ARSENII MUSTAFIN

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Focus: Reinforcement Learning, Deep Learning, Explainability

EDUCATION

PhD, Department of Computer Science, Boston University, Boston, MA, US *2019/09-present*

- GPA: 3.82/4.00
- Field of research: Reinforcement learning
- Research advisors: Prof. Alex Olshevsky, Prof. Yannis Paschalidis

Exchange program in Economics, Peking University, Beijing, PRC *2014/02-2014/07*

Masters, Department of Economics, Saint Petersburg State University, Russia *2013/09-2015/07*

- Asian and African economies and International Economic Relations MA Program
- Diploma with honor (GPA 4.88/5.00)

Exchange program in Chinese language, Shenzhen University, Shenzhen, PRC *2011/09-2012/06*

Bachelors, Department of Social Sciences, Herzen University, Saint Petersburg, Russia *2008/09-2013/07*

- Diploma with honor (GPA 4.94/5.00)

RESEARCH EXPERIENCE

Research Fellow, Department of Computer Science, Boston University *2019/09-present*

- Working on Reinforcement learning problems under the supervision of Prof. Alex Olshevsky and prof. Yannis Paschalidis
- Working on Imitation Leaning for self-driving under the supervision of Prof. Eshed Ohn-Bar
- Former member of BU team participating in DARPA Semafor multi-modal Fake News detection project, team lead – Prof. Kate Saenko
- Did research on explainable AI algorithms in Computer Vision under the supervision of Prof. Sarah Adel Bargal

Visiting Researcher, Modeling and Engineering Risk and Complexity lab, Scuola Superiore Meridionale *2024/06-2024/08*

- Collaborated with Mario di Bernardo's lab on Reinforcement learning research

Visiting Researcher, Division of Decision and Control Systems, KTH *2023/05-2023/08*

- Collaborated with Karl Johansson's lab on Reinforcement learning research

Research Intern, VIZIT *2020/05-2020/08, 2021/09-2021/12*

- Research on explainable AI techniques applied to CV models under the head of research – Dr. Elham Saraee
- Research resulted in market product and patent application

Visiting researcher, Department of Computer Science, University of Texas at Austin *2018/04-2018/09*

- Research on application of machine learning in trading

Research fellow, School of Economics, Fudan University *2015/09-2018/04*

- Research on quantitative analysis of international trade

SELECTED PROJECTS & PUBLICATIONS

Mustafin, A.*, Pakharev, A.*, Olshevsky, A., Paschalidis, I. (2025). Geometry-based Analysis of Classical MDP Solving Algorithms.

- In this paper, we apply the geometric interpretation of MDPs to analyze classical MDP-solving algorithms: Value Iteration and Policy Iteration. We develop novel analytical tools and proof strategies, demonstrating improved convergence in certain cases.
- Currently under submission

Mustafin, A.*, Kolla, S.*, Olshevsky, A., Paschalidis, I. (2025). Analysis of Value Iteration Through Absolute Probability Sequences

- In this paper we use the absolute probability sequences to show the convergence of the Value Iteration algorithm in terms of an L^2 norm.
- Currently under submission

Mustafin, A.*, Pakharev, A.*, Olshevsky, A., Paschalidis, I. (2024). MDP Geometry, Normalization and Reward Balancing Solvers

- In this paper, we introduce a new geometric interpretation of Markov Decision Processes (MDPs) and demonstrate the equivalence of MDP problems to geometry problems. Based on this interpretation, we propose new MDP-solving algorithms that achieve state-of-the-art complexity in several settings.
- The paper was presented on Allerton conference 2024.
- Accepted to AISTATS 2025, currently available on arxiv.

Mustafin, A.*, Olshevsky, A., Paschalidis, I. (2024). On Value Iteration Convergence in Connected MDPs

- This paper establishes that an MDP with a unique optimal policy and ergodic associated transition matrix ensures the convergence of various versions of the Value Iteration algorithm at a geometric rate that exceeds the discount factor γ for both discounted and average-reward criteria.
- Currently under submission, available on arxiv.

Mustafin, A.*, Olshevsky, A., Paschalidis, I. (2022). Closing the Gap Between SVRG and TD-SVRG with Gradient Splitting

- In the paper we significantly improve theoretical guarantees of SVRG method applied to TD update, show that it exhibits the same convergence as SVRG in convex optimization setting and provide theoretical guarantees for practical algorithm.
- Published in Transactions on Machine Learning Research(link).

Mustafin, A.*, Jain, S.*, Lteif, D.*, Majumdar S.*, Tourni, I.*, Bargal S., Saenko K., Sclaroff S. (2022). Ani-GIFs: A Benchmark Dataset for Domain Generalization of Action Recognition from GIFs

- The paper presents a dataset for Domain Generalization problems in the video domain
- Published in Frontiers in Computer Science (link)

Patent: SYSTEMS AND METHODS FOR IMAGE OR VIDEO PERFORMANCE HEAT MAP GENERATION, Saraee E., Hamedi J., Halloran Z., Mustafin A.

- Patent application for results of research done while on internship in VIZIT, available here

WORK EXPERIENCE

Machine learning and data analysis advisor, marketing department, Skyeng *2018/09-2019/08*

- Skyeng is the largest online English teaching platform in Russia
- Used machine learning for data–driven evaluation of marketing strategies and marketing activities planning
- Part-time remote job

Quantitative/Machine learning developer, R&D department, Finery Tech *2018/09-2019/02*

- Finery Tech is a finance and trading company
- Developed an environment to test trading strategies

Volunteer participant, BigDL project by Intel *2017/08-2018/04*

- Worked in a team responsible for building RL and have built a few algorithms, like DQN, DDQN, REINFORCE, TRPO and PPO, utilized Actor-Critic and GAE advantage estimators
- Presented the intermediate results during the O'REILLY AI conference in Beijing

PROFESSIONAL ACTIVITIES

Author presenter, "Closing the Gap Between SVRG and TD-SVRG with Gradient Splitting", TUM, Munich and ETH, Zurich *2023/06*

Guest lecturer, lecture on AlphaZero for EC400: "Introduction to reinforcement learning" in Boston University *2021/12*

Invited speaker, Building deep reinforcement learning applications on BigDL and Spark, O'REILLY AI conference, Beijing *2018/04*

Memberships: AI Research Initiative (BU), BU IVC group, CVF

GRANTS, HONORS AND AWARDS

Amazon DeepFake challenge promotional credit, $1250 *2020/01*

Chinese government scholarship, China *2015-2018*

Dean scholarship for excellent students, Herzen University *2009-2013*

Vladimir Potanin Fellowship, Russia *2009-2010*

Graduated from Presidential Physics and Mathematics Lyceum No. 239 secondary school, top school in Russia, acceptance rate $< 2.5\%$

SELECTED COURSEWORK

BU EC 700: Reinforcement learning *2021/05*

BU CS 505: Natural language processing *2021/05*

BU CS 591: Deep Learning, Boston University *2020/05*

BU CS 565: Algorithmic Data Mining, Boston University *2019/12*

BU CS 542: Machine Learning, Boston University *2019/12*

REFERENCES

Alexander Olshevsky, Assistant Professor, Department of Electrical and Computer Engineering, Boston University

Ioannis Paschalidis, Distinguished Professor, Department of Electrical and Computer Engineering, Boston University

Eshed Ohn-Bar, PhD., Assistant Professor, Department of Electrical and Computer Engineering, Boston University

Kate Saenko, PhD., Associate Professor, Department of Computer Science, Boston University

Sarah Adel Bargal, PhD., Research Assistant Professor, Department of Computer Science, Boston University

Qiang Liu, PhD., Assistant Professor, Department of Computer Science, UT Austin

Adam Klivans, PhD., Associate Professor, Department of Computer Science, UT Austin

Shengsheng (Shane) Huang, Senior Software Architect, Big Data & AI, Intel, Shanghai (Available on my LinkedIn page)