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Ryan Kortvelesy

Machine Learning Research Scientist

RESEARCH AREAS

- Graph Neural Networks
- Transformers
- Multi-Agent Systems
- Reinforcement Learning
- Mathematics

PROJECTS

Generalised Aggregation
- Parametrises the space of aggregation functions, making them learnable
- Increases the representational complexity of GNN architectures, boosting performance on benchmarks
- Defines a "generalised distributive property", which facilitates time and space efficient algorithms

Set Autoencoder
- Introduces a set encoder and set decoder, which define a bijective mapping between sets and fixed-size embeddings
- Enables architectures that produce variable-sized, order-independent outputs
- Serves as the key component in an application-agnostic communication strategy–a GNN trained in an unsupervised manner to reduce partial observability

Integrable Neural Network
- Defines a method for computing *analytic* integrals over neural networks, allowing one to represent the exact integral of a learned function
- Proposes approaches for applying constraints to the learned function (*e.g.* positivity, bounded integrals, etc)
- Suggests several applications, including modelling continuous probability distributions, trajectory optimisation, and distance metrics

Fast Memory
- Introduces a memory mechanism with SOTA performance that can be batched over the time dimension
- Provides a full mathematical derivation, and examines the connection of the resulting model to the Laplace Transform

EDUCATION

University of Cambridge — **2019-2023**
PhD, Computer Science
Graph Neural Networks for Multi-Agent Learning

University of Pennsylvania — **2016-2019**
BSE, Electrical Engineering
Minors in Computer Science and Mathematics
Graduated Summa Cum Laude

WORK EXPERIENCE

Software Development Engineer I — **Summer 2019**
Amazon – Seattle, WA
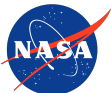
Intern — **Summer 2018**
JHU Applied Physics Lab, NASA – Laurel, MD
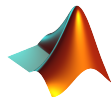
Software Engineering Intern — **Summer 2017**
Mathworks – Natick, MA

SELECTED PUBLICATIONS

Generalised f-Mean Aggregation for Graph Neural Networks — **NeurIPS 2023**
Ryan Kortvelesy, Steven Morad, Amanda Prorok

Permutation-Invariant Set Autoencoders with Fixed-Size Embeddings for Multi-Agent Learning — **AAMAS 2023**
Ryan Kortvelesy, Steven Morad, Amanda Prorok

Reinforcement Learning with Fast and Forgetful Memory — **NeurIPS 2023**
Steven Morad, Ryan Kortvelesy, Amanda Prorok

POPGym: Benchmarking Partially Observable Reinforcement Learning — **ICLR 2023**
Steven Morad, Ryan Kortvelesy, Matteo Bettini, Stephan Liwicki, Amanda Prorok

ModGNN: Expert Policy Approximation in Multi-Agent Systems with a Modular Graph Neural Network Architecture — **ICRA 2021**
Ryan Kortvelesy, Amanda Prorok

Fixed Integral Neural Networks — **Technical Report 2023**
Ryan Kortvelesy

QGNN: Value Factorisation with Graph Neural Networks — **Under Review**
Ryan Kortvelesy, Amanda Prorok