Andrew Holliday

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Publications

2024: **Andrew Holliday**, Ahmed El-Geneidy, Gregory Dudek. "Learning Heuristics for Transit Network Design and Improvement with Deep Reinforcement Learning". arXiv preprint: `https://arxiv.org/abs/2404.05894`

2024: **Andrew Holliday**, Gregory Dudek. "A Hybrid Neural-Evolutionary Algorithm for Autonomous Transit Network Design". Presented at *IEEE Conference on Robotics and Automation (ICRA)*, IEEE.

2024: Faraz Lotfi, Khalil Virji, Farnoosh Faraji, Lucas Berry, **Andrew Holliday**, David Meger, Gregory Dudek. "Uncertainty-aware hybrid paradigm of nonlinear MPC and model-based RL for offroad navigation: Exploration of transformers in the predictive model". Presented at *IEEE Conference on Robotics and Automation (ICRA)*, IEEE.

2023: **Andrew Holliday**, Gregory Dudek. "Augmenting Transit Network Design Algorithms with Deep Learning". Presented at *26th IEEE International Conference on Intelligent Transportation Systems (ITSC)*, pp. 2343-2350, IEEE.

2021: **Andrew Holliday**, Gregory Dudek. "Scale-Invariant Localization Using Quasi-Semantic Object Landmarks". In *Autonomous Robots*, vol. 45, no. 3, pp. 407-420

2020: **Andrew Holliday**, Gregory Dudek. "Pre-trained CNNs as Visual Feature Extractors: A Broad Evaluation". Presented at *17th Conference on Computer and Robot Vision (CRV)*, pp. 78-84, IEEE.

2018: **Andrew Holliday**, Gregory Dudek. "Scale-Robust Localization Using General Object Landmarks". *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pp. 1688-1694, IEEE.

2018: Travis Manderson, **Andrew Holliday**, Gregory Dudek. "Gaze Selection For Enhanced Visual Odometry During Navigation". Presented at *15th Conference on Computer And Robot Vision (CRV)*, pp. 110-117, IEEE.

2017: **Andrew Holliday**, Mohammadamin Barekatain, Johannes Laurmaa, Chetak Kandaswamy, Helmut Prendinger. "Speedup of Deep Learning Ensembles for Semantic Segmentation Using a Model Compression Technique". In *Computer Vision and Image Understanding*, vol. 164, pp. 16-26.

Research Experience

Mobile Robotics Laboratory at McGill University **Montreal, Canada**
Graduate Student *2014-2024*

- Researched the use of reinforcement learning and graph neural nets for the design of public transit systems, resulting in two publications to date and a 4.8% improvement over SOTA
- Researched robotic visual localization and mapping, resulting in several publications and a 70% improvement over SOTA in challenging long-distance localization cases
- Coordinated with researchers at multiple institutions to design and carry out robotics experiments in challenging oceanic and terrestrial environments

Samsung AI Center **Montreal, QC**
Research Intern *2019*

- Developed and enhanced a visual localization algorithm for real-world outdoor and indoor environments using still images and videos
- Designed and ran experiments comparing the algorithm with existing methods, achieving superior accuracy in challenging conditions
- Used Python, PyTorch, and OpenCV for algorithm development and experimentation
- Published findings in a paper in the journal *Autonomous Robots*

National Institute of Informatics **Tokyo, Japan**
Research Team Lead *2016*

- Led a team of 4 other graduate students
- Developed an ensemble distillation technique for semantic segmentation that improved mean IU over existing models by 1.7%, and published a journal paper on this work
- Managed construction a novel dataset of aerial images with semantic-segmentation labels

Technical Skills

Coding Languages: Python, C/C++, Java, Rust

Libraries & Frameworks: PyTorch, PyTorch Geometric, NumPy, OpenCV, ROS

Education

McGill University **Montreal, QC**
PhD, Computer Science *2017–2024*

- Thesis: Applications of Deep Reinforcement Learning to Urban Transit Network Design
- Supervised by Prof. Gregory Dudek and Prof. Ahmed El-Geneidy
- Committee members: Prof. Doina Precup, Prof. Luc Devroye, Prof. Inna Sharf

McGill University **Montreal, QC**
M.Sc, Computer Science *2014–2017*

- Thesis: Object-Features for Localization under Extreme Scale Changes
- Supervised by Prof. Gregory Dudek
- Exchange term at the National Institute of Informatics

University of British Columbia **Vancouver, BC**
B.Sc, Double Major in Physics & Computer Science *2007–2011*

Awards & Fellowships

2020-2022: Graduate Excellence Award

2020: MES Perserverance Award

2020: Lorne Trottier Science Accelerator Fellowship

2019-2021: NSERC Postgraduate Scholarships-Doctoral Program (PGS-D) Award

Conference Presentations

ICRA 2024: "A Hybrid Neural-Evolutionary Algorithm for Autonomous Transit Network Design".

ITSC 2023: "Augmenting Transit Network Design Algorithms with Deep Learning".

CRV 2020: "Pre-trained CNNs as Visual Feature Extractors: A Broad Evaluation".

IROS 2018: "Scale-Robust Localization Using General Object Landmarks".

Professional Activities

- Chair of ITSC 2023 session on public transport modelling
- Conference reviewer for CoRL, RSS, IROS, ITSC, and ICRA (2018-present)
- Student Fellow of the NSERC Canadian Robotics Network (NCRN)

Other Experience

Kinsol Research Inc. **Victoria, BC**
Machine Learning Consultant *2017-2019*

- Designed and implemented neural network architectures and training pipelines for visual object recognition and instance discrimination, time series prediction, and fast estimation of slow exact calculations
- Developed a dataset and annotation pipeline for training an object detection neural network, including the design of a human annotation process and clustering algorithm for final annotation refinement

In Motion Technology **New Westminster, BC**
Software Developer *2011–2013*

- Gathered requirements, designed, and developed applications and core functions for embedded platforms and web servers