Tyler L. Hayes

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Education

Rochester Institute of Technology — *Rochester, NY*
PH.D. IN IMAGING SCIENCE — *Aug. 2016 - May 2022*
- **Thesis**: Towards Efficient Lifelong Machine Learning in Deep Neural Networks
- **Advisor**: Dr. Christopher Kanan

Rochester Institute of Technology — *Rochester, NY*
M.S. IN APPLIED AND COMPUTATIONAL MATHEMATICS — *Jan. 2015 - May 2017*
- **Thesis**: Compassionately Conservative Normalized Cuts for Image Segmentation
- **Advisor**: Dr. Nathan Cahill

Rochester Institute of Technology — *Rochester, NY*
B.S. IN APPLIED MATHEMATICS — *Sept. 2011 - May 2014*
- *Magna Cum Laude*

Experience

NAVER LABS Europe — *Grenoble, France*
RESEARCH SCIENTIST — *Nov. 2022 - May 2024*
- Developed methods for novel class discovery and detection, open-vocabulary object detection with vision-language models, and explainable AI with vision-language models on the team led by Dr. Diane Larlus.
- Led collaboration with Autonomous Driving group to apply our methods to real-world data collected by NAVER shuttles.

ContinualAI Non-Profit Organization — *Virtual*
BOARD MEMBER — *Mar. 2022 - May 2024*
- Contributed to shaping the mission and objectives of the organization. Managed membership fees. Helped organize a 24-hour virtual conference with pre-registered reports and seminars attended by over 280 participants across 36 countries.

Facebook AI Research (FAIR) — *Virtual*
RESEARCH INTERN — *May 2021 - Dec. 2021*
- Developed paradigm for incremental active learning at the category level on long-tailed distributions. Mentored by Dr. Arthur Szlam and Dr. Ludovic Denoyer.

Rochester Institute of Technology — *Rochester, NY*
GRADUATE RESEARCH ASSISTANT — *Aug. 2017 - May 2022*
- Developed efficient neural networks capable of incrementally learning new information without catastrophic forgetting. Mentored by Dr. Christopher Kanan.

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)
- Assessed validity of the manifold hypothesis in neural networks using dimensionality reduction and intrinsic dimension estimation. Mentored by Dr. Leslie Smith.

Rochester Institute of Technology *Rochester, NY*

Graduate Research Assistant *Jan. 2016 - May 2017*

- Developed a new cut cost and optimization algorithm for graph-based image segmentation with ties to manifold learning. Mentored by Dr. Nathan Cahill.

UTC Aerospace Systems *Westford, MA*

Image Science Intern *June 2015 - Aug. 2015*

- Implemented Non-Linear Least Squares optimizer to fit functions to edge data and evaluate sensor sharpness. Quantified confidence via bootstrap resampling.

Liberty Mutual Insurance *Portsmouth, NH*

IT Analyst - Technical Development Program *June 2014 - Sept. 2014*

- Coordinated productivity tracker improvement projects and developed workflow diagrams/traceability matrices for process improvements.

Liberty Mututal Insurance *Portsmouth, NH*

Information Technology Intern *May 2013 - Aug. 2013*

- Researched and compiled presentations on statistical models and software for predictive analytics. Developed use cases involving fraud detection and loss triangles.

Peer-Reviewed Publications

1. G. Csurka, **T.L. Hayes**, D. Larlus, and R. Volpi. What could go wrong? Discovering and describing failure modes in computer vision. *In: ECCVW: Explainable Computer Vision*, 2024
2. **T.L. Hayes**, C.R. de Souza, N. Kim, J. Kim, R. Volpi, and D. Larlus. Pandas: Prototype-based novel class discovery and detection. *In: Conference on Lifelong Learning Agents (CoLLAs)*, 2024
3. E. Verwimp, R. Aljundi, S. Ben-David, M. Bethge, A. Cossu, A. Gepperth, **T.L. Hayes**, E. Hüllermeier, C. Kanan, D. Kudithipudi, C.H. Lampert, M. Mundt, R. Pascanu, A. Popescu, A.S. Tolias, J. van de Weijer, B. Liu, V. Lomonaco, T. Tuytelaars, and G. van de Ven. Continual learning: Applications and the road forward. *In: Transactions on Machine Learning Research (TMLR)*, 2024
4. M. Liu, **T.L. Hayes**, E. Ricci, G. Csurka, and R. Volpi. Shine: Semantic hierarchy nexus for open-vocabulary object detection. *In: Proc. IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2024 [23.6% accept rate; **Highlight Poster (2.8% accept rate)**]
5. M.Y. Harun*, J. Gallardo*, **T.L. Hayes**, R. Kemker, and C. Kanan. Siesta: Efficient online continual learning with sleep. *In: Transactions on Machine Learning Research (TMLR)*, 2023 [* equal contribution]
6. M. Mundt, K.W. Cooper, D.S. Dhami, A. Ribeiro, J.S. Smith, A. Bellot, and **T.L. Hayes**. Continual causality: A retrospective of the inaugural AAAI-23 bridge program. *PMLR*, 2023
7. M.Y. Harun, J. Gallardo, **T.L. Hayes**, and C. Kanan. How efficient are today's continual learning algorithms? *In: CVPRW: Continual Learning in Computer Vision*, 2023
8. **T.L. Hayes**, M. Nickel, C. Kanan, L. Denoyer, and A. Szlam. Can I see an example? Active learning the long tail of attributes and relations. *In: British Machine Vision Conference (BMVC)*, 2022
9. I. Sur, Z. Daniels, A. Rahman, K. Faber, J. Gallardo, **T.L. Hayes**, C.E. Taylor, M.B. Gurbuz, J. Smith, S. Joshi, N. Japkowicz, M. Baron, Z. Kira, C. Kanan, R. Corizzo, A. Divakaran, M. Piacentino, J. Hostetler, and A. Raghavan. System design for an integrated lifelong reinforcement learning agent for real-time strategy games. *In: International Conference on AI-ML Systems*, 2022 [**Oral Presentation**]
10. **T.L. Hayes** and C. Kanan. Online continual learning for embedded devices. *In: Conference on Lifelong Learning Agents (CoLLAs)*, 2022
11. Y. Zhang, **T.L. Hayes**, and C. Kanan. Disentangling transfer and interference in multi-domain learning. *In: AAAIW: Practical Deep Learning in the Wild*, 2022
12. J. Gallardo, **T.L. Hayes**, and C. Kanan. Self-supervised training enhances online continual learning.

In: British Machine Vision Conference (BMVC), 2021 [36.2% accept rate]

13. **T.L. Hayes**, G.P. Krishnan, M. Bazhenov, H.T. Siegelmann, T.J. Sejnowski, and C. Kanan. Replay in deep learning: Current approaches and missing biological elements. *Neural Computation*, 2021
14. **T.L. Hayes** and C. Kanan. Selective replay enhances learning in online continual analogical reasoning. *In: CVPRW: Continual Learning in Computer Vision*, 2021 [**Oral Presentation**]
15. V. Lomonaco, L. Pellegrini, A. Cossu, A. Carta, G. Graffieti, **T.L. Hayes**, M. De Lange, M. Masana, J. Pomponi, G. van de Ven, M. Mundt, Q. She, K. Cooper, J. Forest, E. Belouadah, S. Calderara, G.I. Parisi, F. Cuzzolin, A. Tolias, S. Scardapane, L. Antiga, S. Amhad, A. Popescu, C. Kanan, J. van de Weijer, T. Tuytelaars, D. Bacciu, and D. Maltoni. Avalanche: an end-to-end library for continual learning. *In: CVPRW: Continual Learning in Computer Vision*, 2021 [**Best Library Award**]
16. R. Roady, **T.L. Hayes**, R. Kemker, A. Gonzales, and C. Kanan. Are open set classification methods effective on large-scale datasets? *PLoS ONE*, 2020
17. 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]
18. 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
19. **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; * equal contribution]
20. **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**]
21. 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 [* equal contribution]
22. **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 (ICRA)*, 2019 [44.0% accept rate]
23. **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
24. 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 (CVPR)*, 2018 [29.6% accept rate]
25. 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**]

Patent Applications

1. Two patent applications submit with NAVER LABS Europe, 2024
2. C. Kanan, **T.L. Hayes**, K. Kafle, and R. Shrestha. Method for training parametric machine learning systems, January 28 2021. US Patent App. 16/938,035

Invited Talks

1. Dynamic adaptation through lifelong & open-world learning. *Italian National AI PhD Fall School*, 2023
2. Efficient lifelong machine learning: Where have we been and where do we go next? *French Alternative Energies and Atomic Energy Commission (CEA) Workshop on Continual Learning*, 2023
3. Lifelong learning: Where do we go next? *Schloss Dagstuhl Seminar on Deep Continual Learning*, 2023
4. Real-world considerations and applications for continual machine learning. *CVPR Workshop on Continual Learning in Computer Vision (CLVision)*, 2022

5. Efficient lifelong machine learning in deep neural networks. *NAVER LABS Europe*, 2022
6. Efficient lifelong machine learning in deep neural networks. *Max Planck Institute for Informatics*, 2022
7. Efficient lifelong machine learning in deep neural networks. *University of Alberta and Amii*, 2022
8. Real-world considerations and applications for continual machine learning. *Continual AI Seminar*, 2022
9. Replay in deep learning: Current approaches and missing biological elements. *Continual AI Reading Group*, 2021
10. Continual learning in deep neural networks: Methods and applications. *Open Data Science Conference East*, 2021 (joint with Christopher Kanan)
11. Stream-51: Streaming classification and novelty detection from videos. *Continual AI Meetup: Benchmarks and Evaluation for Continual Learning*, 2020
12. Remind your neural network to prevent catastrophic forgetting. *Continual AI Meetup: Continual Learning with Sequential Streaming Data*, 2020
13. Memory efficient experience replay for mitigating catastrophic forgetting. *RIT AI Seminar Series*, 2019

Awards & Scholarships

- **Best Library Award:** Workshop on Continual Learning in Computer Vision (CLVision) at CVPR 2021 *2021*
- **Travel Grant:** Women in Computer Vision (WiCV) Workshop at CVPR 2021 *2021*
- **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*
- **Best Poster Award:** Western NY Signal Processing Workshop *2017*
- **Scholarship:** RIT Graduate Student Scholarship *2016*
- **Honor Roll Award:** RIT Graduate Student Honor Roll (4.0/4.0 GPA) *2016*
- **Outstanding Teaching Assistant Award:** RIT School of Mathematical Sciences *2016*
- **Scholarship:** RIT Graduate Student Scholarship *2015*
- **Honorary Society:** Alpha Sigma Lambda Honorary Society *2014*
- **Best Mathematical Modeling Project Award:** RIT School of Mathematical Sciences *2014*
- **Best Grader Award:** RIT School of Mathematical Sciences *2013*
- **Scholarship:** RIT Named Scholarship *2012*
- **Scholarship:** RIT Merit Scholarship *2011*

Service

- **Organizer:** Workshop on Continual Learning in Computer Vision (CLVision) at CVPR *2024*
- **PhD Committee:** Served on jury for Ph.D. Dissertation Defense of Gregoire Petit *2024*
- **Organizer:** Bridge Program on Continual Causality at AAAI *2023-24*
- **Organizer:** Tutorial on Visual Recognition Beyond the Comfort Zone: Adapting to Unseen Concepts on the Fly at ICCV *2023*
- **General Chair:** ContinualAI (Virtual) Unconference *2022-23*
- **Organizer:** Tutorial on Lifelong Learning Machines at NeurIPS *2022*
- **Panelist:** Workshop on Continual Learning in Computer Vision (CLVision) *2022*
- **Panelist:** AWARE-AI NSF Research Traineeship (NRT) Program *2022*
- **Help Desk Volunteer:** Women in Machine Learning (WiML) Workshop at NeurIPS *2020-21*
- **Poster Mentor:** Women in Machine Learning (WiML) Workshop at NeurIPS *2020*
- **Graduate Diversity Outreach:** LSAMP/McNair Program for underrepresented minority students *2018-19*

Teaching Experience

- **Guest Discussion:** Discussed the pros/cons and outlook of Generative AI for research with first-year students in the RIT Mathematical Modeling PhD Program. *2024*
- **Guest Lecture:** Lectured on "Lifelong Machine Learning" for Graduate Course of Hava Siegelmann (UMass Amherst) *2023*
- **Guest Lecture:** Lectured on "Lifelong Machine Learning" for Graduate Course of Christopher Kanan (RIT) *2021*
- **Guest Lecture:** Lectured on "Lifelong Machine Learning" for Graduate Course of Christopher Kanan (RIT) *2020*
- **Guest Lecture:** Lectured on "Clustering Techniques" for Graduate Course of Christopher Kanan (RIT) *2017*
- **Teaching Assistant:** Graduate Course – Image Processing and Computer Vision (RIT) *2017*
- **Teaching Assistant:** Graduate Course – Deep Learning for Vision (RIT) *2016*
- **Teaching Assistant:** Undergraduate Courses – Calculus (B, C, I, II) (RIT) *2015-16*
- **Learning Assistant:** Undergraduate Course – Mathematics of Graphical Simulation (RIT) *2014*
- **Grader:** Undergraduate Courses – Multivariable Calculus, Differential Equations, Probability and Statistics (RIT) *2012-13*

Students Supervised

- Mingxuan Liu: PhD Student at University of Trento, Italy (at NAVER LABS Europe) *2023-24*
- Yipeng Zhang: BS Student at University of Rochester *2020-21*
- Hitesh Vaidya: MS Student at Rochester Institute of Technology *2019*
- Xuexun Xiao: MS Student at University of Rochester *2019*
- Michael Geraci: HS Student *2018*

Technical Skills

Deep Learning Frameworks	PyTorch, TensorFlow, Keras
Scientific Computing Packages	Numpy, Scipy, Scikit-learn
Programming (Proficient)	Python, MATLAB
Programming (Basic)	Java
Applications	Git, Bash Scripting, LaTeX, Microsoft Office, Word, Excel, Outlook

Reviewer

- International Conference on Learning Representations (ICLR) *2025*
- ContinualAI Unconference *2023*
- Conference on Lifelong Learning Agents (CoLLAs) [**Senior Reviewer**] *2023-24*
- Journal of Machine Learning Research (JMLR) *2023*
- IEEE Conference on Computer Vision and Pattern Recognition (CVPR) *2022-24*
- Frontiers in Neurorobotics *2021*
- IEEE Access *2020*
- British Machine Vision Conference (BMVC) *2020-22*
- CVPR Workshop on Continual Learning in Computer Vision (CLVision) *2020-23*
- IEEE Transactions on Neural Networks and Learning Systems *2020-21*
- Neural Networks (Elsevier) *2020-22*
- IEEE International Symposium on Biomedical Imaging (ISBI) [Delegate Reviewer] *2018*
- IEEE International Conference on Image Processing (ICIP) *2017*