Tyler Hayes

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Education

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

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

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

Peer-Reviewed Papers

BMVC M. Acharya, **T.L. Hayes**, and C. Kanan. Rodeo: Replay for online object detection. *In: British Machine Vision Conference (BMVC)*, 2020 [29.1% accept rate]

ECCV-W R. Roady, **T.L. Hayes**, and C. Kanan. Improved robustness to open set inputs via tempered mixup. *In: ECCVW: Adversarial Robustness in the Real World*, 2020

ECCV **T.L. Hayes***, K. Kafle*, R. Shrestha*, M. Acharya, and C. Kanan. Remind your neural network to prevent catastrophic forgetting. *In: Proc. European Conference on Computer Vision (ECCV)*, 2020 [27.1% accept rate; * denotes equal contribution]

CVPR-W **T.L. Hayes** and C. Kanan. Lifelong machine learning with deep streaming linear discriminant analysis. *In: CVPRW: Continual Learning in Computer Vision*, 2020 [**Best Paper Award; Oral Presentation**]

CVPR-W R. Roady*, **T.L. Hayes***, H. Vaidya, and C. Kanan. Stream-51: Streaming classification and novelty detection from videos. *In: CVPRW: Continual Learning in Computer Vision*, 2020 [* denotes equal contribution]

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 [44.0% accept rate]

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 [29.6% accept rate]

AAAI R. Kemker, M. McClure, A. Abitino, **T.L. Hayes**, and C. Kanan. Measuring catastrophic forgetting in neural networks. *In: AAAI*, 2018 [24.6% accept rate; **Oral Presentation**]

Papers Under Review & Pre-Prints

Z. Qian, **T.L. Hayes**, K. Kafle, and C. Kanan. Do we need fully connected output layers in convolutional networks? *arXiv*, 2020

R. Roady, **T.L. Hayes**, R. Kemker, A. Gonzales, and C. Kanan. Are out-of-distribution detection methods effective on large-scale datasets? *arXiv*, 2019

Talks

T.L. Hayes. Remind your neural network to prevent catastrophic forgetting. *Continual AI Meetup, Online*, 2020 [**Invited Talk**]

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

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

Abstracts and Posters Without Proceedings

T.L. Hayes*, K. Kafle*, R. Shrestha*, M. Acharya, and C. Kanan. Remind your neural network to prevent catastrophic forgetting. *CVPR Workshop: Women in Computer Vision (WiCV), Seattle, WA*, 2020 [* denotes equal contribution]

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

Research Experience

Rochester Institute of Technology — *Rochester, NY*
Graduate Research Assistant — *Aug. 2017 - Present*

- Machine and Neuromorphic Perception Laboratory (kLab)
- **Mentor**: Dr. Christopher Kanan
- **Tasks**: Develop neural network models capable of learning new information incrementally over time, without catastrophically forgetting previous knowledge.

U.S. Naval Research Laboratory (NRL) — *Washington, DC*
Graduate Research Intern — *June 2017 - Aug. 2017*

- Naval Research Enterprise Internship Program (NREIP) by the American Society for Engineering Education (ASEE)
- **Mentor**: Dr. Leslie Smith
- **Tasks**: Assessed the validity of the manifold hypothesis within deep neural networks. Utilized dimensionality reduction and intrinsic dimension estimation techniques to characterize feature manifolds.

Rochester Institute of Technology — *Rochester, NY*
Graduate Research Assistant — *Jan. 2016 - May 2017*

- Image Computing and Analysis Laboratory (ICAL)
- **Mentor**: Dr. Nathan Cahill
- **Tasks**: Developed a new cut cost and optimization algorithm for graph-based image segmentation with ties to manifold learning.

Work Experience

UTC Aerospace Systems — *Westford, MA*
Image Science Intern — *June 2015 - Aug. 2015*

- **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.

Durham Staffing — *Depew, NY*
Staffing Coordinator — *Oct. 2014 - Jan. 2015*

- **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.

Liberty Mutual Insurance — *Portsmouth, NH*
IT Analyst - Technical Development Program — *June 2014 - Sept. 2014*

- **Tasks**: Led case study presentations. Coordinated process improvement project to improve productivity trackers. Created workflow diagrams and traceability matrices for process improvement projects.

Liberty Mututal Insurance — *Portsmouth, NH*
Information Technology Intern — *May 2013 - Aug. 2013*

- **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

Rochester Institute of Technology — *Rochester, NY*
Graduate Teaching Assistant — *Aug. 2016 - May 2017*

- Chester F. Carlson Center for Imaging Science
- **Classes**: Deep Learning for Vision (Graduate Level), Image Processing and Computer Vision (Graduate Level)
- **Tasks**: Graded and assisted students with homework, proposals, projects, and presentations.

Rochester Institute of Technology — *Rochester, NY*
Graduate Teaching Assistant — *Jan. 2015 - May 2016*

- School of Mathematical Sciences
- **Classes**: Calculus (B, C, I, II)
- **Tasks**: Assisted students with in-class workshops and graded homework assignments.

Rochester Institute of Technology — *Rochester, NY*
Learning Assistant — *Jan. 2014 - May 2014*

- School of Mathematical Sciences
- **Class**: Mathematics of Graphical Simulation
- **Tasks**: Created notes and graded group worksheets. Held recitation sessions for assistance with homework and class concepts.

Rochester Institute of Technology — *Rochester, NY*
Grader — *Sept. 2012 - Dec. 2013*

- School of Mathematical Sciences
- **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
Programming (Proficient)	Python, MATLAB
Programming (Basic)	Java
Operating Systems	Linux (Ubuntu), Microsoft Windows
Applications	Git, Bash Scripting, LaTeX, Microsoft Office, Word, Excel, Outlook

Scholarships & Awards

- **Best Paper Award:** Workshop on Continual Learning in Computer Vision (CLVision) at CVPR-2020 — *2020*
- **Travel Grant:** Women in Computer Vision (WiCV) Workshop at CVPR-2020 — *2020*
- RIT Graduate Student Scholarship — *2016*
- RIT Graduate Student Honor Roll (4.0/4.0 GPA) — *2016*
- RIT Student Achievement Honors for Outstanding Teaching Assistant — *2016*
- RIT Graduate Student Scholarship — *2015*
- Alpha Sigma Lambda Honorary Society — *2014*
- RIT Student Achievement Honors for Best Mathematical Modeling Project — *2014*
- RIT Student Achievement Honors for Best Grader — *2013*
- RIT Named Scholarship — *2012*
- RIT Merit Scholarship — *2011*

Reviewer

- British Machine Vision Conference (BMVC) *2020*
- CVPR Workshop on Continual Learning in Computer Vision (CLVision) *2020*
- IEEE Transactions on Neural Networks and Learning Systems *2020*
- Neural Networks (Elsevier) *2020*
- IEEE International Symposium on Biomedical Imaging (ISBI) [Delegate Reviewer] *2018*
- IEEE International Conference on Image Processing (ICIP) *2017*

Students Supervised

- Yipeng Zhang (BS Student; University of Rochester) *2020*
- Hitesh Vaidya (MS Student; Rochester Institute of Technology) *2019*
- Xuexun Xiao (MS Student; University of Rochester) *2019*
- Michael Geraci (HS Student) *2018*