Raihan Seraj

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raihan-seraj.github.io in raihan-seraj 🖸 Raihan-Seraj

Education

PhD

Jan 2019 – present Montreal, Canada

- McGill University □
 - Research Interest: Reinforcement Learning, Multi-agent systems, Game Theory, Human Automation Teams
 - Affiliations: Montreal Institute of Learning Algorithms (MILA), Group for Research in Decision Analysis (GERAD), Center for Intelligent Machines (CIM).

MEng, Electrical & Computer Enginering

McGill University □

Jan 2017 – Jan 2019 Montreal, Canada

- Thesis: Learning in the presence of partial observability and concept drifts.
- Graduate Courses: Applied Machine Learning, Optimization and Optimal Control, Reinforcement Learning, Intelligent Robotics, Stochastic Control and Markov Decision Processes.

BSc, Electrical & Electronic Engineering

Islamic University of Technology \square

• Thesis: Classification of malignant and benign tissue using logistic regression with dynamic sigmoid function.

Dec 2011 - Dec 2015 Dhaka, Bangladesh

GCE O and Alevel

Mastermind 7

Jan 2009 – Jun 2011 Dhaka, Bangladesh

Research Experience

Research Scientist Intern

Valence Drug Discovery

- Implemented fibrous auto-encoders for constructing a latent space to generate molecules with different structures having the same activity level.
- Used latent molecular representation to construct a Markov Decision Process, and formulated a Reinforcement learning problem with the R&D team to identify scaffold hopping in molecules.

Jun 2021 - Sep 2021 Montreal, Canada

Research Scientist Intern

Paladin AI

- Designed learning algorithms for automatic flight data segmentation through automatic feature learning.
- Performed time series analysis with data from aircraft simulators and segmented pilot reactions during faults to assign them a proficiency metric.

Mar 2020 – Oct 2020 Montreal, Canada

Research Scientist Intern

Aerial Technologies

- Performed automatic feature extraction of WiFi Channel State Information (CSI) data that is robust to concept drift for the application of real-time indoor localization.
- Analyzed time series data and trained deep learning models to classify fall detection using WiFi Channel state information.

Mar 2018 – May 2019 Montreal, Canada

Research Engineer

Department of Biomedical Physics and Technology, University of Dhaka

- Designed learning algorithms to automatically classify QRS complexes to detect acceptable ECG traces.
- Developed a personal computer-based telemedicine system with integrated diagnostic equipment that uses the internet for live (real-time) data transfer.
- Worked on software development for automatic frequency domain analysis to identify neurological disorders from evoked EMG responses.
- Performed software interfacing of a 12 lead computerized ECG machine in android that allows near real-time data transmission to and from remote areas.

Dec 2015 – Dec 2016 Dhaka, Bangladesh

Research Intern

IUT Innovation Lab

- Designed embedded security systems for homes using Arduino and Raspberry Pi.
- Developed a device capable of remotely switching and regulating any 220V AC devices with real-time tweets.

Feb 2014 – Nov 2015 Dhaka, Bangladesh



Programming Languages *Python, Matlab, C, Java, Julia*

Frameworks

Numpy, Pandas, Scikit-Learn, Pytorch, Tensorflow, Chainer **Systems** *Linux, OSX*



GERAD co-supervised student award

Feb 01, 2019

GERAD

Winner of the GERAD research grant competition for co-supervised graduate students.

McGill Engineering Doctoral Award (MEDA)

Jan 01, 2019

McGill University

Awarded to doctoral students based on the excellence of the student's academic and research record.

MITACS Accelerate Fellowship

May 05, 2018

MITACS

Award provided to carry out extensive research in industries.

Graduate Excellence Fellowship

Jan 01, 2018

McGill University

Award to support outstanding Master's students.

Daily Star Award Jun 01, 2011

The Daily Star

Award to recognize outstanding performers in GCE O and A-levels.

Entrance exam scholarship

Dec 25, 2011

Islamic University of Technology

Merit-based scholarship awarded during the university entrance examination.

Publications

Approximate Information State for Approximate Planning and Reinforcement Learning in Partially Observed Environments

Journal of Machine Learning Research (JMLR)

Jayakumar Subramanian, Amit Sinha, Raihan Seraj and Aditya Mahajan

Mean-Field Approximation for Large-Population Beauty-Contest Games. ☑

IEEE Conference on Decision and Control (CDC)

Raihan Seraj, Jerome Le Ny and Aditya Mahajan.

Tsetlin Machine for Solving Contextual Bandit Problems

(submitted)

Raihan Seraj, Jivitesh Sharma, Ole-Christoffer Granmo

Reinforcement Learning for Mean-Field Teams 🛮

AAMAS workshop on Adaptive And Learning Agents

Jayakumar Subramanian, Raihan Seraj and Aditya Mahajan

The K-Means Algorithm: A Comprehensive Survey and Performance Evaluation 🛭

Multidisciplinary Digital Publishing Institute (MDPI), Electronics

Mohiuddin Ahmed, Raihan Seraj, Salimur Chowdhury and Syed Mohammed Samsul Islam.

Entropy Regularization with Discounted Future State Distribution in Policy Gradient Methods ☑

NeurIPS 2019 workshop on Optimization Foundations for Reinforcement Learning. Riashat Islam, Raihan Seraj, Pierre-Luc Bacon and Doina Precup.

Doubly Robust Off-Policy Actor Critic Algorithms for Reinforcement Learning

NeurIPS 2019 workshop on Safety and Robustness in Decision Making Riashat Islam, **Raihan Seraj**, Samin Yeasar Arnob and Doina Precup

Concept Drift for Big Data

Combating Security Challenges in the Age of Big Data. Advanced Sciences and Technologies for Security Applications. Springer, Cham

Raihan Seraj, Mohiuddin Ahmed

IEEE, IUT Student Branch

Handling concept drift in wi-fi-based localization 🛭

US Patent App. 17/383,654, 2021 "Handling concept drift in wi-fi-based localization LIU Qianyu, N Ghourchian, MA Martinez and **Raihan Seraj**

Positions of Responsibility	
Reviewer American Control Conference (ACC)	2021
Teaching Assistant COMP 360, Algorithm Design, McGill University	2020 Montreal, Canada
Teaching Assistant <i>ECSE 324, Computer Organization, McGill University</i>	2019 Montreal, Canada
Teaching Assistant COMP 760, Intelligent Robotics, McGill University	2019 Montreal, Canada
Volunteer Neural Information Processing Systems	2018 Montreal, Canada
Reviewer International Journal for Computers and Applications	2018 Montreal, Canada
President	2014

Dhaka, Bangladesh



Particle filters for simultaneous localization and mapping in robotics

Used particle filters for simultaneous localization and mapping for mobile robots. Implemented conditional particle filters which provide an efficient way of tracking the pose of nearby people and robots simultaneously.

Learning in games

Studied different learning frameworks in stochastic games since learning in the game-theoretic framework is interesting as it does not necessarily guarantee convergence to Nash equilibrium or any concepts of equilibria in general. The project focused on analyzing one of the simplest and earliest forms of learning algorithm known as the fictitious play.

Evaluation of value-based and policy-based methods in dynamic multi drug therapies for HIV treatment

Performed detailed analysis of value-based and policy-based methods for Reinforcement Learning algorithms in order to learn optimal STI strategies using a set of trajectories generated during clinical trials of different STI protocols.

Soft trust DDPG

Worked on devising a trust-region interpretation for Deep Deterministic Policy gradient algorithms. The proposed architecture allowed the use of regularization for deterministic policies in different continuous control tasks.

Reinforcement learning in multi-agent swarms

An adapted version of the conventional single-agent RL algorithm was applied for swarm robotics in the context of swarms adapting to the different target distribution, the work was further extended to incorporate hierarchical reinforcement learning architecture.

Unifying on-policy and off-policy learning in TD Learning and actor critic methods

Combined the stability of On-Policy TD learning with the efficiency of Off-Policy Learning and proposed a unified approach where the control algorithm either uses on-policy sampled action or off-policy samples depending on the amount of exploration. The idea has been further extended to actor-critic methods and Q(sigma) algorithm with eligibility traces.

Analysis of regularized logistic regression and kernel function

Analyzed the performance of kernelized logistic regression for objective automatic assessment of rehabilitative speech treatment in Parkinson's disease.

Analysis of convergence of BFGS and Conjugate gradient

Studied the implementation and convergence of a wide optimization techniques for the optimization of unconstrained functions. A detail analysis of convergence of BFGS, Conjugate gradient and Newton's algorithm with back tracking line search was done on Rosenbrock function.



Available upon request.