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 2019 - Present
Master of Applied Science *Toronto, Canada*

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

Amity University 2015 - 2019
Bachelor of Technology *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 2019 - Present
Thesis Researcher *Toronto, Canada*

- Proposing Learning Embeddings from Latent Actions (LELA) for tackling high dimensional action spaces in Humanoid tasks for continuous control and StarCraft II for multi-agent control.
- 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 2019 - Present
Graduate Research Assistant- Reinforcement Learning *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 2017 - 2019
Undergraduate Research Assistant- Deep Learning *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

- Karush Suri, Xiao Qi Shi, Konstantinos N. Plataniotis, Yuri A. Lawryshyn, "*Evolve To Control: Evolution-based Soft Actor-Critic for Scalable Reinforcement Learning*", Submitted to 4th Conference on Robot Learning (CoRL) 2020, MIT, US. (website) (arXiv) (blog) (code) (videos)
- Karush Suri, Shashank Saurav, "*Attentive Hierarchical Reinforcement Learning for Stock Order Executions*" preprint, 2020. (pdf) (code)
- 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, pp.493-503, 2019. (arXiv) (doi) (code)
- Karush Suri, Rinki Gupta, "*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)
- Karush Suri, Rinki Gupta, "*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)
- Karush Suri, Rinki Gupta, "*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)
- Rinki Gupta, Karush Suri, "*Activity Detection from Wearable Electromyogram Sensors using Hidden Markov Model*", 2nd International Conference on Computing Methodologies and Communication, 2018, IEEE. (arXiv) (doi) (code)

TEACHING ASSISTANTSHIPS

- *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.

LELA: Learning Embeddings from Latent Actions 2020
Reinforcement Learning *RBC Capital Markets*

· Branching architecture capable of learning high-dimensional action spaces from latent actions
· LELA branches the action space into lower-level policies by learning high-level behaviours in a memory-efficient manner
· LELA presents significant improvement on continuous control Humanoid tasks and StarCraft II multi-agent maps

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 with improved hyperparameter robustness
· Developed and improved robotic learning algorithms for MuJoCo and DeepMind control suite continuous tasks.

Attentive Hierarchcial 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.

Faceboard: 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 6^{th} SPIN.
· Member of the coordinating committee at 5^{th} SPIN.
· Member of the volunteering committee at 4^{th} 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, LaTeX.
Frameworks- PyTorch, Tensorflow, torch7, Keras, Theano, Numpy, scikit-learn, Matplotlib.