

KARUSH SURI

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RESEARCH INTERESTS

Karush is a graduate student at the University of Toronto completing his M.A.Sc in Electrical and Computer Engineering. His research focuses on developing novel intelligent agents for hierarchical reinforcement learning, model-based reinforcement learning and planning for robotic control.

EDUCATION

University of Toronto

Master of Applied Science

2019 - Present

Toronto, Canada

- Thesis: Deep Hierarchical Reinforcement Learning
- Advisors: Prof. Yuri A. Lawryshyn & Prof. Konstantinos N. Plataniotis
- GPA: 3.93/4

Amity University

Bachelor of Technology

2015 - 2019

Delhi, India

- Thesis: Application of Deep Learning & Game Theory for Sign Language Recognition using Wearable Sensors ([link](#))
- Advisor: Prof. Rinki Gupta
- GPA: 8.78/10

SCHOLARSHIPS & AWARDS

University of Toronto, Canada

Edward S. Rogers Graduate Scholarship

2019-2021

Amity University, India

Best in Technical Innovation Award (class of 2015-2019)

2019

Most Frugal Innovation Award

2018

100% Curriculum Merit Scholarship

2015

Others

Young Achievers Award

2015

RESEARCH APPOINTMENTS

RBC Capital Markets

Thesis Researcher

2019 - Present

Toronto, Canada

- Worked on model-based Reinforcement Learning and Planning for high-dimensional action abstraction by combining contrastive disagreements with importance sampling.
- Proposed ESAC combining ES and SAC using AMT for sample efficient and scalable reinforcement learning.
- Developed soft winner selection strategies and hindsight crossovers for dominant skill transfer in evolutionary methods.
- Developed Hierarchical Reinforcement Learning pipelines such as HRL and TradeR using policy gradient methods.

University of Toronto*Graduate Research Assistant- Reinforcement Learning*

2019 - Present

Toronto, Canada

- Affiliated with the Center for Management of Technology & Entrepreneurship (CMTE)
- Developed joint policy optimization algorithms using importance sampling and contrastive disagreements.
- Developed Hierarchical Reinforcement Learning methods for cooperation and competition with Multi-Agent Learning using CapsNet and ConvNet.
- Improved policy gradient algorithms in conjunction with evolution-based methods.

Amity University*Undergraduate Research Assistant- Deep Learning*

2017 - 2019

Delhi, India

- Affiliated with the Signal Processing & Deep Learning Lab
- Project entitled "Indian Sign Language to Spoken Language Translator using data from Wearable Multisensor Armbands" Funded by the Department of Science and Technology, Government of India, SERB file number ECR/2016/000637.
- Constructed novel CapsNets and ConvNets for non-cooperative games, Master-Slave DNNs and LSTM-RNNs for transfer-learning and dual-stage SVMs for classification and regression tasks.

PUBLICATIONS

- *Evolve To Control: Evolution-based Soft Actor-Critic for Scalable Reinforcement Learning*
Submitted to 4th Conference on Robot Learning (CoRL) 2020, MIT, US. (available on 28th July)
- *Attentive Hierarchical Reinforcement Learning for Stock Order Executions*
preprint, 2020. ([pdf](#)) ([code](#))
- *Continuous Sign Language Recognition from Wearable IMUs using Deep Capsule Networks and Game Theory*
Computers And Electrical Engineering, Elsevier, Vol. 78, pp.493-503, 2019. ([arXiv](#)) ([doi](#)) ([code](#))
- *Convolutional Neural Network Array for Sign Language Recognition using Wearable IMUs*
5th International Conference on Signal Processing and Integrated Networks, SPIN 2019, IEEE. ([arXiv](#)) ([code](#))
- *Transfer Learning for sEMG-based Hand Gesture Classification using Deep Learning in a Master- Slave Architecture*
International Conference on Communication and Computational Intelligence, 2018, IEEE. ([arXiv](#)) ([doi](#)) ([code](#))
- *Classification of Hand Gestures from Wearable IMUs using Deep Neural Network*
2nd International Conference on Inventive Communication and Computational Technologies, 2018, IEEE. ([arXiv](#)) ([doi](#)) ([code](#))
- *Activity Detection from Wearable Electromyogram Sensors using Hidden Markov Model*
2nd International Conference on Computing Methodologies and Communication, 2018, IEEE. ([arXiv](#)) ([doi](#)) ([code](#))

TEACHING APPOINTMENTS

- *Computer Organization* (Winter 2019)
CSC258H, University of Toronto, Canada.
- *Integral Calculus* (Summer 2016)
MATH, Sai Kripa Orphanage.
- *Numerical Differentiation* (Summer 2016)
MATH, Sai Kripa Orphanage.

- *Linear Algebra* (Summer 2016)
MATH, Sai Kripa Orphanage.
- *Introduction to Physics* (Fall 2016)
PHY, Sai Kripa Orphanage.

INDUSTRY EXPERIENCE

EdAuthority 2019-2020
Content Management Intern- Data Science *Delhi, India*

- Drafted, Edited and Published articles on modern-day trends and advancements in Data Science.
- Backend Website management and development of marketing solutions for digital platform and end-to-end marketing.

Airtel 2018
Network Management Intern *Delhi, India*

- Project entitled “Fundamentals of Network Communication”.
- conducted Fault Management and Throughput Handling by being an active part of the Radio Network Team.

Reliance Jio 2017
Summer Engineering Intern *Delhi, India*

- Project entitled “Excel Data Processing Automator using Python Programming”.
- Devised novel automated algorithms for creation, updating and deletion of spreadsheets consisting of Throughput and Connectivity Loss data.
- Received Letter of Recommendation from Mr. Hemant Jha (General Manager) for excellent innovation during the project.

Sony 2016
Summer Engineering Intern *Delhi, India*

- Project entitled “LCD Television Systems and BRAVIA Engine Applications”.
- conducted circuit assessment and analysis of BRAVIA engine Television sets along with their maintenance.

SELECTED PROJECTS

TradeR: Trade Execution using Reinforcement Learning 2020
Reinforcement Learning *RBC Capital Markets*

- Hierarchical Reinforcement Learning agent capable of trading on stock orders using a customized buy-sell simulator
- Trading operations using variable policies and multi-agent framework
- TradeR has traded over 70 stocks from the S&P 500 index at 1 minute intervals for the 2019-2020 fiscal year.

Evolution-based Soft Actor-Critic for Scalable Reinforcement Learning 2020
Reinforcement Learning *RBC Capital Markets*

- Proposed ESAC combining ES and SAC for sample efficient and scalable reinforcement learning
- Developed and improved robotic learning algorithms for MuJoCo and DeepMind control suite continuous tasks.

Attentive Hierarchical Reinforcement Learning for Stock Order Executions 2020
Reinforcement Learning University of Toronto

- S&P 500 stock order execution pipeline utilizing Hierarchical Reinforcement Learning and Attention for high frequency trading.
- Developed and tested on a total of 6 tickers with 2 minute granularity during the COVID-19 outbreak.

InvestApp: Investing Made Easy 2020
Data Science University of Toronto

- Worked in a team of 4+ members to develop a real-time investment application connecting 7+ countries for project funding via seed finance, joint ventures and fund managers.
- Actively conducted sessions, developed financial models, augmented business macroprocesses and proposed pitch solutions for tackling transaction regulations and making offshore trade feasible.

Facebook: Real-Time Image Generation from Deep Generative Models 2019
Deep Learning University of Toronto

- REST API capable of reconstructing images in real-time from CAEs and GANs deployed on serverless Lambda and scheduled for background runs using Eventbridge.

Continuous Sign Language Recognition from Wearable IMUs using Deep Capsule Networks and Game Theory 2019
Deep Learning Amity University

- Construction of 1D Capsule Networks for sign language recognition and their comparison with CNNs using real-time non-cooperative winner-take-it-all games.

An EMP Jamming Robotic System using Arduino Programming 2018
Robotics Amity University

- Mobile robot capable of jamming 2.4GHz signals using circular patch antenna.
- Won the award for Most Frugal Innovation at the Annual Poster Presentation and Technical Competition (APPTeC 2018)

ORGANIZATIONAL WORK & SERVICES

Elevate 2019
Event Volunteer Toronto, Canada

- Event Volunteer at the Elevate Toronto Tech Festival.
- Worked in a team of 10+ members to manage and assist industry professionals at the Meridian Hall.

Graduate Management Consulting Association 2019
Member Toronto, Canada

- Student member of the GMCA for 4 months (December, 2019 - March, 2020).
- Engaged and collaborated in management consulting events with focus on professional development and business networking.

IEEE Signal Processing & Integrated Networks (SPIN) 2017-2019
Lead Organizer Delhi, India

- Head of the stage team at 6th SPIN.
- Member of the coordinating committee at 5th SPIN.
- Member of the volunteering committee at 4th SPIN.

CERTIFICATIONS

- Big Data (IBM), [\(link\)](#) 2019.
- Customer Analytics (Wharton Business School), [\(link\)](#) 2019.
- Machine Learning (Stanford University), [\(link\)](#) 2017.

TECHNICAL SKILLS

Languages- Python, Lua, MATLAB, HTML, SQL, C, Assembly, Markdown, L^AT_EX.

Frameworks- PyTorch, Tensorflow, Keras, Theano, Numpy, scikit-learn, Matplotlib.