Bo Liu

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Latest CV: https://liubo-cs.github.io/cv_BoLiu.pdf

URL: liubo-cs.github.io

Biography: Bo Liu is currently a Senior Scientist at Amazon Machine Learning. His research areas cover decision-making under uncertainty, human-aided machine learning, symbolic AI, trustworthiness, interpretability in machine learning, and their applications to BIGDATA. Previously, he was a tenured associate professor in the Computer Science Department at Auburn University (AU). He obtained his Ph.D. from the Autonomous Learning Lab at the University of Massachusetts Amherst in 2015, co-led by Drs. Sridhar Mahadevan and Andrew Barto. His Ph.D. thesis helped lay the stochastic optimization foundation of temporal difference learning. He is a recipient of the Tencent Faculty Research Award'2017 and the Amazon Faculty Research Award'2018. His papers won two best paper awards (UAI'2015 Facebook Best Student Paper Award and AAMAS'2022 OptLearnMAS Best Paper Award). He is a senior member of AAAI and IEEE, an editorial board member of Machine Learning (MLJ), and a regular Area Chair/Senior PC of several flagship AI conferences. He has given several tutorials or plenary talks at various conferences, including AAMAS/ICAPS/UAI.

RESEARCH INTEREST

- Generative AI: AIGC, LLM-aided semi-supervised learning
- Trustworthy AI: Explainable AI, Risk-aware AI, Accountable AI, Neuro-symbolic AI
- Control: Reinforcement learning, LLM-aided control

EDUCATION

2010-2015 **Ph.D.** Computer Science, University of Massachusetts Amherst
Advisors: Sridhar Mahadevan (Chair), Andrew Barto
- Thesis nominated for ACM Doctoral Dissertation Award
- UAI-15 Best Student Paper Award.
- NIPS-12 Spotlight Paper Award.
- Thesis result included in the "bible of RL" (2nd edition)
- Work addressed a 30-year-old fundamental RL problem. [NIPS'2015 tutorial]

2008-2010 **M.S.** Computer Engineering, Stevens Institute of Technology
Advisors: Haibo He
- ICNCS-10 Best Paper Award Nomination

2005-2008 **M.S.** Control Engineering, University of Science and Technology of China
- Best Paper Award by Institute of Automation, CAS,2008

EMPLOYMENT

2022-present	Senior Scientist, Amazon, Seattle, WA
	• Work on LLM-aided semi-supervised learning and AIGC.
	• Promoted to AAAI Senior Member
2016-2022	Assistant, then tenured Associate Professor at Auburn University, Auburn, AL
	• Conducted decision-making (RL) and neural-symbolic AI research.
	• Won $\approx$ 1 million research grants, most of which are the first ever granted to AU.
	• Promoted to associate professor with tenure, IEEE Senior Member.
	• AAMAS-22 Best and Visionary Paper Award.
2015-2016	Research Staff Member at Philips Research, Cambridge, MA
	• Conducted research on AI in healthcare.
	• Filed 1 patent and published 2 papers.

MAJOR AWARDS
Best paper awards

2022 Best and Visionary Paper Award at AAMAS-22

2015 Facebook Best Student Paper Award of UAI'2015

2012 Spotlight Award at NIPS'2012 (acceptance ratio $\approx 4\%$)

2010 Best Paper Award Nomination of ICNSC'2010

Senior membership and editorship recognition

2023 Promoted to AAAI Senior Member (the major award of AAAI to mid-career members) [AAAI] [Bloomberg] [Yahoo!] [Amazon]

2022 Elected as Editorial Board member of *Machine Learning* [MLJ]

2021 Elected as Associate Editor of *IEEE-TNNLS* [AU Media]

2020 Promoted to IEEE Senior Member

Federal fundings and industry awards

2019 Received NSF IIS Core Program Funding'2019 ($420K) as single PI, and ∼1 million Federal fundings.

2018 Amazon Research Award, Amazon Inc.[Amazon Media]

2017 Tencent Rhino-Bird Award, Tencent AI Lab

FUNDINGS
Single PI: the only PI with other Co-PIs. Sole PI: the only PI without any Co-PIs.

As PI
P1 **NSF IIS-Core (1910794)**, "*RI: Small: **TIDES: T**rustworthy **I**nteractive **DE**cision-making Using **S**ymbolic Planning*", **NSF**, single PI, $420K, 2019-2023. [link]
The first NSF Robust Intelligence (RI) Core program granted to AU.

P2 **Amazon Research Award**(Class of 2018), "*Sequential Transaction Risk Management with Deep Reinforcement Learning*", **Amazon**, sole PI, $100K. [link]
Acceptance rate: 12%(82/674)
The first Amazon Research Award granted to AU.

P3 Adobe Research gift fund, "*Collective Contextual Bandit with Applications to Digital Marketing*", 2019, **Adobe**, sole PI, $10K.

P4 **Tencent Rhino-Bird Faculty Research Award**, "*ETA:Energy-efficient, Transferable, and Accurate Reinforcement Learning*", **Tencent**, 2017, sole PI, $50K. [link]
One of the first Tencent Research Awards granted to North American Universities.

As Co-PI

CoP1 South Korea Electronics and Telecommunications Research Institute Research Grant, "*Development of cognitive architecture for estimating drivers' status in automated driving mode*", **ETRI** (Korea), Co-PI (PI: Dr. H. Narayanan), $180K.

CoP2 **NSF DUE (1933873)**, "*Data-Enabled Engineering Projects for Undergraduate Data Science and Engineering Education*", Senior Personnel (PI: Dr. Qinghua He), **NSF**, $300K, 2019-2022. [link]

CoP3 Auburn PAIR program, "A Prototype Framework of Climate Services for Decision Making", Co-PI (PI: Dr. Di Tian), Auburn University, $300K.

As Major Student Contributor

SC1 Major student contributor to a four-year National Science Foundation (NSF) proposal titled "*RI: Small: Reinforcement Learning by Mirror Descent*" (PI: Dr. Sridhar Mahadevan), UMass Amherst, $450K. [link]

RESEARCH PUBLICATIONS
Publication statistics:

Google Scholar	citation:>2300, h-index:25.
Journal	Total: **26**
	Transaction papers or equivalent: **11**, Impact factor> 2: **23**
	JAIR(1), IEEE-TNNLS(4), IEEE-TETCI(1), ACM-TECS(1), IET(3), AAS(1)
Conference	Total: **23**
	Top-tier AI/ML conferences: **18**
	NIPS/NeurIPS(3), ICML(2), UAI(3), IJCAI(2), AAAI(5), AAMAS(2), ICLP(1)

Students advised in blue, ∗ denotes co-primary authors with equal contribution.

Five Representative Publications

R1 [**22'IEEE-TETCI**] Daoming Lyu, Fangkai Yang, Hugh Kwon, Wen Dong, Levent Yilmaz, and **Bo Liu**. TDM: Trustworthy Decision-Making via Interpretability Enhancement. *IEEE Transactions on Emerging Topics in Computational Intelligence* (**IEEE-TETCI**), 2022. [pdf] Impact factor: 5.3.

R2 [**20'ICML**] Shangtong Zhang, **Bo Liu**, Shimon Whiteson. Gradientdice: Rethinking generalized offline estimation of stationary values. *International Conference on Machine Learning*

(**ICML**), 2020. [pdf]
Acceptance rate: 21%(1088/4990).

R3 **[19'AAAI]** Daoming Lyu, Fangkai Yang, **Bo Liu**, Steven Gustafson. SDRL: Interpretable and Data-efficient Deep Reinforcement Learning Leveraging Symbolic Planning. *Thirty-Third AAAI Conference on Artificial Intelligence* (**AAAI**), Honolulu, HI, 2019. [pdf]
Acceptance rate: **6.4%(460/7095) (Oral presentation rate).**

R4 **[18'NeurIPS]** **Bo Liu*** , Tengyang Xie* (*equal contribution), Yangyang Xu, Mohammad Ghavamzadeh, Yinlam Chow, Daoming Lyu, Daesub Yoon. A Block Coordinate Ascent Algorithm for Mean-Variance Optimization. *32nd Conference on Neural Information Processing Systems* (**NIPS**), Montreal, Canada, 2018. [pdf]
Acceptance rate: 20%(1011/4856).

R5 **[18'JAIR]** **Bo Liu**, Ian Gemp, Mohammad Ghavamzadeh, Ji Liu, Sridhar Mahadevan, Marek Petrik. Proximal Gradient Temporal Difference Learning: Stable Reinforcement Learning with Polynomial Sample Complexity. *Journal of Artificial Intelligence Research* (**JAIR**), 2018. The arxiv preliminary version is "recommended to read" in the classical RL textbook *Introduction to Reinforcement Learning.* [pdf]
Impact factor: 8.78.

Rigorously-Reviewed Conference Publications (Acceptance Ratio≤30%.)

C1 **[24'CSCWD]** Shiyue Huang, Yuchen Su, Hongbo Liu, Huan Dai, **Bo Liu**. Heart of Betrayal: A PIN Inference Attack Leveraging Photoplethysmography on Wearables. *27th International Conference on Computer Supported Cooperative Work in Design* (**CSCWD**), 2024.

C2 **[24'IEEE-ICC]** Yicong Du, Limin Liu, Hongbo Liu, Yanzhi Ren, **Bo Liu**. Secret Key Generation with Adaptive Pilot Manipulation for Matching-based Method. *IEEE International Conference on Communications* (**ICC**), 2024.

C3 **[24'AAAI]** Dhawal Gupta, Scott Jordan, Shreyas Chaudhari, **Bo Liu**, Philip Thomas, Bruno C. da Silva. From Past to Future: Rethinking Eligibility Traces. *Thirty-Eighth AAAI Conference on Artificial Intelligence* (**AAAI**), 2024. [pdf]
Acceptance rate: 23.7%(2342/9862).

C4 **[23'CISS]** Ce Xu, **Bo Liu**, Yue Zhao. Offline Reinforcement Learning for Price-Based Demand Response Program Design. *Proc. the 57th Annual Conference on Information Sciences and Systems* (**CISS**), 2023.[pdf]

C5 **[22'AAMAS]**Liangliang Xu, Daoming Lyu, Yangchen Pan, Aiwen Jiang, **Bo Liu**. TOPS: Transition-based volatility-reduced policy search. **Best and Visionary Papers Award**, Virtual, 2022.[pdf]

C6 **[21'AAAI]** Shangtong Zhang, **Bo Liu**, Shimon Whiteson. Mean-Variance Policy Iteration for Risk-Averse Reinforcement Learning. *Thirty-Fifth AAAI Conference on Artificial Intelligence* (**AAAI**), 2021.[pdf]
Acceptance rate: 21%(1692/7911).

C7 **[20'ICML]** Shangtong Zhang, **Bo Liu**, Hengshuai Yao, Shimon Whiteson. Provably Convergent Two-Timescale Off-Policy Actor-Critic with Function Approximation. *International Conference on Machine Learning* (**ICML**), 2020. [pdf]
Acceptance rate: 21%(1088/4990).

C8 **[20'ICML]** Shangtong Zhang, **Bo Liu**, Shimon Whiteson. Gradientdice: Rethinking generalized offline estimation of stationary values. *International Conference on Machine Learning* (**ICML**), 2020. [pdf]
Acceptance rate: 21%(1088/4990).

C9 **[19'AAAI]** Daoming Lyu, Fangkai Yang, **Bo Liu**, Steven Gustafson. SDRL: Interpretable and Data-efficient Deep Reinforcement Learning Leveraging Symbolic Planning. *Thirty-Third AAAI Conference on Artificial Intelligence* (**AAAI**), Honolulu, HI, 2019. Oral presentation. [pdf]
Acceptance rate: **6.4%(460/7095) (Oral presentation rate).**

C10 **[19'ICLP]** Daoming Lyu, Fangkai Yang, **Bo Liu**, Steven Gustafson. A Human-Centered Data-Driven Planner-Actor-Critic Architecture via Logic Programming. *35th International Conference on Logic Programming* (**ICLP**), Las Cruces, NM, 2019. [pdf]

C11 **[19'AAMAS]** Fan Yang, **Bo Liu**, Wen Dong. Optimal Control of Complex Systems through Variational Inference with a Discrete Event Decision Process. *Autonomous Agents and Multi-agent Systems* (**AAMAS**), Montreal, Canada, 2019. [pdf]
Acceptance rate: 24%(189/781).

C12 **[19'AAAI]** Shangtong Zhang, Borislav Mavrin, Linglong Kong, **Bo Liu**, Hengshuai Yao. QUOTA: The Quantile Option Architecture for Reinforcement Learning. *Thirty-Third AAAI Conference on Artificial Intelligence* (**AAAI**), Honolulu, HI, 2019. [pdf]
Acceptance rate: 16.2%(1150/7095).

C13 **[18'NeurIPS]** **Bo Liu***, Tengyang Xie* (*equal contribution), Yangyang Xu, Mohammad Ghavamzadeh, Yinlam Chow, Daoming Lyu, Daesub Yoon. A Block Coordinate Ascent Algorithm for Mean-Variance Optimization. *32nd Conference on Neural Information Processing Systems* (**NIPS**), Montreal, Canada, 2018. [pdf]
Acceptance rate: 20%(1011/4856).

C14 **[18'IJCAI]** Fangkai Yang, Daoming Lyu, **Bo Liu**, Steve Gustafson. PEORL: Integrating Symbolic Planning and Hierarchical Reinforcement Learning for Robust Decision-Making. *International Joint Conferences on Artificial Intelligence* (**IJCAI**), 2018. **Press coverage** [pdf]
Acceptance rate: 20%(710/3470).

C15 **[16'UAI]** **Bo Liu**, Ji Liu, Luwan Zhang. Dantzig Selector with an Approximately Optimal Denoising Matrix. *Proceedings of the Conference on Uncertainty in AI* (**UAI**), 2016. [pdf]
Acceptance rate: 30%(85/275).

C16 **[16'IJCAI]** **Bo Liu**, Ji Liu, Mohammad Ghavamzadeh, Sridhar Mahadevan, Marek Petrik. Proximal Gradient Temporal Difference Learning Algorithms. *International Joint Conferences on Artificial Intelligence* (**IJCAI**), 2016. [pdf]
Acceptance rate: 24%(551/2294).

C17 **[16'AAAI]** Deguang Kong, Ji Liu, **Bo Liu**, Xuan Bao. Uncorrelated Group Lasso. *Association for the Advancement of Artificial Intelligence* (**AAAI**), 2016. [pdf]
Acceptance rate: 26%(549/2132).

C18 **[15'UAI]** **Bo Liu**, Ji Liu, Mohammad Ghavamzadeh, Sridhar Mahadevan, Marek Petrik. Finite-Sample Analysis of Proximal Gradient Algorithms. *Proceedings of the Conference on Uncertainty in AI* (**UAI**), 2015, **Facebook Best Student Paper Award**. [pdf]
Acceptance rate: **1%(3/291) (Best paper award rate).**

C19 [**12'NIPS**] **Bo Liu**, Sridhar Mahadevan, Ji Liu. Regularized Off-Policy TD-Learning. *26th Annual Conference on Neural Information Processing Systems* (**NIPS**), Lake Tahoe, Nevada, 2012, December 3-6, **Spotlight Award**. [pdf]
Acceptance rate: **4%(72/1467) (Oral presentation rate).**

C20 [**12'UAI**] Sridhar Mahadevan, **Bo Liu**. Sparse Q-learning with Mirror Descent. *Proceedings of the Conference on Uncertainty in AI* (**UAI**), 2012. [pdf]
Acceptance rate: 30%(95/304).

C21 [**10'NIPS**] Sridhar Mahadevan, **Bo Liu**. Basis Construction from Power Series Expansions of Value Functions. *24th Annual Conference on Neural Information Processing Systems* (**NIPS**), Vancouver, B.C., Canada, 2010, December 6-8. [pdf]
Acceptance rate: 24%(293/1219).

C22 [**10'ICNSC**] Haibo He, **Bo Liu**. A Hierarchical Learning Architecture with Multiple-Goal Representations Based on Adaptive Dynamic Programming. *IEEE International Conference on Networking, Sensing, and Control*, Chicago, 2010. [pdf]

C23 [**10'ICNSC**] **Bo Liu**, Haibo He, Daniel.Repperger. Two-Time-Scale Online Actor-Critic Paradigm Driven by POMDP. *IEEE International Conference on Networking, Sensing, and Control*, Chicago, 2010. **Best Paper Award Nomination** [pdf]

Journal Publications

J1 [**24'ESA**] Yawen Zeng, Yiru Wang, Dongliang Liao, Gongfu Li, Jin Xu, Xiangmin Xu, **Bo Liu**, Hong Man. Contrastive topic-enhanced network for video captioning. *Expert Systems with Applications*, 2024. [pdf]
Impact factor: 8.5.

J2 [**23'IEEE-TNNLS**] Zheng Zhang, Levent Yilmaz, **Bo Liu**. A Critical Review of Inductive Logic Programming Techniques for Explainable AI. *IEEE Transactions on Neural Networks and Learning Systems* (**IEEE-TNNLS**), 2023. [pdf]
Impact factor: 10.4.

J3 [**22'AAMAS**] Liangliang Xu, Daoming Lyu, Yangchen Pan, Aiwen Jiang, **Bo Liu**. TOPS: Transition-Based Volatility-Reduced Policy Search. *Autonomous Agents and Multiagent Systems.* **Best and Visionary Papers Award** (**AAAMAS**), 2022.[pdf]

J4 [**22'JVCIR**] Zhifeng Wang, Aiwen Jiang, Chunjie, Zhang, Hanxi Li, **Bo Liu**. Self-supervised multi-scale pyramid fusion networks for realistic bokeh effect rendering. *Journal of Visual Communication and Image Representation*, 2022. [pdf]
Impact factor: 2.6.

J5 [**22'IEEE-TETCI**] Daoming Lyu, Fangkai Yang, Hugh Kwon, Wen Dong, Levent Yilmaz, and **Bo Liu**. TDM: Trustworthy Decision-Making via Interpretability Enhancement. *IEEE Transactions on Emerging Topics in Computational Intelligence* (**IEEE-TETCI**), 2022. [pdf]
Impact factor: 5.3.

J6 [**21'IET-IP**] Qi Wang, **Bo Liu**, Jianzhe Lin. Crowd understanding and analysis. *IET Image Processing* (**IET-IP**), 2021 [pdf]
Impact factor: 2.37.

J7 [**21'SP**] Long Peng, Aiwen Jiang, Haoran Wei, **Bo Liu** and Mingwen Wang. Ensemble single image deraining network via progressive structural boosting constraints. *Signal Processing:*

Image Communication, 2021. [pdf]
Impact factor: 3.5.

J8 **[21'JVCIR]** Zhaokun Li, Xueliang Liu, Ye Zhao, **Bo Liu**, Zhen Huang, Richang Hong. A Lightweight Multi-scale Aggregated Model for Detecting Aerial Images Captured by UAVs. *Journal of Visual Communication and Image Representation*, 2021. [pdf]
Impact factor: 2.6.

J9 **[20'JOS]** Levent Yilmaz and **Bo Liu**. Model Credibility Revisited: Concepts and Considerations for Appropriate Trust. *Journal of Simulation*, 2020. [pdf]
Impact factor: 2.5.

J10 **[19'IEEE-TNNLS]** Daoming Lyu, **Bo Liu**, Matthieu Geist, Wen Dong, Saad Biaz, and Qi Wang. Stable and Efficient Policy Evaluation. *IEEE Transactions on Neural Networks and Learning Systems* (**IEEE-TNNLS**), 2019. [pdf]
Impact factor: 10.4.

J11 **[19'IEEE-TNNLS]** Qi Wang, Jia Wan, Feiping Nie, **Bo Liu**, Chenggang Yan, Xuelong Li. Hierarchical Feature Selection for Random Projection. *IEEE Transactions on Neural Networks and Learning Systems* (**IEEE-TNNLS**), 2019. [pdf]
Impact factor: 10.4.

J12 **[19'IET-IP]** Kangfu Mei, Aiwen Jiang, Juncheng Li, **Bo Liu**, Mingwen Wang. Deep Residual Refining based Pseudo Multi-frame Network for Effective Single Image Super-Resolution. *IET Image Processing*, 2019. [pdf]
Impact factor: 2.37.

J13 **[18'JAIR]** **Bo Liu**, Ian Gemp, Mohammad Ghavamzadeh, Ji Liu, Sridhar Mahadevan, Marek Petrik. Proximal Gradient Temporal Difference Learning: Stable Reinforcement Learning with Polynomial Sample Complexity. *Journal of Artificial Intelligence Research* (**JAIR**), 2018. The arxiv preliminary version is "recommended to read" in the classical RL textbook *Introduction to Reinforcement Learning.* [pdf]
Impact factor: 8.78.

J14 **[18'IET-CV]** Shuying Li, Zhanwen Liu, Tao Gao, Fanjie Kong, Ziheng Jiao, Aodong Yang, **Bo Liu**. A Novel Restoration Algorithm for Noisy Complex Illumination. *IET Computer Vision*, 2018. [pdf]
Impact factor: 1.7.

J15 **[17'JCST]** Ai-Wen Jiang, **Bo Liu**, Ming-Wen Wang. Deep Multimodal Reinforcement Network with Contextually Guided Recurrent Attention for Image Question Answering *Journal of Computer Science and Technology*, 32(4), 738-748, 2017. [pdf]
Impact factor: 1.9.

J16 **[14'ACM-TECS]** Shuai Li, Yuesheng Lou, **Bo Liu**. Bluetooth aided mobile phone localization: a nonlinear neural circuit approach. *ACM Transactions on Embedded Computing Systems* (**ACM-TECS**), 2014. [pdf]
Impact factor: 2.0.

J17 **[13'IEEE-TNNLS]** Shuai Li, **Bo Liu**, Yangming Li. Selective Positive-negative Feedback Produces the Winner-take-all Competition in Recurrent Neural Networks. *IEEE Transactions on Neural Networks and Learning Systems* (**IEEE-TNNLS**), 2013. [pdf]
Impact factor: 10.4.

J18 **[12'NC]** Shuai Li, Sanfeng Chen, **Bo Liu**, Yangming Li, Yongsheng Liang. Decentralized Kinematic Control of A Class of Collaborative Redundant Manipulators via Recurrent Neural Networks, *Neurocomputing*, 2012. One of the most highly cited Neurocomputing publications since 2012. [pdf]
Impact factor: 6.

J19 **[12'Sensors]** **Bo Liu**, Sanfeng Chen, Shuai Li, Yongsheng Liang. Intelligent control of a sensor-actuator system via kernelized least-squares policy iteration. *Sensors* 12 (3), 2632-2653, 2012. [pdf]
Impact factor: 4.1.

J20 **[12'NCA]** Shuai Li, **Bo Liu**, Baogang Chen, and Yuesheng Lou. Neural Network-Based Mobile Phone Localization Using Bluetooth Connectivity. *Neural Computing and Applications*, 2012. [pdf]
Impact factor: 5.102.

J21 **[12'CNS]** Shuai Li, Yangming Li, **Bo Liu**, Timmy Murray. Model-free Control of Lorenz Chaos Using an Approximate Optimal Control Strategy. *Communications in Nonlinear Science and Numerical Simulation*, 2012. [pdf]
Impact factor: 4.270.

J22 **[12'NPL]** Shuai Li, Sanfeng Chen, **Bo Liu**. Accelerating a Recurrent Neural Network to Finite-Time Convergence for Solving Time-Varying Sylvester Equation by Using a Sign-Bi-power Activation Function, *Neural Processing Letters*, pp.1-17, 2012 [pdf]
Impact factor: 3.514.

J23 **[12'NCA]** Shuai Li, Hongzhu Cui, Yangming Li, **Bo Liu** and Yuesheng Lou. Decentralized Control of Collaborative Redundant Manipulators with Partial Command Coverage via Locally Connected Recurrent Neural Networks. *Neural Computing and Applications*, 2012. [pdf]
Impact factor: 5.102.

J24 **[12'CNS]** Shuai Li, Yunpeng Wang, Jiguo Yu, **Bo Liu**. A Nonlinear Model to Generate the Winner-Take-all Competition. *Communications in Nonlinear Science and Numerical Simulation*, 2012. [pdf]
Impact factor: 3.9.

J25 **[12'Sensors]** Sanfeng Chen, Shuai Li, **Bo Liu**, Yuesheng Lou and Yongsheng Liang. Self-Learning Variable Structure Control for a Class of Sensor-Actuator Systems, *Sensors*, Vol.12, pp.6117-6128, 2012. [pdf]
Impact factor: 4.1.

J26 **[10'AAS]** **Bo Liu**, Haibo He, Sheng Chen. Adaptive Dual Network Design for a Class of SIMO Systems with Nonlinear Time-variant Uncertainties. *Acta Automatica Sinica*, Vol.36, pp.564-572, 2010. [pdf]
Impact factor: 11.8.

Tutorials

T1 **[22'AAMAS]** **Bo Liu**, Bo An, Yangyang Xu. Risk-aware Single-Agent & Multi-agent Reinforcement Learning: Algorithms and Meta-Algorithms. *International Conference on Autonomous Agents and Multiagent Systems* (**AAMAS**), Virtual, 2022.

T2 [**22'ICAPS**] Daoming Lyu, **Bo Liu**, Jianshu Chen, Akshat Kumar, Jiajing Ling. Efficient Neural-Symbolic Reasoning via Reinforcement Learning. *32nd International Conference on Automated Planning and Scheduling* (**ICAPS**), Virtual, 2022.

T3 [**22'UAI**] **Bo Liu**, Bo An, Yangyang Xu. Risk-averse Reinforcement Learning: Algorithms And Meta-algorithms. *International Conference on Uncertainties in Artificial Intelligence* (**UAI**), Eindhoven, the Netherlands, 2022.

Book Chapters

B1 Fangkai Yang, Steven Gustafson, Alexander Elkholy, Daoming Lyu and **Bo Liu**. Program Search for Machine Learning Pipelines: Leveraging Symbolic Planning and Reinforcement Learning. *Genetic Programming Theory & Practice XVI*, Springer, 209231, 2019. ISBN 978-3-030-04734-4.

B2 Daoming Lyu, Fangkai Yang, Hugh Kwon, **Bo Liu**, Wen Dong, Levent Yilmaz. Explainable Neuro-Symbolic Hierarchical Reinforcement Learning. *Frontiers in Artificial Intelligence and Applications*, IOS Press book series, 2021. [pdf]

Workshop Papers with Presentations

W1 Shangtong Zhang, **Bo Liu**, Shimon Whiteson. Mean-Variance Policy Iteration for Risk-Averse Reinforcement Learning. *NeurIPS Workshop on Offline Reinforcement Learning*, Vancouver, CA, 2020.

W2 Daoming Lyu, Qi Qi, Mohammad Ghavamzadeh, Hengshuai Yao, Tianbao Yang, and **Bo Liu**. Variance-Reduced Off-Policy Memory-Efficient Policy Search. *NeurIPS Workshop on Offline Reinforcement Learning*, Vancouver, CA, 2020.

W3 Shangtong Zhang, **Bo Liu**, Hengshuai Yao, Shimon Whiteson. Provably Convergent Off-Policy Actor-Critic with Function Approximation. *NeurIPS Workshop on The Optimization Foundations of Reinforcement Learning*, Vancouver, CA, 2019.

W4 Daoming Lyu, Fangkai Yang, Steven Gustafson, **Bo Liu**. A Joint Planning and Learning Framework for Human-Aided Decision-Making. *AAAI Fall Symposium*, DC, 2019. (oral presentation)

W5 **Bo Liu**, Ji Liu, Kenan Xiao. R^2PG: Risk-Sensitive and Reliable Policy Gradient. *32nd AAAI Conference on Artificial Intelligence workshop on planning and inference*, New Orleans, LA, 2018. (oral presentation) [pdf]

W6 Hasan, S. A., **Bo Liu**, Liu, J., et al. Neural Clinical Paraphrase Generation with Attention. ClinicalNLP, Osaka, Japan, 2016.

W7 Ian Gemp, Sridhar Mahadevan, **Bo Liu**. Solving Large-Scale Sustainable Supply Chain Networks using Variational Inequalities, *AAAI Workshop on Computational Sustainability*, Austin, Texas, 2015.

W8 **Bo Liu**, Haibo He, Sheng Chen. A Dual-System Learning and Control Method for Machine Intelligence. *Proc. Int. Conf. on Cognitive and Neural Systems* (ICCNS'09), Boston, May 27-30, 2009.

US Patents

UP1 Sadid Hasan. S., **Bo Liu**, O. Farri Farri, Junyi Liu, & Aaditya Prakash. (2019). Systems and methods for neural clinical paraphrase generation. U.S. Patent Application No. 16/072,128.

China Patents

CP1 Wang Yong, Zhang Yang, **Bo Liu**, Shao Changxing, Hydraulic FlapGate Design, 200630188416.7, 2007-12-19,

Workshop Organized

WO1 Organized "Primal-dual optimization and reinforcement learning" at *INFORMS*'2020 (virtual). (with Dr. Yangyang Xu at RPI)

EDUCATIONAL PUBLICATIONS

E1 Wu, L., Yang, A., Dubrovskiy, A., He, H., Yang, X., Yan, H., Gao, Z., Qin, X., **Bo Liu**, ... & Yang, T. A. Advancing AI-aided Computational Thinking in STEM (Science, Technology, Engineering & Math) Education (*Act*-STEM). *Advances in Artificial Intelligence and Applied Cognitive Computing* (pp. 787-795). Springer, 2021.

E2 Wu, L., Yang, A., He, H., Yang, X., Yan, H., Gao, Z., **Bo Liu**, ... & Yang, T. A. Realistic Drawing & Painting with AI-Supported Geometrical and Computational Method (*F*un-*J*oy). *Advances in Artificial Intelligence and Applied Cognitive Computing* (pp. 797-804). Springer, 2021.

E3 He, Q. P., Wang, J., Mao, S., Parson, L., **Bo Liu**, Zeng, P., ... & Henry, D. Real Data and Application based Data Science Education in Engineering. *Proceedings of 2020 ASEE-SE Conference*, 2020.

E4 He, Q. P., Wang, J., Mao, S., Parson, L., **Bo Liu**, Zeng, P., ... & Henry, D. Data-Enabled Engineering Projects (DEEPs) Modules for Data Science Education in Engineering. *Proceedings of 2020 ASEE-SE Conference*, 2020.

INVITED TALKS

T1 Towards Trustworthy Artificial Intelligence (virtual), University of Nevada Reno, March 2022

T2 Explainable and Failure-Critical Decision-Making, UMass Amherst, October 2021

T3 Explainable and Failure-Critical Decision-Making (virtual), NCSU, October 2021, Clemson, December 2021. (**2 talks**)

T4 Plug-and-Play Risk-Aware Policy Search, INFORMS 2021 Annual Meeting, November 2021

T5 Towards Trustworthy Decision-Making and AI: Explainability and Safety (virtual), Penn State University, National University of Singapore, George Mason University, McMaster University, University of Victoria, Virginia Tech, 2021 (**6 talks**)

T6 Explainable and Safety-Critical Decision-Making (virtual), Eli Lilly, Indiana, January 2021; Nanyang Technological University, Singapore, November 2020; Tencent AI Lab, September 2020 (**3 talks**)

T7 Legendre-Fenchel Dualities In Reinforcement Learning: Successes, Challenges & Opportunities (virtual), INFORMS 2020 Annual Meeting, November 2020

T8 A Joint Planning and Learning Framework for Human-Aided Decision-Making, AAAI Fall Symposium, DC, November 2019

T9 A Human-Centered Data-Driven Planner-Actor-Critic Architecture via Logic Programming, ICLP, NM, September 2019

T10 SDRL: Symbolic Deep Reinforcement Learning, KAIST, South Korea, August 2019; ETRI, South Korea, August 2019; Amazon Research, Seattle, April 2019; AAAI, Honolulu, HI, January 2019; RBC Borealis AI, June 2018; University of Alberta, June 2018 (**6 talks**)

T11 Reinforcement Learning at Scale, Amazon Research, Seattle, April 2019

T12 Efficient Mean-Variance Optimization, Rensselaer Polytechnic Institute, November 2018; University of Alberta, July 2018 (**2 talks**)

T13 Duality in TD Learning and Risk Control, Huawei (Futurewei) RLAD Lab, Edmonton, May 2018

T14 Gradient, Semi-gradient and Pseudo-gradient Reinforcement Learning, SIAM Conference on Optimization, Vancouver, July 2017

T15 Proximal Gradient Temporal Difference Learning Algorithms. IJCAI, NYC, NY, 2016

T16 Proximal Reinforcement Learning. Job talk at SUNY Buffalo, NY, Auburn University, AL, and U Wyoming, WY, 2016 (Got offers from all)

T17 Proximal Reinforcement Learning. Washington State University, Pullman, WA, 2015

T18 Efficient Transfer Decision-making. Amazon Research, Seattle, WA, 2015; Philips Research, Briarcliff, NY, 2015

T19 Sequential Decision-Making Meets Big Data. WSU, Pullman, WA, 2013

T20 First-Order Sparse Reinforcement Learning. Adobe Research, CA, 2012

ACADEMIC SERVICES
Associate Editor:
Editorial Board of Machine Learning (**MLJ**)(2021-present);
IET Image Processing (2020-present);
IEEE Geoscience and Remote Sensing Letters (2016-2019);
IEEE Trans. on Neural Networks and Learning Systems (**IEEE-TNNLS**) (2021-2023);

Area Chair/Senior PC:
IJCAI 2017-present, UAI 2021-present, AAAI 2022-present
Conference Review:
ICML, NIPS/NeurIPS, COLT, UAI, AISTATS, AAAI, IJCAI, ICLR, etc.
Journal Review:
JMLR, JAIR, MLJ, AIJ, Neural Computation, Neural Networks, IEEE-TNN, etc.
Workshop Organizing:
INFORMS'2020 Workshop on Primal-Dual Optimization and Reinforcement Learning.
Proposal Panel Review:
NSF panels 2016-present, Swiss NSF panels 2020.

STUDENT ADVISED
Ph.D. Students (2)

PhD 1. Wang, Xinning; Graduation: Nov 2017. Current position: Assistant professor, Ocean University of China, China

PhD 2. Lyu, Daoming: Graduation: May 2022. Current position: Postdoc, Cornell University.

Master Students (6)

MS. 1. Joshi, Bhargav; Graduation: May 2022. Current position: ASSYST, VA, United States

MS. 2. Gupta, Vinika; Graduation: Jul 2021. Current position: Data Scientist, Nordstrom, CA, US

MS. 3. Zhang, Zheng; Graduation: Dec 2018. Current position: PhD student, Auburn University, AL, US

MS. 4. Vick, Bradley; Graduation: Dec 2018. Current position: Senior Engineer, Alabama Power Company, AL, US

MS. 5. Muthuswamy, Ahila; Graduation: Nov 2020. Current position: Senior software engineer, EY Global, GA, US

MS. 6. Patel, Nirmitkumar; Graduation: Dec 2020. Current position: Senior software engineer, Walmart Global Tech, AK, US

STUDENT ACHIEVEMENT

S1 Daoming Lyu is the first AU's CS PhD who went to the Ivy League for a postdoc (Cornell).

S2 Liangliang Xu and Daoming Lyu won the AAMAS-22 OptLearnMAS Best Paper Award.

S3 My group published AU's first papers in almost all major AI/ML venues. Daoming made a particular contribution.

S4 Bhargav Joshi is the first M.S. graduate of AU's Data Engineering M.S. program.

S5 Nirmit Patel received the *Outstanding Master Student Award* 2019.