Curriculum Vitae
Afshin Oroojlooy
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Research Interests

Deep Reinforcement Learning, Multi-echelon Supply Chain, Inventory Optimization, Routing Problem, Mixed Integer Programming, Forecasting.

Appointments

- **Reinforcement Learning Researcher/Developer, Artificial Intelligence and Machine Learning R&D at SAS Institute**, Sep 2018- now,
  - Member of Reinforcement Learning research and development team.
  - Designed a general structure for Reinforcement Learning development framework.
  - Designed and developed a universal RL algorithm for real-time traffic signal control problem.
  - Designed and developed an RL algorithm for real-time queue/server management system with inputs from camera.
  - Designed and developed an RL framework to control oven temperature in glass manufacturing.
  - Designed and developed an machine learning framework for web-site recommendation system.
  - Designed and developed an RL framework for Heating, ventilation, and air conditioning (HVAC) problem.
  - Developed a general RL package in SAS via C++.
  - Developed a SAS-C framework for customer journey optimization problem.
  - Patented five research projects on applications of RL.
- **Machine Learning Intern, Artificial Intelligence and Machine Learning R&D at SAS Institute**, Jun 2017- Aug 2018
  - Member of Reinforcement Learning team.
  - Developed a feasibility study of Reinforcement Learning application for real world problems, applied on customer journey optimization for proof of the concept.
  - Developing a general Reinforcement Learning package in SAS-C.
  - Developed DQN algorithm in SAS-C and tested on OpenAI gym atari 2600 games.
  - Developed a Deep Concurrent Temporal Difference and Deep Q-Network algorithm for customer journey optimization.
  - Developed a DDPG algorithm for HVAC problem.
  - Drafted and submitted the corresponding patent application.
- **Research Assistant at Lehigh University**, Aug 2014- Sep 2018
  - Developed an adjusted Deep Q-Network algorithm to solve the ordering problem in a serial multi-echelon supply chain network.
  - Developed an integrated Policy Gradient algorithm and Pointer Network to solve the Vendor Route Problem and Stochastic Vendor Route Problem.

- Implemented a Deep Q-Network, Deep Deterministic Policy Gradient algorithm, and an integrated Policy Gradient algorithm and Pointer Network to solve Traveling Salesman Problem problem.
  - Implemented DQN, Deep TD, Deep Concurrent TD, Policy Gradient, Pointer Network, and DDPG algorithms.
  - Implemented classical Q-learning and Sarsa(λ) algorithms.
  - Implemented on PyTorch and TensorFlow.
- Integrated Estimation and Optimization Research Project for Supply Chain Problems.
  - Developed a Stock-out prediction tool with Deep Neural Networks for general multi-echelon supply chain problems.
    - Predicted one and multi-step ahead stock-out predictions.
  - Proposed and implemented a Deep Neural Networks algorithm to solve newsvendor problem (strongly competitive to the current approaches).
  - Implemented on caffe (C++) and TensorFlow.
- System Administrator of the COR@L lab, Aug 2016 up to now.
  - General maintenance of a small size high performance computing cluster.
  - Managed several Debian computational OS servers.
- Course Projects of Computational Methods in Optimization: Developed in C++
  - Parallel implementation of Conjugate Gradient algorithm with `Boost::MPI`.
  - Cache efficient implementation of different factorization methods.
  - Cache efficient implementation of different sort and matrix multiplication algorithms.
  - Parallel implementation of a matrix vector multiplication algorithm.
- Course Projects of Mining Massive Datasets: Implemented with Apache Spark Python
  - Dimensionality reduction algorithm based on singular value decomposition.
  - A-Priori Algorithm to extract frequent item sets and association rule in transactional databases.
  - Latent factor model as a recommendation system for Netflix problem.
  - PageRank algorithm to rank Wikipedia web pages.
  - K-means, SVD and SVM algorithms.
  - Min hashing algorithm to obtain text and web page similarity.

- **SAP ERP Implementation Consultant** at SamenEA, IT company- June 2011- Sep 2014
  - Responsible for system design, mapping, development, implementation, training and supporting.
  - Consulted with modules Financial Accounting: Asset (AA), Account Payable/Receivable (AP/AR), Cost Accounting, Employee/Manager Self Service (ESS/MSS), Personal Development (PD), Personal Time Management (PT), Organization Management (OM), Personal Administration, Workflow Management on ECC 6.0.
  - Interviewed key users of the organizations to gather the business processes.
  - Analyzed gathered data and prepared AS-IS documents (e.g. process and organization models, etc.)
  - Developed solutions, proposed improved methods of actions, documented TO-BE materials.
  - Prepared manuals and trained workers in use of new forms, reports, procedures or software, according to organizational policy.
  - Participated in two full life cycles, blueprint to go-live, implementations.
- **System Architecture and Analyzer**- Isfahan Municipality and Isfahan's Fire Station - Jun-Sep 2010

- Interviewed with key users, gathered required data, analyzed the data and prepared AS-IS documents (e.g. process and organization models, etc.).

Education

Ph.D. **Lehigh University**, Aug. 2014 - Sep 2018
Industrial Engineering, GPA: 3.75
Research: *Application of Machine Learning in Supply Chain Problems*
Advisers: Prof. *Lawrence Snyder* and Prof. *Martin Takac*

M.Sc. **Sharif University of Technology**, Sep. 2010 – Sep. 2012
Industrial Engineering, GPA: 4.0
Thesis: *Mixed Integer Programming Model for Train Timetabling on Multiple Track and Station Capacity Railway with Enhanced Upper Bound Heuristic Method and Lagrangian Relaxation Lower Bound*
Adviser: Prof. *Kourosh Eshghi*

B.Sc. **Isfahan University of Technology**, Sep. 2006 – Sep. 2010,
Industrial Engineering- Industrial Production, GPA: 3.87

Peer Reviewed Publications

1. A. Oroojlooy, M. Nazari, D. Hajinezhad, and J. Silva. "AttendLight: Universal Attention-Based Reinforcement Learning Model for Traffic Signal Control", The 33th Conference on Neural Information Processing Systems, NeurIPS 2020, Vancouver, CA.

2. A. Oroojlooy, R. Nazari, L. Snyder, and M. Takac. "A Deep Q-Network for the Beer Game: Reinforcement Learning for Inventory Optimization." Manufacturing & Service Operations Management (MSOM), 2021.

3. R. Nazari, A. Oroojlooy, L. Snyder, and M. Takac. "A Reinforcement Learning Framework for Solving Combinatorial Optmization Problems: Applications in Stochastic Vehicle Routing Problem." The 31th Conference on Neural Information Processing Systems, NeurIPS 2018, 9839–9849, Montreal, CA.

4. A. Oroojlooy, R. Nazari, L. Snyder, and M. Takac. "A Deep Q-Network for the Beer Game with Partial Information." Neural Information Processing Systems (NIPS), Deep Reinforcement Learning Symposium 2017, Long Beach, CA.

5. R. Nazari, A. Oroojlooy, M. Kabul. "Online Reinforcement Learning with the applications in Customer Journey Optimization." Neural Information Processing Systems (NIPS), Deep Reinforcement Learning Symposium 2017, Long Beach, CA.

6. A. Oroojlooy, L. Snyder, and M. Takac. "Applying Deep Learning to the Newsvendor Problem." IISE Transaction, 2019, DOI: 10.1080/24725854.2019.1632502.

7. A. Oroojlooy, K. Eshghi, Train Timetabling on multiple track and station capacity railway with enhanced upper and lower bound heuristic method for same train in network, Scientia Iranica 24 (6), 2017, 3324-3344.

8. BR. Vellaboyana, A. Oroojlooy, D. Fooladivanda, J. Taylor, L. Snyder, Optimal Scheduling of Networked Energy Storages, *IEEE Global Conference on Signal and Information Processing 2015, Orlando, Florida, USA*

9. K. Kianfar, S.M.T. Fatemi Ghomi, A. Oroojlooy, 2012, Study of stochastic sequence-dependent flexible flow shop via developing a dispatching rule and a hybrid GA, *Engineering Applications of Artificial Intelligence* 25 (2012) 494–506.

Under Review and Working Papers

1. D. Hajinezhad, A. Oroojlooy, X. Hunt, S. Das, J. Silva, M. Nazari "Automated Learning of Radiation Therapy Dose Distribution", Under review.
2. A. Oroojlooy and D. Hajinezhad. "A Review of Cooperative Multi-Agent Deep Reinforcement Learning." arXiv preprint arXiv:1908.03963.
3. A. Oroojlooy, L. Snyder, M. Takac. "Stock-out Prediction in Multi-echelon Networks." arXiv: 1709.06922.

Invited Talks

1. Approximate Dynamic Programming and Reinforcement Learning for Routing
   - M. Nazari, A. Oroojlooy, L. V. Snyder, M. Takáç, Reinforcement learning for solving the vehicle routing problem. INFORMS, Phoenix, AZ, November 2018.
2. Opex Analytics Round-table Tech
   - A. Oroojlooy, Application of Machine Learning on Supply Chain Problems, Online Talk, Sep 2017.
3. Machine Learning and Data-Driven Research
   - A. Oroojlooy, L. Snyder, M. Takáç, Application of Deep Learning for Newsvendor Problems, *Production and Operations Management Society conference*, Seattle, WA, May 2017.

Contributed Talks

1. A. Oroojlooy, M. Nazari, D. Hajinezhad, J. Silva. Attendlight: Universal Attention-based Reinforcement Learning Model For Traffic Signal Control, *INFORMS Annual Meeting*, Online Meeting, 2020.
2. A. Oroojlooy, D. Hajinezhad. Deal With Non-stationarity In Multi Agent Reinforcement Learning: A Review Of Fully Observable Critic Models, *INFORMS Annual Meeting*, Online Meeting, 2020.
3. D. Hajinezhad, A. Oroojlooy. Consensus Optimization In Multi-agent Reinforcement Learning: A Review, *INFORMS Annual Meeting*, Online Meeting, 2020.
4. A. Oroojlooy, M. Nazari, L. V. Snyder, M. Takáç. Reinforcement Learning algorithm for Inventory Optimization: Case on Beer Game, *INFORMS Annual Meeting*, Phoenix, AZ, Nov 2018.
5. M. Nazari, A. Oroojlooy, L. V. Snyder, M. Takáç. Reinforcement learning for solving the vehicle routing problem. MOPTA, Bethlehem, PA, August 2018.
6. A. Oroojlooy, M. Nazari, L. V. Snyder, M. Takáç. A Computer Plays the Beer Game: A Deep Reinforcement Learning Algorithm for Inventory Optimization, *INFORMS Annual Meeting*, Houston, TX, Oct 2017.
7. M. Nazari, A. OroojlooyJadid, L. V. Snyder, M. Takáç. Controlling stochastic VRP systems by using deep reinforcement learning., *INFORMS Annual Meeting*, Houston, TX, Oct 2017.
8. A. Oroojlooy, M. Nazari, L. V. Snyder, M. Takáç. A Deep Q-Network Algorithm for Inventory Optimization, Application on Beer Game, *Modeling and Optimization: Theory and Applications conference*, Bethlehem, PA, Aug 2017.

9. A. Oroojlooy, L. V. Snyder, M. Takáç. A Deep Learning model for the Newsvendors Problem, MSOM, Chapel Hill, NC, Jul 2017.

10. A. Oroojlooy, L. V. Snyder, M. Takáç. Application of Deep Learning for Newsvendor Problems, POMS, Seattle, WA, May 2017

11. A. Oroojlooy, L. V. Snyder, M. Takáç. Deep Learning for Newsvendors Problem, *INFORMS Annual Meeting*, Nashville, TN, Oct 2016.

12. A. Oroojlooy, L. V. Snyder, M. Takáç. A Deep Learning Model to Predict Stockouts in Multi-Echelon Inventory Systems, *Modeling and Optimization: Theory and Applications conference*, Bethlehem, PA, Aug 2016.

13. A. Oroojlooy, L. V. Snyder, M. Takáç. Deep Learning for Newsvendors, *Modeling and Optimization: Theory and Applications conference*, Bethlehem, PA, Aug 2016.

Patents

- Published:
  - M. Nazari, A. Orooiloov, M. Kabul. Computer-Assisted Reinforcement Learning System, US Patent No 10,762,424-B2, 1 Sep. 2020.
- Received Notice of Allowance:
  - A. Oroojlooy, M. Nazari,D. Hajinezhad, J. Silva, "Universal Attention-Based Reinforcement Learning Model for Control Systems", App No 17/177,694, 17 Feb 2021.
  - H. Ghadyali, K. Prabhudesai, J. Walker, X. Wu, X. Du, B. Biller, M. Nazari, A. Oroojlooy, A. Phelps, D. Hajinezhad, V. Valsaraj, J. Silva, J. Yi, "Real-Time Concealed Object Tracking", App No 17/060,504, 1 Oct 2020.
- Under Review:
  - M. Nazari, A. Oroojlooyjadid, A. Phelps, D. Hajinezhad, B. Biller, J. Walker, H. Ghadyali, K. Prabhudesai, X. Wu, X. Du, J. Silva, V. Valsaraj, J. Yi. "Discrete Event Simulation with Sequential Decision Making", 17/060,260,2020, 1 Oct 2020.

Reviewing Papers

- *ICML 2018-2021* 20 papers
- *NeurIPS 2018-2021* 20 papers
- *IJCAI 2019-2020* 5 papers
- *AAAI 2020-2021* 7 papers
- *ICLR 2021* 3 papers
- *ICTAI 2020* 1 papers
- *IISE Transaction (Institute of Industrial and Systems Engineers)* 3 papers
- *Journal of the Operational Research Society* 1 paper
- *European Journal of Operations Research* 1 paper

Honors and Awards

- *P.C. Rossin Fellowship*, P.C. Rossin College of Engineering and Applied Science, Lehigh University, May 2017.
- DDA Scholarship, P.C. Rossin College of Engineering and Applied Science, Lehigh University, Aug 2014.
- Awarded *DAAD* scholarship for Summer School from German Academic Exchange Service, May 2009.

Organized Conference Sessions and Sessions Chair

1. "Cooperative Multi-Agent Deep Reinforcement Learning", INFORMS Annual Meeting, Online Meeting, 2020.
2. "Reinforcement Learning for Supply Chain and Inventory Optimization", INFORMS Annual Meeting, Phoenix, AZ, Nov 2018.
3. "Reinforcement Learning for Supply Chain", Modeling and Optimization: Theory and Applications conference, Bethlehem, PA, Aug 2018.
4. "Using Deep Neural Networks for Solving Combinatorial Optimization Problems", INFORMS Annual Meeting, Houston, TX, Oct 2017.
5. "Machine Learning", Modeling and Optimization: Theory and Applications conference, Bethlehem, PA, Aug 2017.
6. "Application of Machine Learning", Modeling and Optimization: Theory and Applications conference, Bethlehem, PA, Aug 2016.

Memberships

- INFORMS Member.
- INFORMS College on Artificial Intelligence

Teaching Assistantship (All included office hours and grading homeworks)

- ***Introduction to Deterministic Optimization Models in Operations Research***, spring 2016.
  - Included teaching AMPL and MATLAB.
- ***Introduction to Stochastic Models in Operations Research***, fall 2015.
  - Included preparing homeworks, solutions.
- ***Production Analysis***, spring 2015.
- ***Resource Planning and Scheduling*** (graduate course), fall 2014.
  - Included teaching CPLEX IBM ILOG, Defining project and grading.
- ***Graph Theory*** (graduate course), spring 2013.
- ***Operations Research I***, fall 2011, spring 2012.
- ***Design and Analysis of Experiments*** (graduate course), fall 2011.

- ***Inventory Control and Production Planning***, spring 2009.

Computer Skills

Programming Languages	Python, C/C++ (C++14, MPI, OpenMP), MATLAB
Deep Learning	PyTorch, PyTorch C++, TensorFlow, caffe, TensorBoard
Mathematical Modelling	CPLEX, Gurobi, AMPL, ILOG OPL
Cluster Computing	Apache Spark
Time Series Analysis	SAS
Data Bases	Microsoft SQL
OS/ General	Linux, Bash Scripting, LaTeX, Windows, git, Microsoft Office

Other Local Service

- I have created and offered to PhD students at Lehigh University a teaching on Linux/Unix programming to use high performance computation services.
- Participated in developing a free online beer game for teaching students basic ideas of inventory optimization.
- Volunteer at INFORMS Annual Meeting, Philadelphia, Nov 2015 and Nashville, Oct 2016.
- Volunteer at MOPTA conference, Bethlehem, PA, Aug 2016, 2017, and 2018.