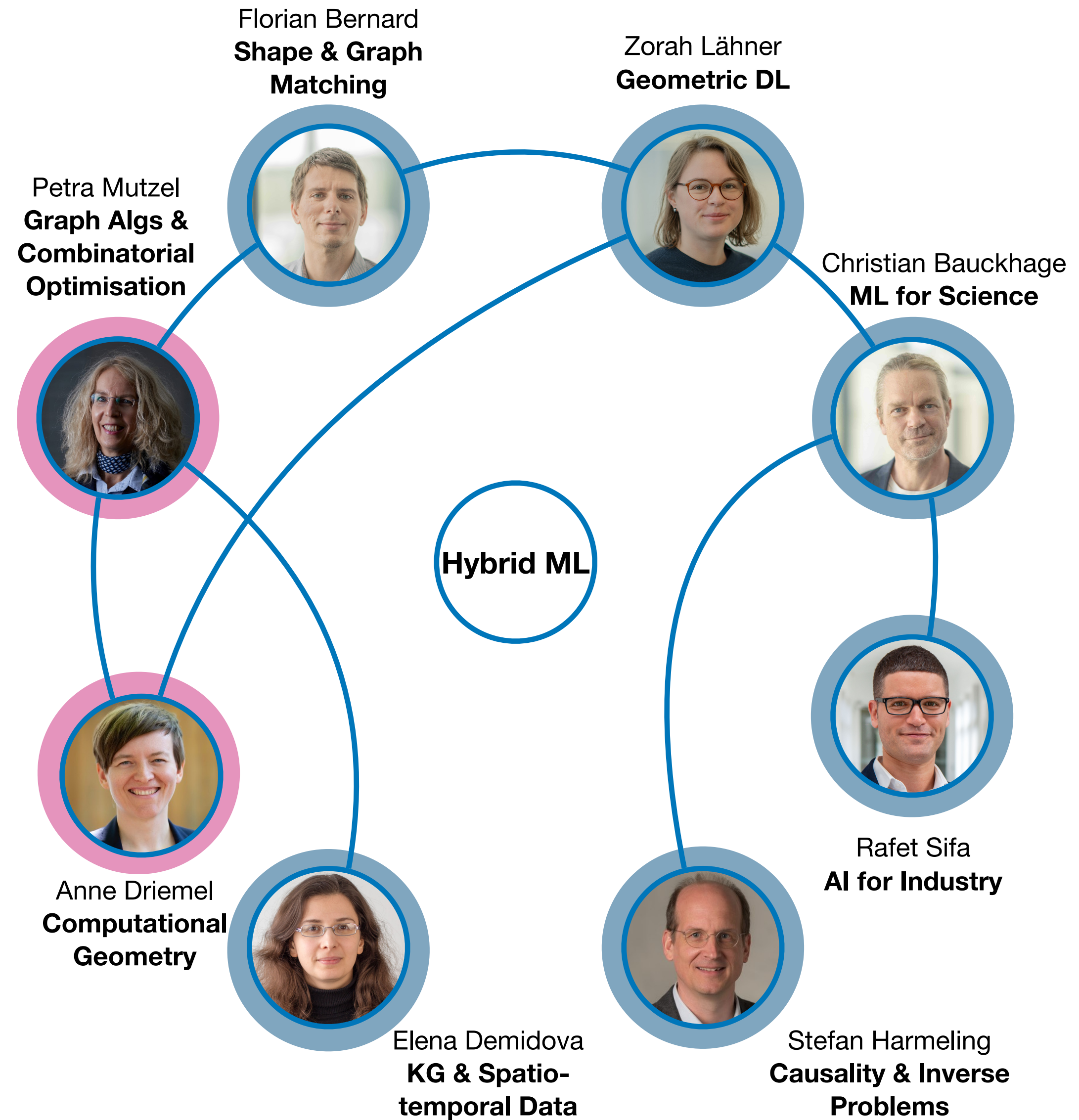
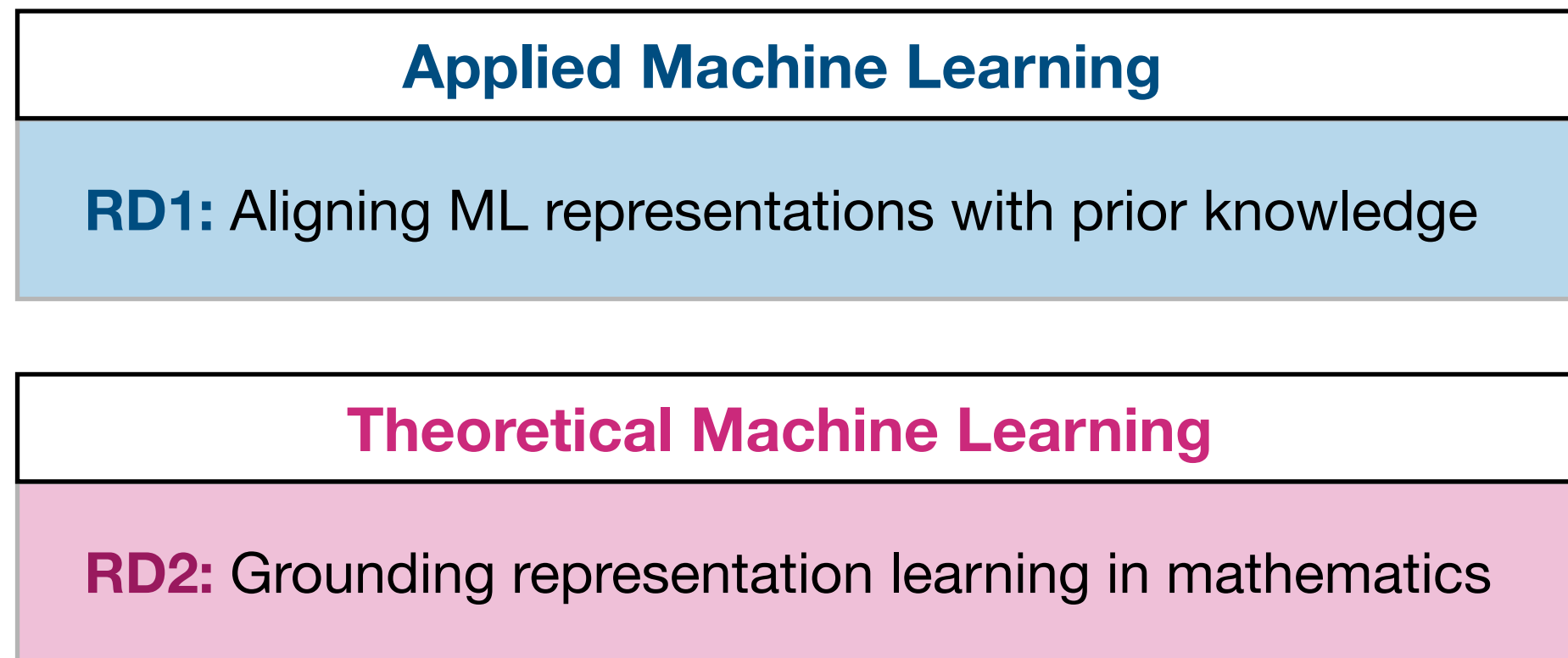
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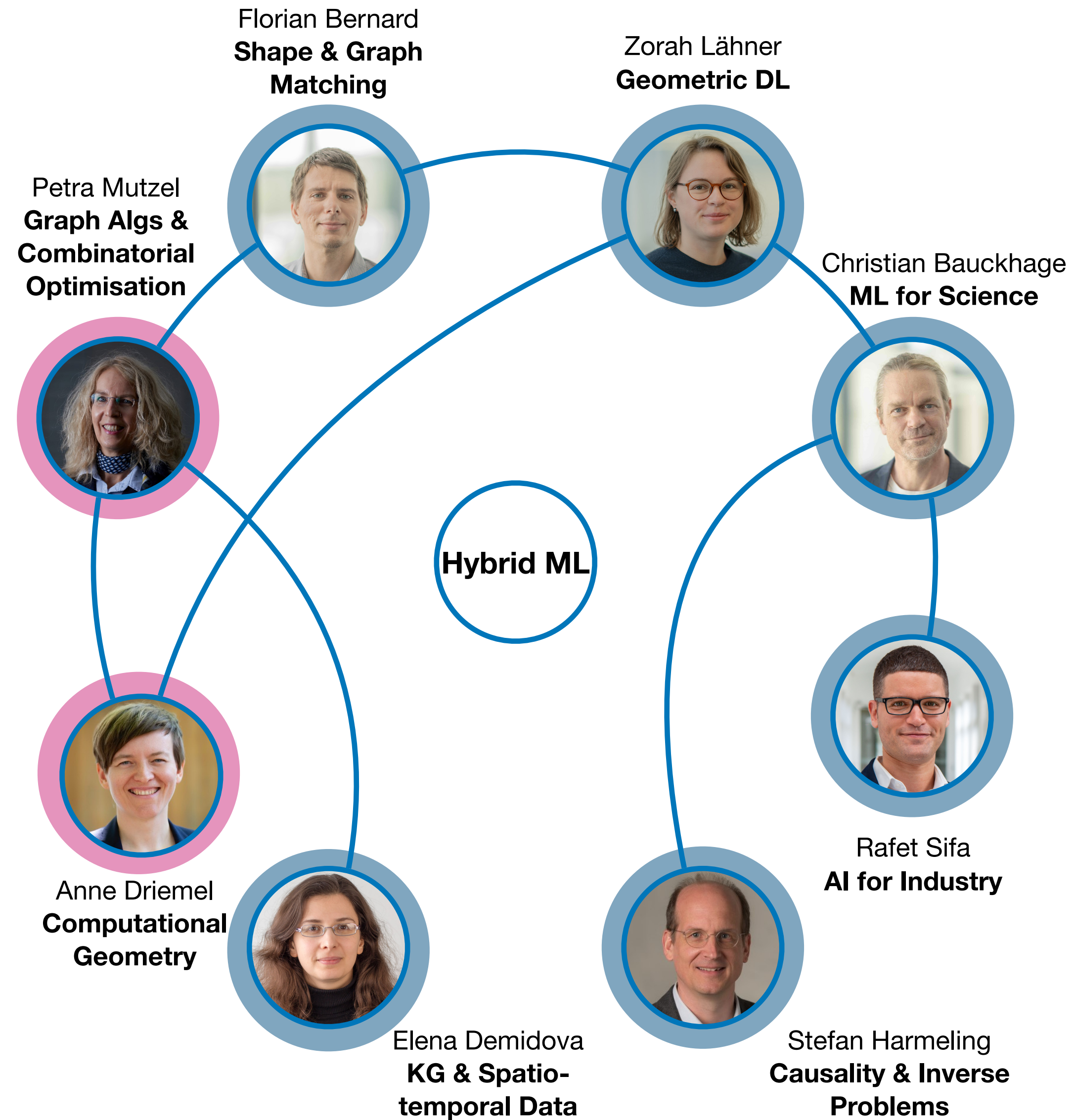
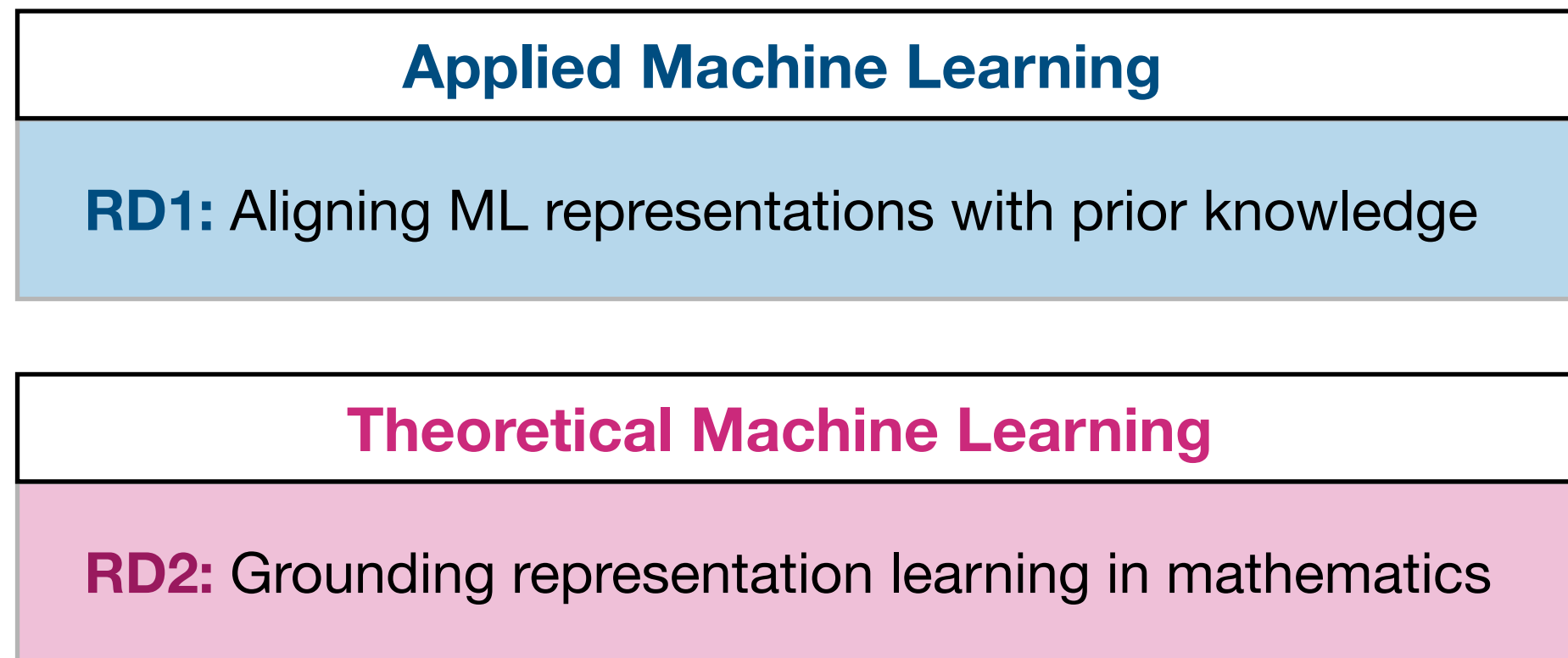
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Hybrid Machine Learning Research



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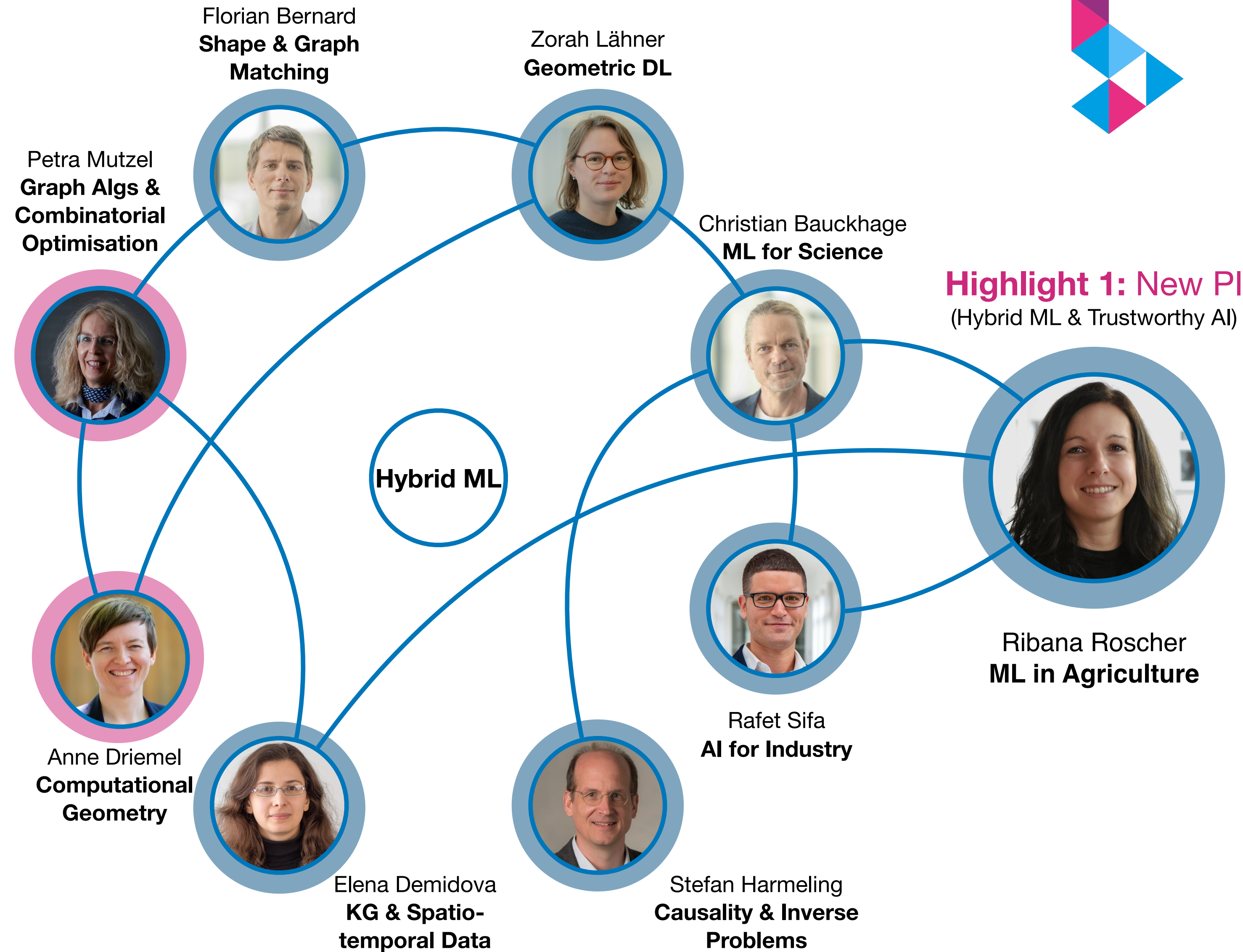
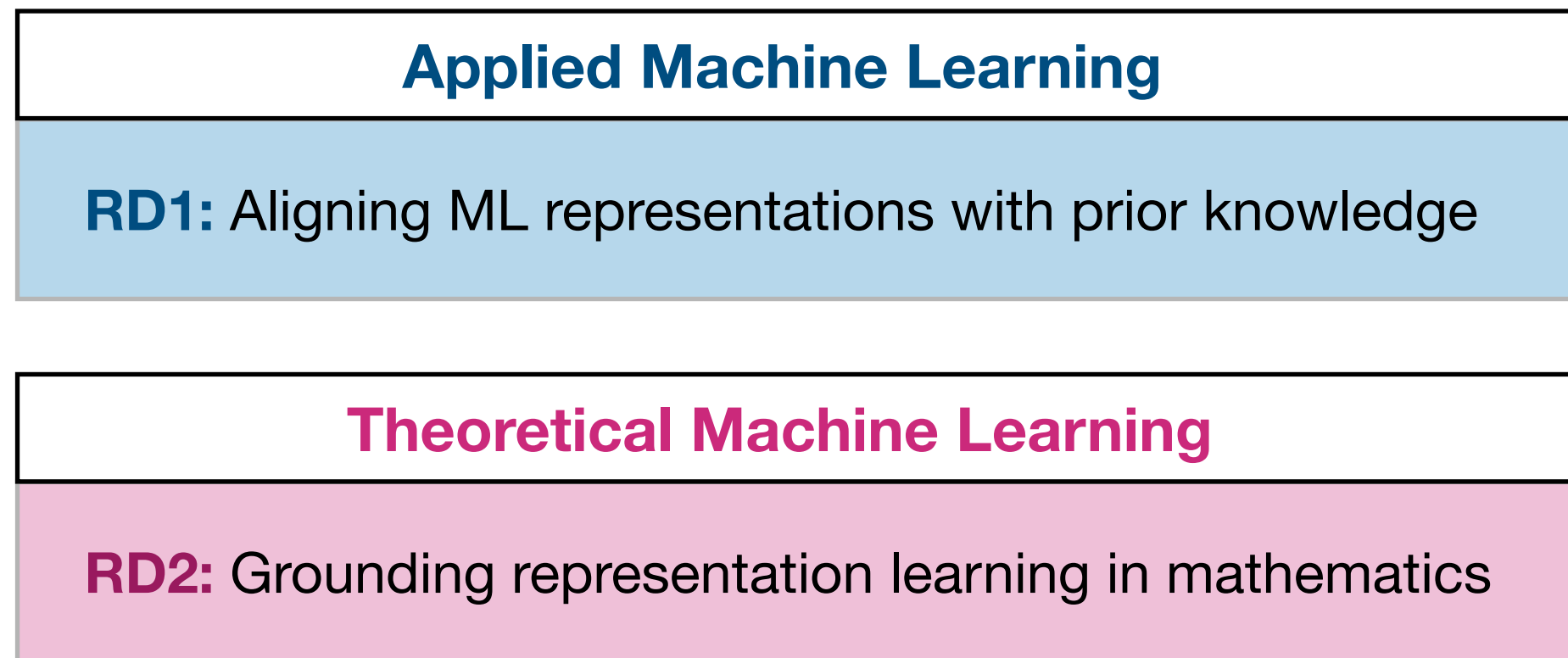


Highlight 1: New PI
(Hybrid ML & Trustworthy AI)



Ribana Roscher
ML in Agriculture

Hybrid Machine Learning Research



Highlight 1: New PI
(Hybrid ML & Trustworthy AI)

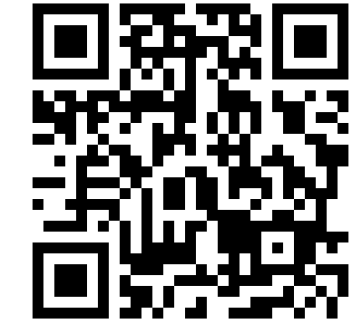
Highlight 2



Zorah Löhner
Geometric DL

MoAngelo: Motion-Aware Neural Surface Reconstruction for Dynamic Scenes

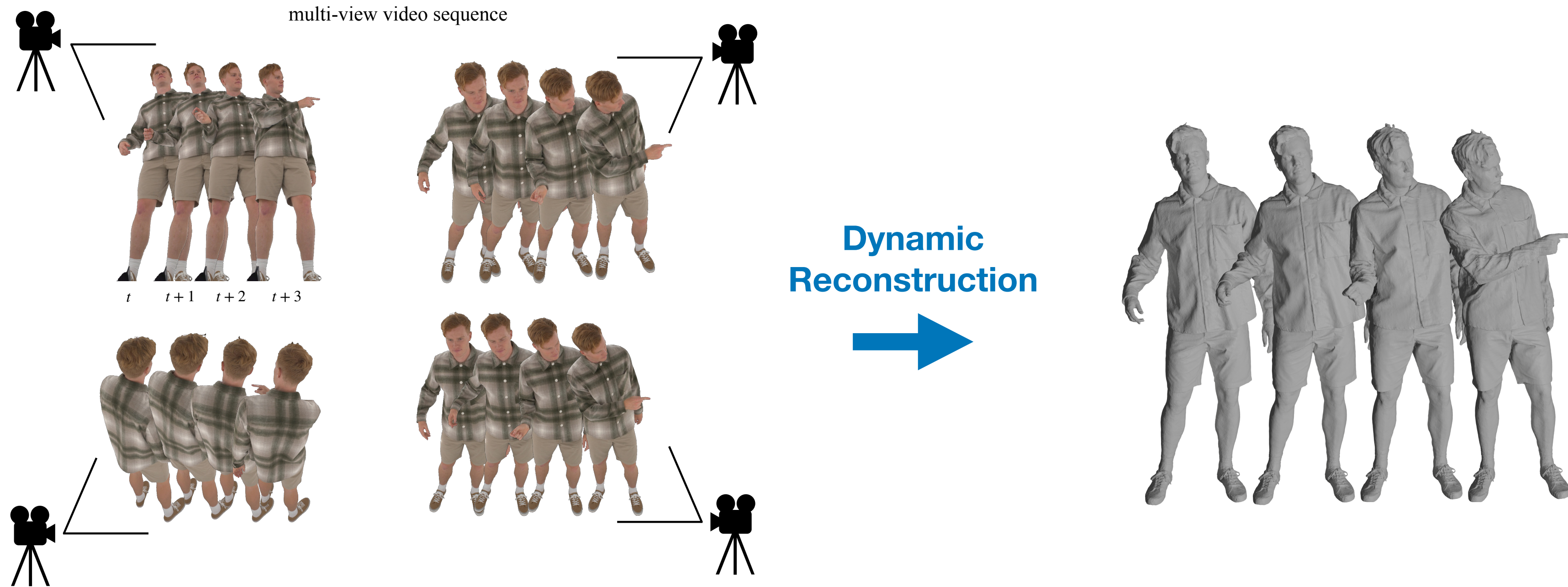
Mohamed Ebbed Zorah Löhner



Link to paper



3DV2026



Key idea: start from a strong static 3D surface and then learn how it deforms and is refined over time.

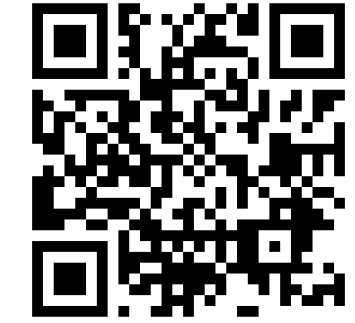
Highlight 3



Florian Bernard
Shape & Graph
Matching

Symmetry Informative and Agnostic Feature Disentanglement for 3D Shapes

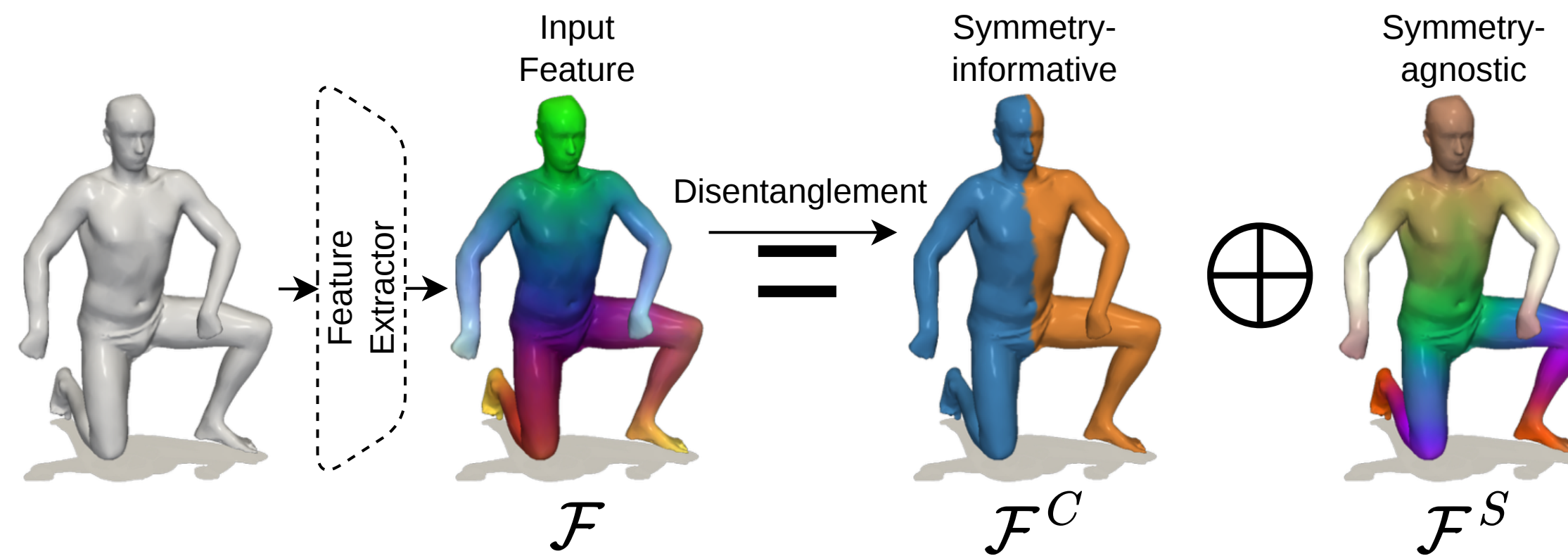
Tobias Weißberg Weikang Wang Paul Roetzer Nafie El Amrani Florian Bernard



Link to paper



3DV2026



This work is based on their earlier **ICCV25** paper

χ : Symmetry Understanding of 3D Shapes via Chirality Disentanglement

Weikang Wang* Tobias Weißberg* Nafie El Amrani Florian Bernard

Highlight 4



Stefan Harmeling
Causality & Inverse Problems

Unsupervised Coherent Noise Removal From Seismological Distributed Acoustic Sensing Data

Sebastian Konietzny¹ , Voon Hui Lai² , Meghan S. Miller² , John Townend³ , and Stefan Harmeling¹

Journal of Geophysical Research (2024)

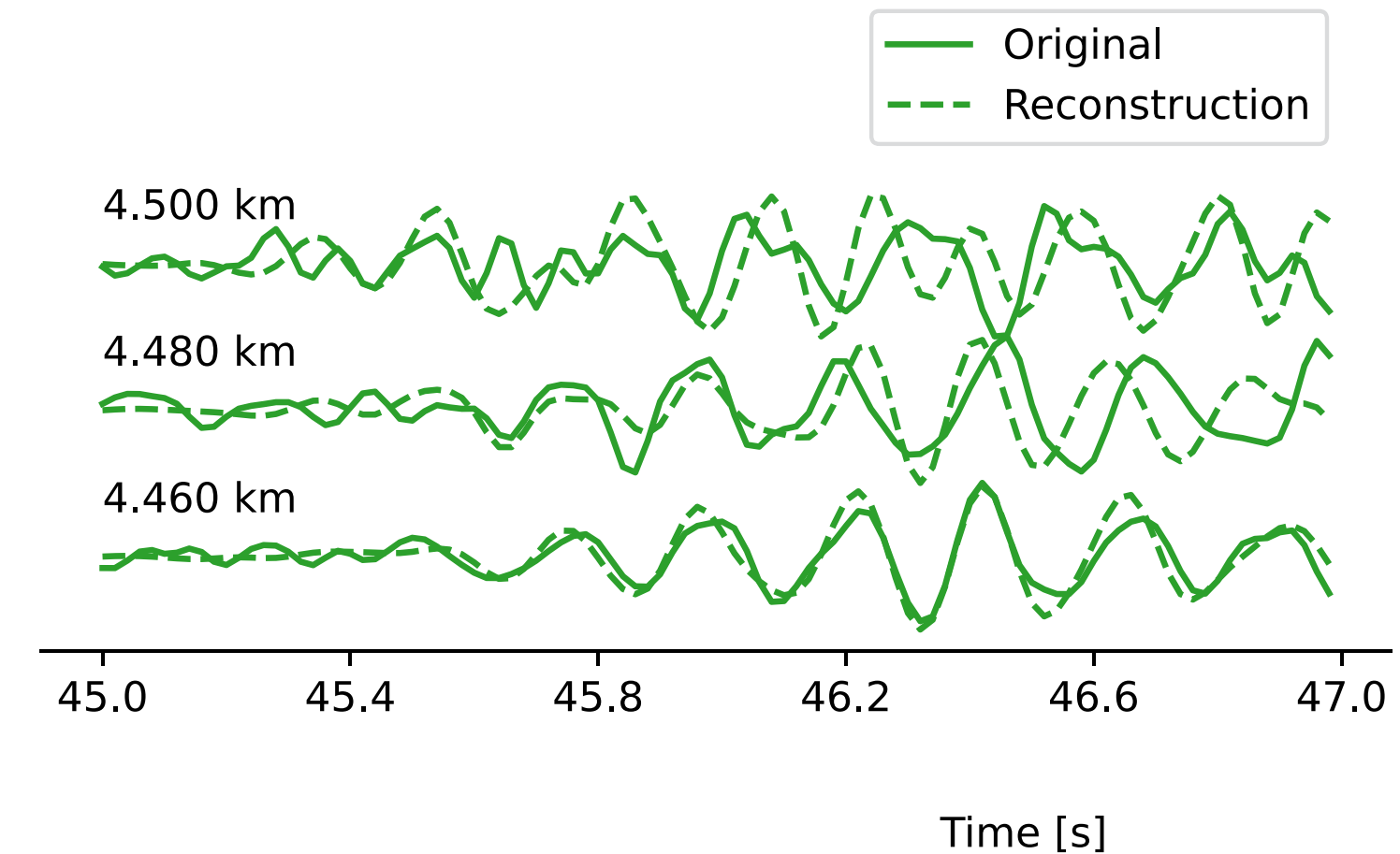
Key idea: self-supervised denoiser that uses motion-aware masking to remove coherent traffic noise from (DAS) earthquake data

RELATIVE VALUE LEARNING

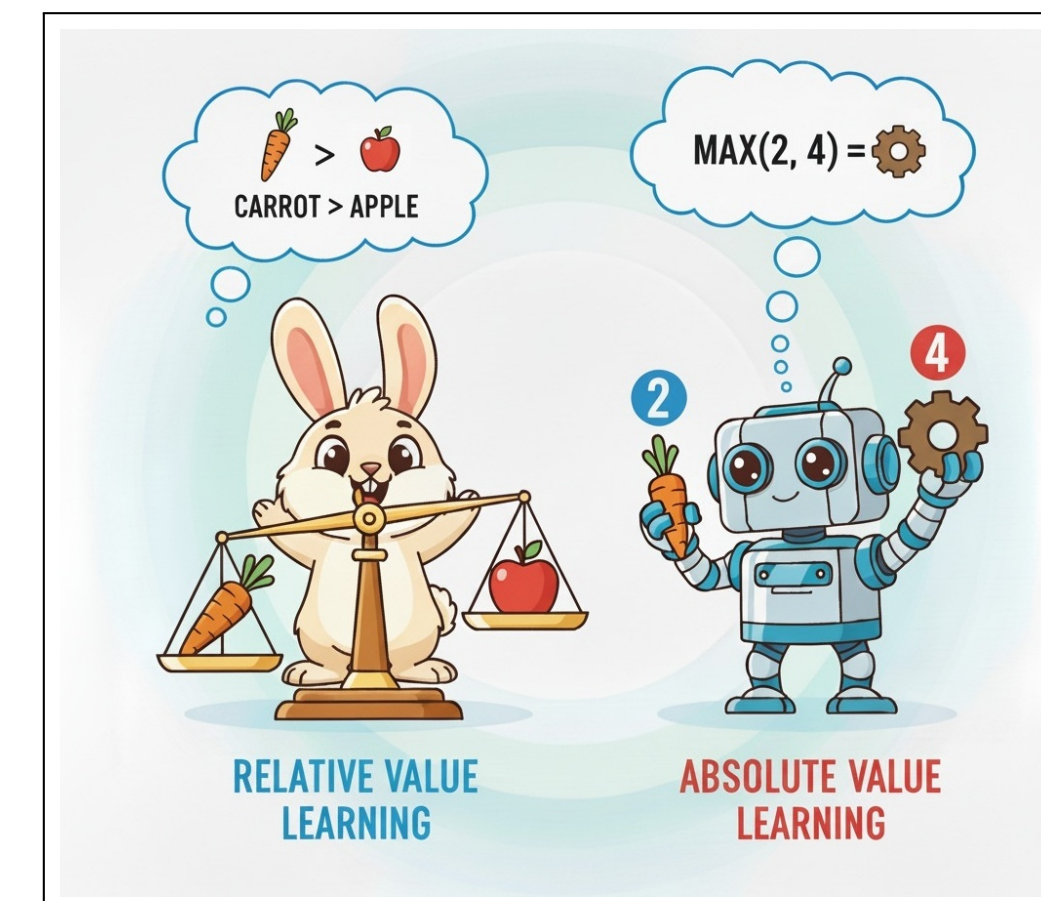
Marc Höftmann, Jan Robine & Stefan Harmeling

ICLR-26

Key idea: the RL critic learns pairwise value differences between states instead of absolute state values.



Link to paper



Link to paper

Highlight 5



Elena Demidova
KG & Spatio-temporal Data



The **SecureNeuroAI** Project, funded by the BMFTR since **July 2025**, develops neuro-symbolic AI to safeguard medical devices by detecting epileptic seizures and cyberattacks at the same time.



SECURE NEURO AI



[Link to project page](#)

Highlight 6: *Amortised Inference* Reading Group



Lamarr's Deep Learning for Scientific Discovery Group



Katharina Eggensperger
(Resource-aware ML)



Matthias Feurer
(Resource-aware ML)



Oliver Rauh



Niklas Hartung



Cesar Ojeda



Paul Bürkner
(TU Dortmund)



Highlight 6: Amortised Inference Reading Group



What do we mean by amortised inference?

$$\mathcal{D} = \{x^{(1)}, \dots, x^{(N)}\} \stackrel{\text{iid}}{\sim} p(x | \theta)p(\theta)$$

Data Prior over latent variables (θ), which can represent causal graphs, differential equations, programs, functions, finite parameters, etc.

Pretrain DL models on *synthetic data* to infer, in **zero-shot mode**:

1. Posterior distribution, given the data $p(\theta | \mathcal{D})$
2. Posterior predictive distribution, given the data

$$p(x | \mathcal{D}) = \int p(x | \theta)p(\theta | \mathcal{D})d\theta$$

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Niklas Hartung



Cesar Ojeda



News:

1. We had our first meeting on Feb 5 2026
2. We will have an informal session **Today at 2pm** about amortising linear regression

3. **Join us via Mattermost:**



Highlight 7



Cesar Ojeda

Niklas Hartung



Foundation Inference Model Program

Prior-fitted Networks For Pharma

Foundation Inference Models for Markov Jump Processes

David Berghaus^{1,2}, Kostadin Cvejovski^{1,2}, Patrick Seifner^{1,3}
César Ojeda⁴ & Ramsés J. Sánchez^{1,2,3}

[NeurIPS-24]

ZERO-SHOT IMPUTATION WITH FOUNDATION INFERENCE MODELS FOR DYNAMICAL SYSTEMS

Patrick Seifner^{1,2}, Kostadin Cvejovski^{1,3}, Antonia Körner² & Ramsés J. Sánchez^{1,2,3}

[ICLR-25]

Amortized In-Context Mixed Effect Transformer Models: A Zero-Shot Approach for Pharmacokinetics

Cesar Ojeda, Niklas Hartung, Wilhelm Huisinga, Ramsés J. Sánchez

[AISTATS-26]

In-Context Learning of Stochastic Differential Equations with Foundation Inference Models

Patrick Seifner^{1,2}, Kostadin Cvejovski^{1,3}, David Berghaus^{1,3}
César Ojeda⁴ & Ramsés J. Sánchez^{1,2,3}

[NeurIPS-25]

IN-CONTEXT LEARNING OF TEMPORAL POINT PROCESSES WITH FOUNDATION INFERENCE MODELS

David Berghaus^{1,2}, Patrick Seifner^{1,3}, Kostadin Cvejovski⁴,
César Ojeda⁵ & Ramsés J. Sánchez^{1,2,3}

[ICLR-26]

Prior-Fitted Functional Flow: In-Context Generative Models for Pharmacokinetics

Cesar Ojeda, Niklas Hartung, Purity Kamene Kaywele, Tim Jahn, Piyush Kumar, Marian Klose, Wilhelm Huisinga, Ramsés J. Sánchez, Darius A. Faroughy

[Under Review at UAI-26]

Foundation Inference Models for Ordinary Differential Equations

Maximilian Maue^{1*}, Johannes R. Hübers^{2,3*}, David Berghaus^{2,3}, Patrick Seifner^{1,2}, Ramsés J. Sánchez^{1,2,3}

[Under Review at ICML-26]

Check out our pretrained models & tutorials:

