Rui Liu

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Summary

- A passionate **machine learning Ph.D. candidate** with a solid background of **mathematics and statistics**, strong proficiency in **Python**, and **a publication in the top-tier machine learning conference (ICML).**
- 4+ years of research experience in the area of **machine learning (especially reinforcement learning), multi-agent systems, matrix completion, and optimization**.

Education

Boston University **Boston, MA, USA**
Ph.D of System Engineering, ***GPA:*** *4.0/4.0,* *September 2017 - Present (Expected Graduation: August 2022)*
Advisor: Prof. Alex Olshevsky,
Research Interests and Related Courses: Learning from Data; Reinforcement Learning; Optimization.

University of Chinese Academy of Sciences, **Beijing, China**
Master of Science, Operations Research and Cybernetics, ***GPA:*** *92.37/100,* *September 2014 - June 2017*
Advisor: Prof. Han-Fu Chen,
Related Courses: Advanced Probability; Stochastic Processes; Multi-Agent Systems; Linear Systems.

Nankai University **Tianjin, China**
Bachelor of Science, Mathematics and Statistics, ***GPA:*** *92.49/100,* *September 2010 - June 2014*
Related Courses: Mathematical Statistics; Graph Theory.

Programming Skills

Python, MATLAB/Simulink, PyTorch, C++, R, and LaTeX.

Research Experience & Projects

Reinforcement Learning and Machine Learning

- **Distributed Temporal Difference (TD) Learning with Almost No Communication.** [PDF]
  • Proposed a new distributed TD algorithm (relies on "one-shot averaging"), which significantly saves on communication and performs essentially identically to the other methods. Moreover, this is the first result rigorously showing benefits from parallelism for TD methods.
  • Implemented simulations on classic control problems in the OpenAI Gym and a grid world Markov Decision Process (MDP) problem.

- **Temporal Difference Learning as Gradient Splitting.**, International Conference on Machine Learning (ICML), PMLR, 2021. **Accepted for long presentations(Top 3%).** [PDF]
  • Provided an interpretation of TD in terms of a splitting of the gradient of an appropriately chosen quadratic function.
  • Proved improved non-asymptotic convergence times, as well as a better scaling with the discount factor.

- **Anomaly Detection for Flagging Fake Product Reviews.** [PDF]

  • Applied and compared a number of supervised and unsupervised methods to the problem of review spam detection.
  • Implemented experiments on YelpCHI datasets (contains hotel reviews and restaurant reviews).

Optimization and Matrix Completion

- **Asymptotic Convergence Rate of Alternating Minimization for Rank One Matrix Completion.** IEEE Control Systems Letters, 2020. [PDF]

  • Studied alternating minimization algorithm for matrix completion, and bounded the asymptotic convergence rate without any assumptions on degrees or diameter.
  • Performed simulations for various kinds of graphs (line, star, 2d-grid and 3d-grid and complete graph).

Stochastic Approximation

- **Distributed and Recursive Blind Channel Identification to Sensor Networks.** Control Theory and Technology, 2017. [PDF]

  • Proposed a distributed and recursive blind channel identification algorithms(based on the truncated stochastic approximation) for both time-invariant and time-varying networks.
  • Proved its convergence and showed computation results consistent with theoretical analysis.

Work Experience

- **Teaching Fellow:** Probability, Statistics, and Data Science (ENG EK381, Boston University), Fall 2019 and Fall 2020.

Publications

- Rui Liu, and Alex Olshevsky. "Distributed TD (0) with Almost No Communication." under review , 2021.
- Rui Liu, and Alex Olshevsky. "Temporal Difference Learning as Gradient Splitting." International Conference on Machine Learning. PMLR, 2021.
- Rui Liu, and Alex Olshevsky. "Asymptotic Convergence Rate of Alternating Minimization for Rank One Matrix Completion." IEEE Control Systems Letters 5.4 (2020): 1139-1144.
- Rui Liu, and Han-Fu Chen. "Distributed and Recursive Blind Channel Identification to Sensor Networks." Control Theory and Technology 15.4 (2017): 274-287.

Awards

- Boston University SE/CISE Grace Hopper Scholarship, 2020
- Dean's Fellowship Award, Sep. 2017-Aug. 2018
- Samsung Scholarship, Sep. 2012-Aug. 2013
- Meritorious Winner of The Mathematical Contest in Modeling, 2013
- First Prize of Excellent Undergraduate Scholarship, Sep. 2011-Aug. 2012