Tyler L. Hayes

Personal Data

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Research Interests

Lifelong Machine Learning, Computer Vision, Deep Learning

Education

Aug. 2016 - Dec. 2021 — Doctor of Philosophy in Imaging Science
Rochester Institute of Technology, Rochester, NY
Advisor: Dr. Christopher Kanan
GPA: 3.81/4.0

Jan. 2015 - Mar. 2017 — Master of Science in Applied and Computational Mathematics
Rochester Institute of Technology, Rochester, NY
Advisor: Dr. Nathan Cahill
GPA: 4.0/4.0

Sept. 2011 - May 2014 — Bachelor of Science in Applied Mathematics
Rochester Institute of Technology, Rochester, NY
GPA: 3.65/4.0, *Magna Cum Laude*

Peer-Reviewed Conference Papers

ICRA — **T.L. Hayes**, N.D. Cahill, and C. Kanan. Memory efficient experience replay for streaming learning. *In: Proc. IEEE International Conference on Robotics and Automation*, 2019

CVPR-W — **T.L. Hayes**, R. Kemker, N.D. Cahill, and C. Kanan. New metrics and experimental paradigms for continual learning. *In: CVPRW: Real-World Challenges and New Benchmarks for Deep Learning in Robotic Vision*, 2018

CVPR — N.D. Cahill, **T.L. Hayes**, R.T. Meinhold, and J.F. Hamilton. Compassionately conservative balanced cuts for image segmentation. *In: Proc. IEEE Conference on Computer Vision and Pattern Recognition*, 2018

AAAI — R. Kemker, M. McClure, A. Abitino, **T.L. Hayes**, and C. Kanan. Measuring catastrophic forgetting in neural networks. *In: AAAI*, 2018

Papers Under Review

T.L. Hayes*, K. Kafle*, R. Shrestha*, M. Acharya, and C. Kanan. Remind your neural network to prevent catastrophic forgetting. *arXiv*, 2019

T.L. Hayes and C. Kanan. Lifelong machine learning with deep streaming linear discriminant analysis. *arXiv*, 2019

Abstracts and Posters Without Proceedings

T.L. Hayes and C. Kanan. Lifelong machine learning with deep streaming linear discriminant analysis. *Western NY Signal Processing Workshop, Rochester, NY*, 2019

T.L. Hayes and C. Kanan. Lifelong machine learning with deep streaming linear discriminant analysis. *DARPA L2M PI Meeting, Chicago, IL*, 2019

T.L. Hayes, N.D Cahill, and C. Kanan. Memory efficient experience replay for streaming learning. *Western NY Signal Processing Workshop, Rochester, NY*, 2018

T.L. Hayes, R. Kemker, N.D. Cahill, and C. Kanan. New metrics and experimental paradigms for continual learning. *CVPR Workshop: Real-World Challenges and New Benchmarks for Deep Learning in Robotic Vision, Salt Lake City, UT*, 2018

R. Kemker, M. McClure, A. Abitino, **T.L. Hayes**, and C. Kanan. Measuring catastrophic forgetting in neural networks. *Conference on Data Analysis (CoDA), Santa Fe, NM*, 2018

R. Kemker, M. McClure, A. Abitino, **T.L. Hayes**, and C. Kanan. Measuring catastrophic forgetting in neural networks. *Western NY Signal Processing Workshop, Rochester, NY*, 2017

Conference Papers

T.L. Hayes, R.T. Meinhold, J.F. Hamilton, and N.D. Cahill. Piecewise flat embeddings for hyperspectral image analysis. *In: Proc. SPIE DCS Defense and Security: Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XXIII*, 2017

R.T. Meinhold, **T.L. Hayes**, and N.D. Cahill. Efficiently computing piecewise flat embeddings for data clustering and image segmentation. *In: Proc. IEEE MIT Undergraduate Research and Technology Conference*, 2016

Thesis

T.L. Hayes. Compassionately conservative normalized cuts for image segmentation. *MS Thesis, Rochester Institute of Technology*, 2017

Talks

T.L. Hayes. Memory efficient experience replay for mitigating catastrophic forgetting. *RIT AI Seminar Series, Rochester, NY*, 2019 [**Invited Talk**]

T.L. Hayes and N.D. Cahill. Piecewise flat embeddings for hyperspectral image analysis. *SPIE DCS Defense and Security Conference, Anaheim, CA*, 2017

Research Experience

Aug. 2017 - Present | Graduate Research Assistant
Machine and Neuromorphic Perception Laboratory (kLab)
Rochester Institute of Technology, Rochester, NY
Topics: Lifelong Machine Learning, Deep Learning, Streaming Learning

June 2017 - Aug. 2017 | Graduate Research Intern
Naval Research Enterprise Internship Program (NREIP) by the American Society for Engineering Education (ASEE)
U.S. Naval Research Laboratory (NRL), Washington, DC
Tasks: Assessed the validity of the manifold hypothesis within deep neural networks. Utilized dimensionality reduction and intrinsic dimension estimation techniques to characterize feature manifolds.

Jan. 2016 - May 2017 | Graduate Research Assistant
Image Computing and Analysis Laboratory (ICAL)
Rochester Institute of Technology, Rochester, NY
Tasks: Developed a new cut cost and optimization algorithm for graph-based image segmentation with ties to manifold learning.

Work Experience

June 2015 - Aug. 2015 | Image Science Intern
UTC Aerospace Systems, Westford, MA
Tasks: Implemented Non-Linear Least Squares optimizer to fit functions to edge spread data. Derived metrics from fitted edge data to evaluate resolution sharpness metrics of airborne sensors and quantified confidence estimates using bootstrap resampling.

Oct. 2014 - Jan. 2015 | Staffing Coordinator
Durham Staffing, Depew, NY
Tasks: Contacted employees regarding job opportunities and answered employee and client questions via phone. Administered and organized application materials. Maintained notes on applicants in database.

June 2014 - Sept. 2014 | IT Analyst - Technical Development Program
Liberty Mutual Insurance, Portsmouth, NH
Tasks: Led case study presentations. Coordinated process improvement project to improve productivity trackers. Created workflow diagrams and traceability matrices for process improvement projects.

May 2013 - Aug. 2013 | Information Technology Intern
Liberty Mutual Insurance, Portsmouth, NH
Tasks: Researched and compiled presentations on statistical models and statistical software used for predictive analytics. Developed use cases involving loss triangling methods and fraud detection techniques.

Teaching Experience

Aug. 2016 - May 2017 | Graduate Teaching Assistant
Chester F. Carlson Center for Imaging Science
Rochester Institute of Technology, Rochester, NY
Classes: Deep Learning for Vision (Grad.), Image Processing and Computer Vision (Grad.)
Tasks: Graded and assisted students with homework, proposals, projects, and presentations.

Jan. 2015 - May 2016	Graduate Teaching Assistant School of Mathematical Sciences **Rochester Institute of Technology**, Rochester, NY **Classes**: Calculus (B, C, I, II) **Tasks**: Assisted students with in-class workshops and graded homework assignments.
Jan. 2014 - May 2014	Learning Assistant School of Mathematical Sciences **Rochester Institute of Technology**, Rochester, NY **Class**: Mathematics of Graphical Simulation **Tasks**: Created notes and graded group worksheets. Held recitation sessions for assistance with homework and class concepts.
Sept. 2012 - Dec. 2013	Grader School of Mathematical Sciences **Rochester Institute of Technology**, Rochester, NY **Classes**: Multivariable Calculus, Differential Equations, Probability and Statistics **Tasks**: Graded homework assignments.

Technical Skills

Deep Learning Frameworks: PyTorch, TensorFlow, Keras
Scientific Computing Packages: Numpy, Scipy, Scikit-learn
Competent in Programming: Python, MATLAB
Also Familiar With: Java
Operating Systems: Linux (Ubuntu), Microsoft Windows
Applications: Git, Bash Scripting, LaTeX, Microsoft Office, Word, Excel, Outlook

Scholarships and Awards

2016 RIT Graduate Student Honor Roll (4.0/4.0 GPA)
2016 RIT Student Achievement Honors for Outstanding Teaching Assistant
2015 RIT Graduate Student Scholarship
2014 Alpha Sigma Lambda Honorary Society
2014 RIT Student Achievement Honors for Best Mathematical Modeling Project
2013 RIT Student Achievement Honors for Best Grader
2012 RIT Named Scholarship
2011 RIT Merit Scholarship

Interns Supervised

2019 Hitesh Vaidya (MS Student) - co-supervised with Ryne Roady
2019 Xuexun Xiao (MS Student)
2017 Michael Geraci (HS Student) - co-supervised with Kushal Kafle

Reviewer

2018 IEEE International Symposium on Biomedical Imaging (ISBI) [Delegate Reviewer]
2017 IEEE International Conference on Image Processing (ICIP)