

# KARUSH SURI

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## RESEARCH INTERESTS

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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 Energy-based Reinforcement Learning and Probabilistic Control.

## EDUCATION

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### **University of Toronto**

*Master of Applied Science (M.A.Sc)*

2019 - Present

*Toronto, Canada*

- Department: Electrical & Computer Engineering
- Thesis: Deep Hierarchical Reinforcement Learning ([link](#)) ([video](#))
- Advisors: Prof. Yuri A. Lawryshyn & Prof. Konstantinos N. Plataniotis
- GPA: 4/4

### **Amity University**

*Bachelor of Technology (B.Tech)*

2015 - 2019

*Delhi, India*

- Department: Electronics & Communication Engineering
- 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

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### **University of Toronto, Canada**

Electrical & Computer Engineering Fellowship

2020-2021

Edward S. Rogers Graduate Scholarship

2019-2020

### **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

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### **Borealis AI**

*Thesis Researcher*

2019 - Present

*Toronto, Canada*

- Proposed Energy-based MIXer (EMIX) networks for surprise minimization in multi-agent StarCraft II.
- Proposed Evolution-based Soft Actor Critic (ESAC) combining ES and SAC with novel Automatic Mutation Tuning (AMT) for sample-efficient and scalable reinforcement learning.
- Proposed bilevel hierarchical framework for practical deep hierarchical reinforcement learning applications using energy-based policies.

**University of Toronto***Graduate Research Assistant- Reinforcement Learning*

2019 - Present

*Toronto, Canada*

- Affiliated with the Center for Management of Technology & Entrepreneurship (CMTE)
- Developing joint policy optimization algorithms for continuous control and multi-agent reinforcement learning.
- 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.
- Proposed novel CapsNets and ConvNets for non-cooperative games in real-time gesture recognition from wearable IMUs
- Proposed Master-Slave Nets for knowledge transfer in hand motion using sEMG sensors.

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**PUBLICATIONS**

- Karush Suri, Xiao Qi Shi, Konstantinos N. Plataniotis, Yuri A. Lawryshyn, “*Energy-based Surprise Minimization for Multi-agent Value Factorization*”, Deep Reinforcement Learning Workshop, 34<sup>th</sup> Conference on Neural Information Processing Systems (NeurIPS) 2020. ([website](#)) ([arXiv](#))
- Karush Suri, Xiao Qi Shi, Konstantinos N. Plataniotis, Yuri A. Lawryshyn, “*Maximum Mutation Reinforcement Learning for Scalable Control*”, Deep Reinforcement Learning Workshop, 34<sup>th</sup> Conference on Neural Information Processing Systems (NeurIPS) 2020. ([website](#)) ([arXiv](#))
- Karush Suri, Rinki Gupta, “*Continuous Sign Language Recognition from Wearable IMUs using Deep Capsule Networks and Game Theory*”, Computers And Electrical Engineering, Elsevier, Vol. 78, 2019. ([arXiv](#)) ([code](#))
- Karush Suri, Rinki Gupta, “*Transfer Learning for sEMG-based Hand Gesture Classification using Deep Learning in a Master- Slave Architecture*”, 3<sup>rd</sup> International Conference on Communication and Computational Intelligence (IC3I) 2018, IEEE. ([arXiv](#)) ([code](#))

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**INDEPENDENT STUDIES**

- Karush Suri, “*On Variational Generalization Bounds for Unsupervised Visual Recognition*”, Report, 2020. ([link](#)) ([code](#))
- Karush Suri, “*On Cooperation in Multi-Agent Reinforcement Learning*”, Report, 2020. ([link](#)) ([code](#))
- Karush Suri, Shashank Saurav, “*Attentive Hierarchical Reinforcement Learning for Stock Order Executions*”, Report, 2020. ([link](#)) ([code](#))

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**TEACHING ASSISTANTSHIPS**

- ECE1512H *Digital Image Processing and Applications*, University of Toronto (Winter 2021)
- CSC104H *Computational Thinking*, University of Toronto (Winter 2021)
- CSC2209H *Computer Networks*, University of Toronto (Fall 2020)
- CSC458H *Computer Networking Systems*, University of Toronto (Fall 2020)
- CSC258H *Computer Organization*, University of Toronto (Winter 2020)

- MATH *Integral Calculus*, Sai Kripa Orphanage (Summer 2016)
- MATH *Numerical Differentiation*, Sai Kripa Orphanage (Summer 2016)
- MATH *Linear Algebra*, Sai Kripa Orphanage (Summer 2016)

## INDUSTRY EXPERIENCE

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**EdAuthority** 2018-2019  
*Content Management Intern- Data Science* *Delhi, India*

- Published blog posts on data science concepts and their extensions to the education industry.
- Backend website management and development of scalable solutions for a digital platform.

**Airtel** 2018  
*Summer Engineering Intern* *Delhi, India*

- Project entitled “Fundamentals of Network Communication”.
- Calibrated network interface cards and connectivity sensors for throughput handling.

**Reliance Jio** 2017  
*Summer Engineering Intern* *Delhi, India*

- Project entitled “Excel Data Processing Automator using Python Programming”.
- Automated excel data management for spreadsheet handling and cell-to-cell logging.

**Sony** 2016  
*Summer Engineering Intern* *Delhi, India*

- Project entitled “LCD Television Systems and BRAVIA Engine Applications”.
- Programmed BRAVIA engine cards for video processing and image analysis.

## ORGANIZATIONAL WORK & SERVICES

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

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

**Signal Processing & Deep Learning Lab** 2017-2019  
*Lab Assistant* *Delhi, India*

- Hand motion data collector for lab test subjects.
- sEMG and IMU sensor calibrator for real-time demonstrations.

## TECHNICAL SKILLS

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**Languages-** Python, Lua, MATLAB, HTML, C, C++, Assembly, Markdown, L<sup>A</sup>T<sub>E</sub>X.

**Frameworks-** PyTorch, Tensorflow, torch7, Numpy, Gym, MuJoCo, Flask, ROS.

**Platforms-** Amazon Web Services, Google Cloud Platform, Git.