

James Smith

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RESEARCH FOCUS I want to build vision systems which learn from data that is from multiple sources and distributions, while protecting data privacy concerns. To work towards this goal, I look at problems such as: **lifelong/continual learning**, **knowledge distillation**, **federated learning**, and **low-label classification**.

EDUCATION **PhD in Machine Learning, Georgia Institute of Technology** (current)

Advisor: *Dr. Zolt Kira*

Enrolled: August 2018 | Expected Graduation Date: December 2022

Master of Science in Electrical Engineering, Auburn University (May 2018)

Advisor: *Dr. Bogdan Wilamowski*

Thesis: "Deep Learning Methods Using Levenberg-Marquardt with Weight Compression and Discrete Cosine Transform Spectral Pooling"

Bachelor of Electrical Engineering, Auburn University (May 2017)

Minors in Computer Science, Political Science

- PUBLICATIONS**
- [1] **James Smith**, Yen-Chang Hsu, Jonathan Balloch, Yilin Shen, Hongxia Jin, Zolt Kira. "Always Be Dreaming: A New Approach for Data-Free Class-Incremental Learning", *arXiv preprint arXiv:2106.09701*, 2021. [\[Paper\]](#)
 - [2] **James Smith**, Cameron Taylor, Seth Baer, Constantine Dovrolis. "Unsupervised Progressive Learning and the STAM Architecture", *International Joint Conference on Artificial Intelligent (IJCAI)*, 2021. **(13.9% acceptance rate)** [\[Paper\]](#) [\[Code\]](#)
 - [3] **James Smith**, Yen-Chang Hsu, Jonathan Balloch, Zolt Kira. "Memory-Efficient Semi-Supervised Continual Learning: The World is its Own Replay Buffer", *International Joint Conference on Neural Networks (IJCNN)*, 2021. [\[Paper\]](#) [\[Code\]](#)
 - [4] **James Smith**, Bo Wu, Bogdan Wilamowski. "Neural Network Training with Levenberg-Marquardt and Adaptable Weight Compression", *IEEE Transactions on Neural Networks and Learning Systems*, 30(2), 580-587, 2019. [\[Paper\]](#)
 - [5] **James Smith**, Michael Baginski. "Thin-Wire Antenna Design Using a Novel Branching Scheme and Genetic Algorithm Optimization", *IEEE Transactions on Antennas and Propagation*, 67(5), 2934-2941, 2019. [\[Paper\]](#)
 - [6] Bo Wu, **James Smith**, Bogdan Wilamowski, Mark Nelms. "DCMDS: Density-Concentrated Multi-Dimensional Scaling Algorithm for Data Visualization", *Journal of Visualization*, 22, 341-357, 2019. [\[Paper\]](#)
 - [7] **James Smith**, Bogdan Wilamowski. "Discrete Cosine Transform Spectral Pooling Layers for Convolutional Neural Networks", *International Conference on Artificial Intelligence and Soft Computing (ICAISC)*, Zakopane, Poland, 2018. [\[Paper\]](#)

WORKSHOPS

- [8] **James Smith**, Seth Baer, Cameron Taylor, Constantine Dovrolis. “Unsupervised Progressive Learning and the STAM Architecture”, *Lifelong Learning Workshop at ICML*, 2020.
- [9] **James Smith**, Seth Baer, Zsolt Kira, Constantine Dovrolis. “Unsupervised Continual Learning and Self-Taught Associate Memory Hierarchies”, *Learning with Limited Labeled Data Workshop at ICLR*, 2019.

EXPERIENCE

SRI International Princeton, NJ (virtual from Atlanta) <i>Computer Vision Research Intern, PhD</i>	Since May 2021
Georgia Tech Atlanta, GA <i>Graduate Research Assistant, College of Computing</i>	Since August 2018
Radiance Technologies Huntsville, AL <i>Machine Learning Intern</i>	May 2018 – August 2018
Auburn University Auburn, AL <i>Graduate Research Assistant, Department of Electrical and Computer Engineering</i>	May 2017 – May 2018
Auburn University Auburn, AL <i>Undergraduate Research Fellow</i>	July 2016 – May 2017
Naval Research Laboratories Washington, DC <i>Research Intern</i>	May 2015 – August 2015

RESEARCH PROJECTS**Data-Free Class-Incremental Learning [1]**

- We contribute a novel incremental distillation strategy which does not store training data, achieving state-of-the-art performance on data-free class-incremental learning benchmarks
- Impact: reduce memory budget and eliminate private data storage for incremental learning applications (healthcare, autonomous vehicles, etc.)

Unsupervised Progressive Learning [2,8,9]

- We formalize the Unsupervised Progressive Learning (UPL) setting: learning representations for downstream tasks (such as classification) from a non-stationary stream of unlabeled data in which the number of object classes increases with time
- We contribute a neuro-inspired architecture for UPL which involves an online clustering modules, called Self-Taught Associative Memory (STAM)
- Impact: enable fast and efficient low-label streaming applications such as facial recognition

Semi-Supervised Continual Learning [3]

- We formalize the realistic Semi-Supervised Continual Learning (SSCL) setting, where data distributions reflect object class correlations between, and among, the labeled and unlabeled data distributions
- We contribute a novel learning approach that works within this realistic, memory-constrained continual learning setting, DistillMatch, notably outperforming closest prior art
- Impact: enable SSCL for on-device learning that is robust to several realistic data SSCL distributions

Deep Learning for Object Classification and Image Compression [4,7]

- We contribute the Levenberg-Marquardt with Weight Compression (LMWC) algorithm to combat diminishing gradients in second-order neural network optimization
- We contribute a new spectral pooling techniques for convolutional neural networks using discrete cosine transformations

Multi-bend Antenna Optimization by Genetic Algorithms [5]

- We show Genetic Algorithms and the Method of Moments (MoM) can optimize arbitrarily branching antenna structures capable of producing complex radiation patterns that cannot be designed

HONORS

- NSF Graduate Research Fellowship Program Honorable Mention (2018)
- Alton B. Zerby and Carl T. Koerner National Outstanding Electrical and Computer Engineering Student Award, L.A. Alumni Chapter IEEE/HKN (2017)
- President's Award, Samuel Ginn College of Engineering (2016 – 2017)
- SGA Student of the Year, Auburn University Honors College (2016 – 2017)
- Electrical and Computer Engineering Outstanding Student of the Year, Auburn University (2016 – 2017)
- Auburn University Nominee for Rhodes and Marshall Scholarships (Fall 2016)