Mark Coletti, Ph.D.

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mission statement

Dr. Mark Coletti creates innovative solutions to challenging national-scale problems using his expertise and knowledge in evolutionary algorithms (EA) and high performance computing (HPC). He has developed novel approaches to resolving national problems in domains that include remote sensing, power utility monitoring, and autonomous vehicles. He is actively engaged in research to improve understanding of the dynamics of EAs in HPC settings.

education

Ph.D., Computer Science, George Mason University, 2014.
Dissertation: *An Analysis of a Model-Based Evolutionary Algorithm: Learnable Evolution Model.*
Advisor: Dr. Kenneth De Jong

M.Sc., Computer Science, George Mason University, 2007.

B.Sc., Computer Science, Southern Polytechnic State University (now Kennesaw State University), 1989.

representative publications

Coletti, **M.**, A. Fafard, and D. Page (2019). "Troubleshooting deep-learner training data problems using an evolutionary algorithm on Summit." *IBM Journal of Research and Development (In-press)*, pp. 1–1. issn: 0018-8646. doi: 10.1147/JRD.2019.2960225.

Coletti, **Mark**, Dalton Lunga, Jeffrey K. Bassett, and Amy Rose (2019). "Evolving larger convolutional layer kernel sizes for a settlement detection deep-learner on Summit." : *Workshop for Deeplearning for Supercomputers*. The International Conference for High Performance Computing, Networking, Storage, and Analysis (In-press).

Coletti, **Mark**, Dalton Lunga, Anne Berres, Jibonananda Sanyal, and Amy Rose (2018). "Ramifications of Evolving Misbehaving Convolutional Neural Network Kernel and Batch Sizes." : *Workshop for Learning in HPC Environments at Supercomputing 2018*. The International Conference for High Performance Computing, Networking, Storage, and Analysis.

Bassett, Jeffrey, **Mark Coletti**, and Kenneth De Jong (2009). "Controlling Bloat by Increasing Evolvability in a Pittsburgh Classifier System." : *Proceedings of the Genetic and Evolutionary Computation Conference (GECCO)*. Montréal, Canada.

Coletti, **Mark** (2009). "Learnable Evolution Model Performance Impaired by Binary Tournament Survival Selection." : *Proceedings of the Genetic and Evolutionary Computation Conference (GECCO)*. Graduate Student Workshop. Montréal, Canada.

presentations

"Git tutorial", **Mark Coletti**. Git training for regional mobility team. Oak Ridge National Laboratory, January 2020.

"Leveraging Titan and Summit for Deep-Learning Tuning & Large-Scale Image Workflows with GPUs." Anne Berres, **Mark Coletti.** Oak Ridge National Laboratory, Oak Ridge, Tennessee, May 2019.

"Evolving Better DSM Evaluators." Processing Stereo Imagery for Country-Level Operational Support Team 3 $\times$ 5 talk. **Mark Coletti.** Oak Ridge National Laboratory, Oak Ridge, Tennessee, March 2019.

"Curb the Violations – Effectively communicating with residents about curbside waste violations using automatically generated postcards." **Mark Coletti**, Alex Sorokine, Eric Weber, Matt Whitehead. KnoxDev First Annual Hackathon Finalists Presentation. Knoxville, Tennessee, March 2019.

"LEAPing Forward — A tour through an open-source evolutionary algorithm toolkit". **Mark Coletti**. PyKnox User's Group presentation series on local open-source software contributions. Knoxville, Tennessee, February 2019.

"Git-ing started with git", **Mark Coletti**. Techniques and tools to start with HPC Workshop. Oak Ridge National Laboratory, July 2018.

"Preliminary results for optimizing a building footprint detection deep learner's hyperparameters with an evolutionary algorithm," **Mark Coletti**, Jeanette Weaver, Anne Berres, Lexie Yang, Dalton Lunga, Kuldeep Kurtre, et al. OLCF User Group Meeting Poster, Oak Ridge National Laboratory. May 2018.

"Size Matters — Evolving Misbehaving Deep Learner Kernel and Batch Sizes," **Mark Coletti**, Jeanette Weaver, Anne Berres, Lexie Yang, Dalton Lungam, et al. Urban Dynamics Institute Lunch and Learn Talk, Oak Ridge National Laboratory. April 2018.

"Results of using an evolutionary algorithm to optimize a building footprint detecting deep learner's hyper-parameters," **Mark Coletti**, Jeanette Weaver, Anne Berres, Lexie Yang, Dalton Lungam, et al. American Association of Geographers Annual Meeting, New Orleans, April 2018.

"Accelerated Global Human Settlement Discovery," Lexie Yang, Dalton Lunga, **Mark Coletti**, Anne Berres, et al. Urban Dynamics Institute Annual Meeting, Oak Ridge National Laboratory, April 2018.

"GPUManager: an open-source tool for managing Nvidia GPUs for multiple users," **Mark Coletti**. Urban Dynamics Institute Cities Advisory Council Symposium, Oak Ridge National Laboratory, September 2017.

"Symbiotic systems of evolutionary algorithms and machine learners," **Mark Coletti**. Oak Ridge National Laboratory, July 2016.

"Using an Evolutionary Algorithm to Optimize Deep Learner Hyper-parameters," **Mark Coletti**, Dalton Lunga, Jibonananda Sanyal, Lexie Yang, Jiangye Yuan, Jeanette Weaver, Robert Stewart, Amy Rose. Oak Ridge National Laboratory Settlement Mapping Tool talk, March 2016.

"Validating Safecast Data," **Mark Coletti**, Carolynne Hultquist, William G. Kennedy, Guido Cervone. Oak Ridge National Laboratory Urban Dynamics Institute Brown Bag talk, February 2016.

"Enhancing Next-generation Earth Systems Models by Integrating Earth System Modeling, Data Analytics and Agent- based Modeling." Allen, Melissa R., Olufemi A. Omitaomu, Joseph H. Kennedy, Sujithkumar S. Nair, H.M. Abdul Aziz, **Mark Coletti**. Abstract GC31B-1114 presented at 2015 Fall Meeting, American Geophysical Union (AGU), San Francisco, California, USA. December 14, 2016.

"Incorporating human behavior into climate simulations," **Mark Coletti** and Melissa Allen, International Congress on Agent Computing, George Mason University, 2016.

"Writing more with sharelatex," Oak Ridge National Laboratory, **Mark Coletti**, Geographic Information Science and Technology Group staff talk, Oak Ridge National Laboratory, 2016.

"A Python QGIS plugin for tweeter analysis during emergencies", Guido Cervone and **Mark Coletti**, UCAR Software Engineering Assembly, 2015.

"An Eclectic Walk Through Software Engineering and Computer Science," **Mark Coletti**, Oak Ridge National Laboratory, 2015.

"The Future of GeoMASON", **Mark Coletti**, MASON NSF Workshop, George Mason University, 2013.

"Learnable Evolution Model Performance Impaired by Binary Tournament Survival Selection," **Mark Coletti**, Genetic and Evolutionary Algorithm Conference, 2009.

invited talks

"Geographic Information Systems: An Overview," Invited class lecture, The Pennsylvania State University, 2015.

workshops

5th Annual Research Symposium, *Co-organizer*. Oak Ridge National Laboratory Postgraduate Association, Oak Ridge National Laboratory, 2017.

Research statement workshop, *Co-organizer*. Oak Ridge National Laboratory Postgraduate Association, Oak Ridge National Laboratory, 2017.

Teaching philosophy statement workshop, *Co-organizer*. Oak Ridge National Laboratory Postgraduate Association, Oak Ridge National Laboratory, 2016.

Workshop on Human Activity at Scale in Earth System Models, *Co-organizer*. Climate Change Sciences Institute and Urban Dynamics Institute, Oak Ridge National Laboratory, 2016.

MASON National Science Foundation Workshop, *Speaker*. George Mason University, 2013.

Center for Computational Analysis of Social and Organizational Systems (CASOS) Summer Institute, *Participant*. Institute for Software Research, Carnegie Mellon University, 2011.

skills

Agent-based Modeling, C/C++, Evolutionary Computation, Java, LaTeX, Machine Learning, Python, R, shell scripts

work experience

Staff Researcher, Oak Ridge National Laboratory, Geographic Information Science and Technology Group — 2017–*Present*

- Applying an adversarial evolutionary algorithm to improve an autonomous vehicle deep neural network-based model.
- Researching use of a steady-state evolutionary algorithm for tuning a deep learner's hyper-parameters for extracting building footprints from satellite imagery.
- Redesigned back-end architecture for Extract, Transform, and Load (ETL) scripts that poll United States power utility information for the EAGLE-I project.

Postdoctoral Researcher, Oak Ridge National Laboratory, Geographic Information Science and Technology Group — 2015–2017

- Researching use of a steady-state evolutionary algorithm for tuning a deep learner's hyper-parameters for extracting building footprints from satellite imagery.
- Redesigned python screen scraping scripts that polled United States power utility information for the EAGLE-I project.
- Refactored back-end image processing code that extracted features for finding settlements from satellite imagery.
- Assisted researching effectiveness of using novel WorldView-4 bands for settlement feature extraction.
- Researched incorporating agent-based models in meso-level climate models.

Postdoctoral Scholar, The Pennsylvania State University, Geoinformatics and Earth Observation Laboratory 2014–2015

- Validated radiation observations gathered from volunteers in the Fukushima Prefecture for the Safecast project by comparing that data to similar observations made by the U. S. Department of Energy.
- Developed a QuantumGIS plug-in for gathering Twitter tweets for further Volunteered Geographic Information (VGI) research.
- Assisted in U. S. Medicare data-mining research by gathering and pre-processing relevant data; wrote R scripts for analytics and visualization.

Graduate Research Assistant, George Mason University, Center for Social Complexity, Fairfax, Virginia, USA 2008–2012

- Developed GeoMASON for a Multi-University Research Initiative (MURI) project.
- GeoMASON added geospatial capabilities to the agent-based simulation and modeling toolkit, MASON.
- MURI project large-scale simulation to study impact of encroaching farming on nomadic tribes in Africa.

Graduate Research Assistant, George Mason University, Krasnow Institute of Advanced Studies, Fairfax, Virginia, USA. 2005–2006

- Software developer on a Defense Advanced Research Project Agency (DARPA) project for the Krasnow Institute's Adaptive Systems Laboratory.
- The DARPA project entailed developing software for a new Grand Challenge, Biologically Inspired Cognitive Architecture (BICA).
- The BICA project was designed to emulate aspects of human-level sapience, and borrowed from current cognitive science and neuroscience research.

Senior Software Engineer, Science Applications International Corporation, Reston, Virginia, USA 1997–2007

- Developed software supporting the Spatial Data Transfer Standard (SDTS) for United States Geological Survey (USGS)
- Helped design, implement, and maintain a public domain C++ toolkit, sdts++, for reading and writing SDTS datasets, and eventually became its technical lead.
- Wrote two translators, one a USGS Digital Orthophotoquad (DOQ) to SDTS encoder, and the other a USGS Digital Elevation Model (DEM) to SDTS encoder.

Software Engineer, DBA Systems, Inc., Fairfax, Virginia, USA 1992–1997

- Enhanced a spatial data editor written for the the U. S. Army Corps of Engineers Topographic Engineering Center (TEC) at Ft. Belvoir, Virginia.
- Refactored image processing application, PROMAM, for the Royal Observatory, Edinburgh, Scotland that would highlight potential cancer sites in mammogram images.
- Developed a C++ library for reading Digital Line Graphics - Enhanced (DLGE) spatial data.
- Rewrote a utility that translates spatial data from the DLGE format to the SDTS format to use our DLGE library.
- Also helped design and implement an SDTS C++ library, which was an earlier version of the toolkit developed while at SAIC.
- Helped write a map browsing application for the National Oceanic and Atmospheric Administration (NOAA) that read DX-90 geospatial data.
- Worked on a terrain visualization program, which entailed reverse engineering pre-existing code, designing and implementing new capabilities, writing documentation, and rewriting and reorganizing code.

Software Engineer, CCG Associates, Inc., Silver Spring, Maryland, USA 1990–1991

- Was project leader and knowledge engineer for the development of an expert system for NOAA that validated and corrected weather data transmitted from ships.
- Developed an expert system for the U.S. Army's Army Materiel Command (AMC) to validate purchases.
- Developed a user-interface wrapper for a road-wear simulation program for the Federal Highway Administration.

awards

Supplemental Performance Award, Oak Ridge National Laboratory, 2016.

Best Graduate Student Workshop Paper, Genetic and Evolutionary Algorithm Conference, 2009.

National Dean's List, 1989.

Dean's List, Kennesaw State College, 1984.

professional affiliations

Institute of Electrical and Electronics Engineers
Association for Computing Machinery
American Association of Geographers
American Geophysical Union

service to the profession

Judge for 7th Annual ORNL Postdoc Association's Research Symposium, August 2019.

Judge for 6th Annual ORNL Postdoc Association's Research Symposium, August 2018.

Social Committee *Chair*, Oak Ridge National Laboratory Postgraduate Society, 2016–2017.

Writer's Group *Organizer*, Oak Ridge National Laboratory Postgraduate Society, 2016–2017.

Chair, Pennsylvania State University Postdoctoral Society, 2014–2015.

Co-Organizer, Dissertation Writer's Group, George Mason University, 2010–2014.

graduate student guidance

Defense Committee Reader, Arti Abramovitz, Ph.D., The Chicago School of Professional Psychology, International Psychology, 2015.

mentoring

Mentor, Oumar Diallo, Oak Ridge National Laboratory, 2017.

Mentor, Dakotah Maguire, Oak Ridge National Laboratory, 2017 – present.