James Smith

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EDUCATION

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

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

RESEARCH EXPERIENCE

Graduate Research Assistant, Georgia Institute of Technology — August 2018 – present
Coreset-Free Knowledge Distillation for Online Continual Learning (current)

- More details available upon request
- Advisor - Dr. Zsolt Kira

Semi-Supervised Continual Learning

- We formalize the Semi-Supervised Continual Learning (SSCL) setting, where data distributions reflect object class correlations between, and among, the labeled and unlabeled data distributions
- We propose a novel learning approach that works within this realistic, memory-constrained continual learning setting, notably outperforming closest prior art
- Advisor - Dr. Zsolt Kira

Unsupervised Progressive Learning

- Posed the Unsupervised Progressive Learning (UPL) problem: 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
- Developed a neuro-inspired architecture for UPL which involves an online clustering modules, called Self-Taught Associative Memory (STAM)
- Advisor - Dr. Constantine Dovrolis

Graduate Research Student, Auburn University — May 2017 – May 2018
Deep Learning for Object Classification and Image Compression

- Developed the Levenberg-Marquardt with Weight Compression (LMWC) algorithm to combat diminishing gradients in second-order neural network optimization
- Developed a new spectral pooling techniques for convolutional neural networks using discrete cosine transformations
- Advisor - Dr. Bogdan M. Wilamowski

Undergraduate Research Fellow, Auburn University — August 2016 – May 2017
Multi-bend Antenna Optimization by Genetic Algorithms

- Used Genetic Algorithms and the Method of Moments (MoM) to explore arbitrarily branching antenna structures capable of producing complex radiation patterns that cannot be designed
- Advisor - Dr. Michael E. Baginski

Research Internship, Naval Research Laboratories — May 2015 – August 2015
- Optimized Method of Moments (MoM) Fortran code simulating current induction on large bodies to dramatically decrease run time and increase memory management
- Advisor - Dr. Sadasiva M. Rao

PUBLICATIONS

Smith, J., Baer, S., Taylor, C., & Dovrolis, C. (2020). Unsupervised Progressive Learning and the STAM Architecture. arXiv preprint:1904.02021

Smith, J.S., Wu, B., & Wilamowski, B.M. (2019). Neural Network Training with Levenberg–Marquardt and Adaptable Weight Compression. *IEEE Transactions on Neural Networks and Learning Systems, 30*, 580-587.

Smith, J.S., Baginski, M.E. (2019). Thin-Wire Antenna Design Using a Novel Branching Scheme and Genetic Algorithm Optimization. *IEEE Transactions on Antennas and Propagation, 67*, 2934-2941.

Wu, B., Smith, J.S., Wilamowski, B.M., & Nelms, R.M. (2019). DCMDS: Density-Concentrated Multi-Dimensional Scaling Algorithm for Data Visualization. *Journal of Visualization, 22*, 341-357.

Smith, J.S., & Wilamowski, B.M. (2018). Discrete Cosine Transform Spectral Pooling Layers for Convolutional Neural Networks. *ICAISC*.

WORKSHOPS

Smith, J., Baer, S., Taylor, C., & Dovrolis, C. (2020). Unsupervised Progressive Learning and the STAM Architecture. *Lifelong Learning Workshop, ICML 2020*.

Smith, J., Baer, S., Kira, Z., & Dovrolis, C. (2019). Unsupervised Continual Learning and Self-Taught Associative Memory Hierarchies. *Learning with Limited Labeled Data Workshop, ICLR 2019*.

PRACTICAL EXPERIENCE

Radiance Technologies Machine Learning Engineer — May 2018 – August 2018
- Developed deep learning software for defense system target identification and classification
- Applied reinforcement learning to automate high-level decision making in simulation environment

Animal Detection System, Auburn University — Fall 2016, Spring 2018
- Led a project to detect small animals at power stations for Florida Power and Light
- Project started as a senior design project involving the amplification and filtering of radar signals and continued during graduate school with a deep learning approach using OpenCV and a raspberry pi

Dynetics Student Engineer — May 2016 – August 2016
- Used Matlab Simulink to model foreign weapon systems purposed for an integrated threat analysis simulation environment

Troy7 Laser Safety Engineer — May 2014 – August 2014
- Used Microsoft Visual Studios and Apple Xcode to develop programs for both PC and iPhone that implemented calculations for High Energy Laser safety hazards and optical sensor properties

RELEVANT COURSES

Georgia Tech

- **CS 6476** – Computer Vision
- **CS 8803** – Machine Learning with Limited Supervision
- **ISYE 6412** – Theoretical Statistics
- **ISYE 6663** – Nonlinear Optimization
- **ECE 6254** – Statistical Machine Learning
- **ECE 8843** – Math Foundations of Machine Learning
- **ECE 6555** – Optimal Estimation

Auburn

- **COMP 6600** – Artificial Intelligence
- **ELEC 8900** – Advanced Intelligent Systems
- **ELEC 6410** – Digital Signal Processing
- **PSYC 7400** – Cognitive Neuroscience
- **COMP 7970** – Deep Learning
- **ELEC 7450** – Digital Image Processing

HONORS/AWARDS

- 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)