Thomy Phan
Curriculum Vitae

Contact Information

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Research Interests

I am interested in various topics related to artificial intelligence, such as multi-agent systems, machine learning, pattern recognition, bio-inspired algorithms, automated planning, optimization, as well as validation and verification of self-learning systems. My current research focuses on *multi-agent learning for optimization* of large-scale distributed and intelligent systems such as warehouse automation, fleet management, and drone delivery.

Education

2018 – 2023 **Ph.D. in Computer Science**, *LMU Munich*, Germany
- Thesis: *"Emergence and Resilience in Multi-Agent Reinforcement Learning"*
  - Thesis committee: Claudia Linnhoff-Popien, Sven Koenig, Long Tran-Thanh
  - Based on work published at AAMAS, AAAI, IJCAI, NeurIPS, and ICML

2015 – 2017 **M.Sc. in Computer Science**, *LMU Munich*, Germany
- Focus on artificial intelligence, data science, and autonomous systems
- Master thesis: *"EVADE: Emergent Value Function Approximation for Distributed Environments"*
  - Supervision: Claudia Linnhoff-Popien, Lenz Belzner
  - Results published at AAMAS 2018 as a full conference paper

2011 – 2015 **B.Sc. in Computer Science**, *Munich University of Applied Sciences*, Germany
- Collaborative study program (duales Studium) with the City of Munich
- Focus on software development and image processing
- Bachelor thesis: *"Quantification and Feature Extraction of 3D Single-Molecule Switching Microscopy Data"*
  - Supervision: Alfred Nischwitz, Joerg Bewersdorf
  - Practical work done at Bewersdorf Lab, Yale School of Medicine
  - Results published in Cell 2016 as a journal paper (cover story)

Professional Experience

2023 – Present **Postdoctoral Scholar**, *University of Southern California*, Los Angeles, CA, USA
- Advisor: Sven Koenig
- Focus on multi-agent learning for optimization.

2017 – 2023 **Research Assistant**, *LMU Munich*, Germany
- Advisor: Claudia Linnhoff-Popien
- Focus on emergence and resilience in multi-agent systems.

| 2015 – 2018 | **Software Developer**, *it@M, City of Munich*, Germany |
| | Development, maintainance, and integration of business applications (part-time). |

Internships

2015	**Visiting Scholar in Research (3 Months)**, *Yale University*, New Haven, CT, USA
	- Advisor: Joerg Bewersdorf
	- Focus on data analysis and feature extraction of cellular structures in super-resolution microscopy data. Co-authored publication in Cell 2016 (cover story).
2012 – 2014	**Working Student (Collaborative Study Program)**, *City of Munich*, Germany
	Regular internships focusing on IT architecture, project management, and software development during the semester holidays.

Honors and Awards

2023	**Top Reviewer**, *Conference on Neural Information Processing Systems (NeurIPS)*, New Orleans, LA, USA
2022	**Premier Paper of AAMAS 2022**, *Journal of the International Foundation for Autonomous Agents and Multi-Agent Systems (JAAMAS)*
	Fast-track invitation to submit an extended version of our AAMAS 2022 paper *"Emergent Cooperation from Mutual Acknowledgment Exchange"* (main author).
2022	**Highlight Paper at the Workshop on Ad Hoc Teamwork**, *International Joint Conference on Artificial Intelligence (IJCAI)*, Vienna, Austria
	Recognition of our AAMAS 2022 paper *"Emergent Cooperation from Mutual Acknowledgment Exchange"* (main author).
2022	**Top 10% Reviewer**, *International Conference on Machine Learning (ICML)*, Baltimore, MD, USA
2021	**ICAART 2021 – Springer Selection**, *Lecture Notes in Artificial Intelligence*
	Fast-track invitation to submit an extended version of our ICAART 2021 paper *"SAT-MARL: Specification Aware Training in Multi-Agent Reinforcement Learning"* (co-author).
2019	**Travel Grant for AAMAS 2019**, *DAAD*, Montreal, Canada
2016	**Best Bachelor Award**, *Rohde & Schwarz GmbH & Co. KG*, Munich, Germany
2016	**Award for an Outstanding Bachelor Thesis in the Field of Image Processing**, *Stemmer Imaging GmbH*, Munich, Germany
2012 – 2017	**Scholarship**, *Studienstiftung des Deutschen Volkes*, Munich, Germany
	In Germany, the top 0.5% of university or high school students get selected for funding by the German Academic Scholarship Foundation.

Research Projects

2023 – Present	**AI4OPT – AI Institute for Advances in Optimization**, *National Science Foundation*, Los Angeles, CA, USA
	Research on multi-agent learning for optimization.
2023	**Dependability of Machine Learning in Industrial Robotics**, *Siemens AG*, Munich, Germany
	Research on robust machine learning in industrial robotics. Assisted acquisition.

2022 – 2024	**AI-Fusion – Evaluation of Emergence in Distributed Intelligent Systems**, *Bavarian Ministry of Economic Affairs, Regional Development, and Energy*, Munich, Germany
	Research on emergence in multi-agent learning in collaboration with Fraunhofer IKS. Assisted acquisition.
2022	**Validation and Verification of Modular Machine Learning Systems**, *Siemens AG*, Munich, Germany
	Research on modular machine learning. Assisted acquisition.
2020 – 2021	**Federated Learning in Industrial Environments**, *Siemens AG*, Munich, Germany
	Research on adaptive testing of federated learning systems. Assisted acquisition.
2019	**Dependability of Machine Learning in Industrial Environments**, *Siemens AG*, Munich, Germany
	Research on resilience in multi-agent reinforcement learning.
2018	**Coevolution in Machine Learning Based Industrial Environments**, *Siemens AG*, Munich, Germany
	Research on scenario coevolution in reinforcement learning.
2017 – 2023	**InnoMI – Innovation Center Mobile Internet**, *Bavarian Ministry of Economic Affairs, Regional Development, and Energy*, Munich, Germany
	Research on innovative mobile and distributed applications.

Selected Publications

Conferences

2024	[C15]	**Adaptive Anytime Multi-Agent Path Finding using Bandit-Based Large Neighborhood Search**
		Thomy Phan, Taoan Huang, Bistra Dilkina, and Sven Koenig.
		AAAI Conference on Artificial Intelligence (AAAI), 2024. To appear.
2023	[C14]	**Attention-Based Recurrence for Multi-Agent Reinforcement Learning under Stochastic Partial Observability**
		Thomy Phan, Fabian Ritz, Philipp Altmann, Maximilian Zorn, Jonas Nüßlein, Michael Kölle, Thomas Gabor, and Claudia Linnhoff-Popien.
		International Conference on Machine Learning (ICML), pages 27840–27853, 2023.
	[C13]	**CROP: Towards Distributional-Shift Robust Reinforcement Learning using Compact Reshaped Observation Processing**
		Philipp Altmann, Leonard Feuchtinger, Fabian Ritz, Jonas Nüßlein, Claudia Linnhoff-Popien, and Thomy Phan.
		International Joint Conference on Artificial Intelligence (IJCAI), pages 3414–3422, 2023.
2022	[C12]	**Emergent Cooperation from Mutual Acknowledgment Exchange**
		Thomy Phan, Felix Sommer, Philipp Altmann, Fabian Ritz, Lenz Belzner, and Claudia Linnhoff-Popien.
		International Conference on Autonomous Agents and Multiagent Systems (AAMAS), pages 1047–1055, 2022.
	[C11]	**Towards Anomaly Detection in Reinforcement Learning (Blue Sky Ideas)**
		Robert Müller, Steffen Illium, Thomy Phan, Tom Haider, and Claudia Linnhoff-Popien.
		International Conference on Autonomous Agents and Multiagent Systems (AAMAS), pages 1799–1803, 2022.
2021	[C10]	**VAST: Value Function Factorization with Variable Agent Sub-Teams**
		Thomy Phan, Fabian Ritz, Lenz Belzner, Philipp Altmann, Thomas Gabor, and Claudia Linnhoff-Popien.
		Advances in Neural Information Processing Systems (NeurIPS), pages 24018–24032, 2021.
	[C9]	**Resilient Multi-Agent Reinforcement Learning with Adversarial Value Decomposition**
		Thomy Phan, Lenz Belzner, Thomas Gabor, Andreas Sedlmeier, Fabian Ritz, and Claudia Linnhoff-Popien.
		AAAI Conference on Artificial Intelligence (AAAI), pages 11308–11316, 2021.

	[C8]	**SAT-MARL: Specification Aware Training in Multi-Agent Reinforcement Learning** Fabian Ritz, <u>Thomy Phan</u>, Robert Müller, Thomas Gabor, Andreas Sedlmeier, Marc Zeller, Jan Wieghardt, Reiner Schmid, Horst Sauer, Cornel Klein, and Claudia Linnhoff-Popien. *International Conference on Agents and Artificial Intelligence (ICAART)*, pages 28—37, 2021.
2020	[C7]	**A Quantum Annealing Algorithm for Finding Pure Nash Equilibria in Graphical Games** Christoph Roch, <u>Thomy Phan</u>, Sebastian Feld, Robert Müller, Thomas Gabor, Carsten Hahn, and Claudia Linnhoff-Popien. *International Conference on Computational Science (ICCS)*, pages 488–501, 2020.
	[C6]	**Learning and Testing Resilience in Cooperative Multi-Agent Systems** <u>Thomy Phan</u>, Thomas Gabor, Andreas Sedlmeier, Fabian Ritz, Bernhard Kempter, Cornel Klein, Horst Sauer, Reiner Schmid, Jan Wieghardt, Marc Zeller, and Claudia Linnhoff-Popien. *International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, pages 1055–1063, 2020.
2019	[C5]	**Adaptive Thompson Sampling Stacks for Memory Bounded Open-Loop Planning** <u>Thomy Phan</u>, Thomas Gabor, Robert Müller, Christoph Roch, and Claudia Linnhoff-Popien. *International Joint Conference on Artificial Intelligence (IJCAI)*, pages 5607–5613, 2019.
	[C4]	**Subgoal-Based Temporal Abstraction in Monte-Carlo Tree Search** Thomas Gabor, Jan Peter, <u>Thomy Phan</u>, Christian Meyer, and Claudia Linnhoff-Popien. *International Joint Conference on Artificial Intelligence (IJCAI)*, pages 5562–5568, 2019.
	[C3]	**Scenario Co-Evolution for Reinforcement Learning on a Grid World Smart Factory Domain** Thomas Gabor, Andreas Sedlmeier, Marie Kiermeier, <u>Thomy Phan</u>, Marcel Henrich, Monika Pichlmair, Bernhard Kempter, Cornel Klein, Horst Sauer, Reiner Schmid, and Jan Wieghardt. *Genetic and Evolutionary Computation Conference (GECCO)*, pages 898–906, 2019.
	[C2]	**Memory Bounded Open-Loop Planning in Large POMDPs using Thompson Sampling** <u>Thomy Phan</u>, Lenz Belzner, Marie Kiermeier, Markus Friedrich, Kyrill Schmid, and Claudia Linnhoff-Popien. *AAAI Conference on Artificial Intelligence (AAAI)*, pages 7941–7948, 2019.
2018	[C1]	**Leveraging Statistical Multi-Agent Online Planning with Emergent Value Function Approximation** <u>Thomy Phan</u>, Lenz Belzner, Thomas Gabor, and Kyrill Schmid. *International Conference on Autonomous Agents and Multiagent Systems (AAMAS)*, pages 730–738, 2018.

Journals

2023	[J5]	**Emergent Cooperation from Mutual Acknowledgment Exchange in Multi-Agent Reinforcement Learning** <u>Thomy Phan</u>, Felix Sommer, Fabian Ritz, Philipp Altmann, Jonas Nüßlein, Michael Kölle, Lenz Belzner, and Claudia Linnhoff-Popien. *Journal on Autonomous Agents and Multi-Agent Systems (JAAMAS)*, 2023. Invited from AAMAS 2022.
2022	[J4]	**Specification Aware Multi-Agent Reinforcement Learning** Fabian Ritz, <u>Thomy Phan</u>, Robert Müller, Thomas Gabor, Andreas Sedlmeier, Marc Zeller, Jan Wieghardt, Reiner Schmid, Horst Sauer, Cornel Klein, and Claudia Linnhoff-Popien. *Springer Book of ICAART 2021*, pages 3–21, 2022. Invited from ICAART 2021.
2021	[J3]	**Productive Fitness in Diversity-Aware Evolutionary Algorithms** Thomas Gabor, <u>Thomy Phan</u>, and Claudia Linnhoff-Popien. *Natural Computing*, 20(3): 363–376, 2021.
2020	[J2]	**The Scenario Coevolution Paradigm: Adaptive Quality Assurance for Adaptive Systems** Thomas Gabor, Andreas Sedlmeier, <u>Thomy Phan</u>, Fabian Ritz, Marie Kiermeier, Lenz Belzner, Bernhard Kempter, Cornel Klein, Horst Sauer, Reiner Schmid, Jan Wieghardt, Marc Zeller, and Claudia Linnhoff-Popien. *International Journal on Software Tools for Technology Transfer (STTT)*, 22(4): 457–476, 2020.

2016	[J1]	**Ultra-High Resolution 3D Imaging of Whole Cells (Cover Story)**

Fang Huang, George Sirinakis, Edward S Allgeyer, Lena K Schroeder, Whitney C Duim, Emil B Kromann, Thomy Phan, Felix E Rivera-Molina, Jordan R Myers, Irnov Irnov, Mark Lessard, Yongdeng Zhang, Mary Ann Handel, Christine Jacobs-Wagner, C Patrick Lusk, James E Rothman, Derek Toomre, Martin J Booth, and Joerg Bewersdorf.
Cell, 166(4): 1028–1040, 2016.

Workshops

Workshop papers with a conference or journal version are not listed.

2023 [W3] DIRECT: Learning from Sparse and Shifting Rewards using Discriminative Reward Co-Training
Philipp Altmann, Thomy Phan, Fabian Ritz, Thomas Gabor, and Claudia Linnhof-Popien.
Adaptive and Learning Agents Workshop (ALA) at AAMAS, 2023.

2020 [W2] The Holy Grail of Quantum Artificial Intelligence: Major Challenges in Accelerating the Machine Learning Pipeline
Thomas Gabor, Leo Sünkel, Fabian Ritz, Thomy Phan, Lenz Belzner, Christoph Roch, Sebastian Feld, and Claudia Linnhoff-Popien.
International Workshop on Quantum Software Engineering (Q-SE) at ICSE, pages 456–461, 2020.

[W1] A Distributed Policy Iteration Scheme for Cooperative Multi-Agent Policy Approximation
Thomy Phan, Lenz Belzner, Kyrill Schmid, Thomas Gabor, Fabian Ritz, Sebastian Feld, and Claudia Linnhoff-Popien.
Adaptive and Learning Agents Workshop (ALA) at AAMAS, 2020.

Extended Abstracts

Extended abstracts with a conference or journal version are not listed.

2019 [E1] Distributed Policy Iteration for Scalable Approximation of Cooperative Multi-Agent Policies
Thomy Phan, Kyrill Schmid, Lenz Belzner, Thomas Gabor, Sebastian Feld, and Claudia Linnhoff-Popien.
International Conference on Autonomous Agents and Multiagent Systems (AAMAS), pages 2162–2164, 2019.

Academic Activities

Organizing Committee

2019   International Symposium on Applied Artificial Intelligence (ISAAI)

Program Committee

2021 – 2024   AAAI Conference on Artificial Intelligence (AAAI)

2023   International Joint Conference on Artificial Intelligence (IJCAI – AI and Social Good)

2023   International Joint Conference on Artificial Intelligence (IJCAI – Main Track)

2023   European Conference on Artificial Intelligence (ECAI)

2023   International Conference on Autonomous Agents and Multiagent Systems (AAMAS – Blue Sky Ideas)

Reviewer

2022 – 2024   International Conference on Machine Learning (ICML)

2024   International Conference on Learning Representations (ICLR)

2024   AAAI 2024 Workshop on Cooperative Multi-Agent Systems Decision-making and Learning (CMASDL)

2022 – 2023   Conference on Neural Information Processing Systems (NeurIPS)

2023   International Conference on Autonomous Agents and Multiagent Systems (AAMAS – Main Track)

2018, 2022	International Symposium On Leveraging Applications of Formal Methods (ISoLA)
2021	PLOS ONE Journal
2020	International Journal on Software Tools for Technology Transfer (STTT)

Teaching

Spring 2024   **CSCI 599: Autonomous Decision-Making (Upcoming)**, *University of Southern California*, Los Angeles, CA, USA
- Special topics lecture on planning, reinforcement learning, and multi-agent systems
- Primary instructor
- Syllabus available at https://classes.usc.edu/term-20241/course/csci-599/

2019 – 2023   **Autonomous Systems**, *LMU Munich*, Germany
- Practical course for 12 – 18 master students on planning and reinforcement learning
- Primary supervising assistant until summer semester 2022
- Syllabus and registration count for summer semester 2022 provided at https://uni2work.ifi.lmu.de/course/S22/IfI/ASP

2019 – 2023   **Working Group "Artificial Intelligence"**, *LMU Munich*, Germany
- Voluntary working group for more than 100 bachelor and master students on current AI topics
- Primary supervising assistant
- Syllabus and registration count for summer semester 2022 provided at https://uni2work.ifi.lmu.de/course/S22/IfI/AIAG

2018 – 2019   **Mobile and Distributed Systems**, *LMU Munich*, Germany
- Practical course for 12 – 18 master students on mobile app development and on-device machine learning
- Secondary supervising assistant

2017 – 2023   **Student Mentoring**, *LMU Munich*, Germany
- 26 master theses
- 24 bachelor theses
- 8 individual research projects

Talks

Invited Talks

07/2022   **Emergent Cooperation from Mutual Acknowledgment Exchange**, Workshop on Ad Hoc Teamwork at IJCAI 2022 (virtual)
Highlight presentation of our AAMAS 2022 paper *"Emergent Cooperation from Mutual Acknowledgment Exchange"* (main author).

06/2021   **Stability in AI-Systems**, Digitale Stadt München e.V., Germany (virtual)
DigiTalk event on Safe Intelligence of the Digital City Association of Munich.

12/2020   **Artificial Intelligence – How Do Robots Learn?**, Gymnasium Berchtesgaden, Germany (virtual)
P-seminar talk for high school students and the Junior Science Café.

03/2019   **Building Autonomous Systems with AI**, *University of Augsburg*, Germany
AI workshop for students of the Software Engineering Elite Graduate Program.

Presentations at Conferences as Main Author

07/2023   **Attention-Based Recurrence for Multi-Agent Reinforcement Learning under Stochastic Partial Observability**, Honolulu, Hawaii, USA
International Conference on Machine Learning (ICML).

05/2022   **Emergent Cooperation from Mutual Acknowledgment Exchange**, virtual
International Conference on Autonomous Agents and Multiagent Systems (AAMAS).

12/2021   **VAST: Value Function Factorization with Variable Agent Sub-Teams**, virtual
Conference on Neural Information Processing Systems (NeurIPS).

02/2021   **Resilient Multi-Agent Reinforcement Learning with Adversarial Value Decomposition**, virtual
AAAI Conference on Artificial Intelligence (AAAI).

05/2020   **Learning and Testing Resilience in Cooperative Multi-Agent Systems**, virtual
International Conference on Autonomous Agents and Multiagent Systems (AAMAS).

08/2019   **Adaptive Thompson Sampling Stacks for Memory Bounded Open-Loop Planning**, Macao, China
International Joint Conference on Artificial Intelligence (IJCAI).

05/2019   **Distributed Policy Iteration for Scalable Approximation of Cooperative Multi-Agent Policies**, Montreal, Canada
International Conference on Autonomous Agents and Multiagent Systems (AAMAS).

02/2019   **Memory Bounded Open-Loop Planning in Large POMDPs using Thompson Sampling**, Honolulu, Hawaii, USA
AAAI Conference on Artificial Intelligence (AAAI).

07/2018   **Leveraging Statistical Multi-Agent Online Planning with Emergent Value Function Approximation**, Stockholm, Sweden
International Conference on Autonomous Agents and Multiagent Systems (AAMAS).

Other Talks

2019   **Unitag: Artificial Intelligence – How Do Robots Learn?**, *LMU Munich*, Germany
University event for gifted high school students from Upper Bavaria (Oberbayern).