Raihan Seraj

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

Education

PhD Jan 2019 – present
McGill University Montreal, Canada

- **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 Jan 2017 – Jan 2019
McGill University 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 Dec 2011 – Dec 2015
Islamic University of Technology Dhaka, Bangladesh

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

GCE O and Alevel Jan 2009 – Jun 2011
Mastermind Dhaka, Bangladesh

Research Experience

Research Scientist Intern Jun 2021 – Sep 2021
Valence Drug Discovery Montreal, Canada

- 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.

Research Scientist Intern Mar 2020 – Oct 2020

Paladin AI Montreal, Canada

- 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.

Research Scientist Intern Mar 2018 – May 2019

Aerial Technologies Montreal, Canada

- 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.

Research Engineer Dec 2015 – Dec 2016

Department of Biomedical Physics and Technology, University of Dhaka Dhaka, Bangladesh

- 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.

Research Intern Feb 2014 – Nov 2015

IUT Innovation Lab Dhaka, Bangladesh

- 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.

Skills

Programming Languages
Python, Matlab, C, Java, Julia

Frameworks
Numpy, Pandas, Scikit-Learn, Pytorch, Tensorflow, Chainer

Systems
Linux, OSX

Awards

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

Tsetlin Machine for Solving Contextual Bandit Problems
Neural Information Processing Systems (NeurIPS) 2022
Raihan Seraj, Jivitesh Sharma, Ole-Christoffer Granmo

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.

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

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 2022
International Conference on Machine Learning (ICML)

Reviewer 2021
American Control Conference (ACC)

Teaching Assistant 2020
COMP 360, Algorithm Design, McGill University Montreal, Canada

Teaching Assistant 2019
ECSE 324, Computer Organization, McGill University Montreal, Canada

Teaching Assistant 2019
COMP 760, Intelligent Robotics, McGill University Montreal, Canada

Volunteer 2018
Neural Information Processing Systems Montreal, Canada

Reviewer 2018
International Journal for Computers and Applications Montreal, Canada

President 2014
IEEE, IUT Student Branch Dhaka, Bangladesh

Projects

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.

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.

References

Available upon request.