Gregory Ditzler

Assistant Professor

Applied Machine Learning, Scalable Data Mining, Feature Subset Selection, Multiple Classifier Systems, & Data Science

Education

2011–2015 **PhD**, *Drexel University*, Electrical & Computer Engineering.
Advisor: Gail Rosen, Ph.D.
Research areas: feature subset selection, online learning, and knowledge discovery in the microbiome

2009–2011 **MSc**, *Rowan University*, Electrical & Computer Engineering.
Advisor: Robi Polikar, Ph.D.
Research areas: learning in nonstationary environments, imbalanced data, and change detection

2004–2008 **BSc**, *Pennsylvania College of Technology*, Electronics Engineering Technology.
Project: PowerPC and MicroBlaze applications on the Xilinx Virtex-II Pro
Minor: Mathematics

Employment

Current **The University of Arizona**, *Department of Electrical & Computer Engineering*, Tucson, AZ.
Assistant Professor 2015–Present

2011–2015 **Drexel University**, *Department of Electrical & Computer Engineering*, Philadelphia, PA.
Research Fellow 2011–2015
Teaching Assistant 2011–2013

2009–2015 **Rowan University**, *Department of Electrical & Computer Engineering*, Glassboro, NJ.
Adjunct Professor 2010–2015
Research Assistant 2009–2011

2013 **AT&T Research Labs**, *Shannon Laboratory*, Florham Park, NJ.
Research Intern (Technical II) 2013

2007–2009 **QorTek, Inc.**, *Systems Engineering*, Williamsport, PA.
Electronic Systems Engineer 2008/09
Electronic Systems Intern 2007/08

Affiliations

The University of Arizona's Cognitive Sensing Research Center 2016–Present
The University of Arizona's Machine Learning and Data Analytics Lab 2015–Present

Awards & Honors

2016 Air Force Research Labs Summer Faculty Fellowship
2015 Joseph and Shirley Carleone Endowed Fellowship
2015 Drexel University's Office of Graduate Studies Research Excellence Award
2015 Best Poster at the Drexel IEEE Research Day Poster Competition
2014 IEEE SSCI 2014 Doctoral Consortium Travel Award
2014 NSF Travel Award to the ACM International Workshop on Big Data in Life Sciences

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2014 Best Student Paper at the International Joint Conference on Neural Networks
2014 IEEE Computational Intelligence Society Travel Award
2013 Nihat Bilgutay Research Award
2013 Koerner Family Engineering Research Award
2012 Defense Threat Reduction Agency & NSF Algorithms Workshop Travel Grant
2011 Student Travel Award for the IJCNN, National Science Foundation
2011 Graduate Research Achievement Award, Rowan University
2008 Award for Outstanding Leadership & Service to the Pennsylvania College of Technology IEEE Branch
2008 Penn College Award for Leadership to the College and Community

Professional Affiliations

2014–Present Association for Computing Machinery
2004–Present IEEE Member (Signal Processing Society, Computational Intelligence Society)
2014–Present Society for Industrial and Applied Mathematics

Publications

In Preparation / Submitted / Under Revision

Under Revision

- **G. Ditzler**, R. Polikar, and G. Rosen, "A Sequential Learning Approach for Scaling up Filter-Based Feature Subset Selection," under revision in *IEEE Transactions on Neural Networks and Learning Systems*, 2016.
- **G. Ditzler**, J. LaBarck, J. Ritchie, G. Rosen, and R. Polikar, "Online Feature Selection Using Bagging and Boosting," under revision in *IEEE Transactions on Neural Networks and Learning Systems*, 2016.

Submitted

- **G. Ditzler** and A. Prater, "Learning Variable Selection Models from Adversarial Environments," submitted to *IEEE International Conference on Acoustic, Speech and Signal Processing*, 2017.
- V. Carluccio, N. Bouaynaya, **G. Ditzler**, and H. M. Fathallah Shaykh, "The AKRON-Kalman Filter for Tracking Time-Varying Networks," submitted to *International Conference on Biomedical and Health Informatics*, 2017.
- **G. Ditzler**, N. Bouaynaya, and R. Shterenberg, "AKRON: An Algorithm for Approximating Sparse Kernel Reconstruction using Convex Optimization," submitted to *IEEE Signal Processing Letters*, 2016.

In Preparation

- **G. Ditzler**, "Extending Spectral Meta-Learning to Non-stationary Environments," in preparation to a *Journal*, 2016.
- H. Liu and **G. Ditzler**, "Improvements to Online Streaming Feature Selection," in preparation to a *Conference*, 2017.

Book Chapters

- C. Alippi, G. Boracchi, **G. Ditzler**, R. Polikar, and M. Roveri, "Adaptive Classifiers for Nonstationary Environments," *Contemporary Issues in Systems Science and Engineering*, IEEE/Wiley Press Book Series, M.-C. Zhou, H.-X. Li, and M. Weijnen (Eds), 2015.
- J.-L. Bouchot, W. Trimble, **G. Ditzler**, Y. Lan, S. Essinger, and G. Rosen, "Advances in machine learning for processing and comparison of metagenomic data," *Computational Systems Biology*, In A. Kriete and R. Eils (Eds), Springer, 2014.
- **G. Ditzler**, Y. Lan, J.-L. Bouchot, and G. Rosen, "Feature selection for metagenomic data analysis," *Encyclopedia of Metagenomics*, K. E. Nelson (Eds), 2014.

Journals

- **G. Ditzler**, J. Calvin Morrison, Y. Lan, and G. Rosen, "Fizzy: Feature selection for metagenomics," BMC Bioinformatics, 2015, vol. 16, no. 358.

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- **G. Ditzler**, M. Roveri, C. Alippi, and R. Polikar, "Adaptive strategies for learning in nonstationary environments: a survey," *IEEE Computational Intelligence Magazine*, 2015, vol. 10, no. 4, pp. 12–25.
- **G. Ditzler**, R. Polikar, and G. Rosen, "Multi-Layer and Recursive Neural Networks for Metagenomic Classification," *IEEE Transactions on Nanobioscience*, vol. 14, no. 6, 2015, pp. 608–616.
- **G. Ditzler**, R. Polikar, and G. Rosen, "A bootstrap based Neyman-Pearson test for identifying variable importance," *IEEE Transactions on Neural Networks and Learning Systems*, vol. 26, no. 4, 2015, pp. 880-886.
- **G. Ditzler** and R. Polikar, "Incremental learning of concept drift from streaming imbalanced data," in *IEEE Transactions on Knowledge and Data Engineering*, vol. 25, no. 10, 2013, pp. 2283–2301.

Conferences

- **G. Ditzler**, "A Study of Incremental Spectral Meta-Learning for Nonstationary Environments," to appear in *IEEE/INNS International Joint Conference on Neural Networks*, 2016, Vancouver, Canada.
- **G. Ditzler**, M. Austen, R, Polikar, and G. Rosen, "Scaling a Neyman-Pearson Subset Selection Approach Via Heuristics for Mining Massive Data," 2014, *IEEE Symposium on Computational Intelligence and Data Mining*, 2014, Orlando, FL. (**travel award**)
- **G. Ditzler**, G. Rosen, and R. Polikar, "Domain Adaptation Bounds for Multiple Expert Systems Under Concept Drift," *IEEE/INNS International Joint Conference on Neural Networks*, 2014, Beijing, China. (**travel award & best paper**)
- **G. Ditzler** and G. Rosen, "Feature Subset Selection for Inferring Relative Importance of Taxonomy," *ACM International Workshop on Big Data in Life Sciences*, 2014, Newport Beach, CA. (**invited & travel award**)
- **G. Ditzler**, G. Rosen, and R. Polikar, "Incremental learning of new classes with unbalanced data," *IEEE/INNS International Joint Conference on Neural Networks*, 2013, Dallas, TX.
- **G. Ditzler**, G. Rosen and R. Polikar, "Discounted expert weighting for concept drift," *International Symposium on Computational Intelligence in Dynamic and Uncertain Environments*, 2013, Singapore, pp. 61–67.
- **G. Ditzler**, R. Polikar, and G. Rosen, "Information theoretic feature selection for high dimensional metagenomic data," in *IEEE International Workshop on Genomic Signal Processing and Statistics*, 2012, Washington, D.C., pp. 143–146.
- **G. Ditzler**, G. Rosen and R. Polikar, "A transductive learning algorithm for concept drift," in *IEEE/INNS International Joint Conference on Neural Networks*, 2012, Brisbane, Australia, pp. 945–952.
- **G. Ditzler**, R. Polikar and G. Rosen, "Determining significance in metagenomics," in *North Eastern Biomedical Engineering Conference*, 2012, Philadelphia, PA, pp. 385–386.
- **G. Ditzler**, R. Polikar, and G. Rosen, "Forensic identification with environmental samples," in *IEEE International Conference on Acoustic, Speech and Signal Processing*, 2012, Kyoto, Japan, pp. 1861–1864.
- **G. Ditzler** and R. Polikar, "Semi-supervised learning in nonstationary environments," in *International Joint Conference on Neural Networks*, 2011, San Jose, CA, pp. 2471–2478. *(student travel award)*
- **G. Ditzler** and R. Polikar, "Hellinger distance based drift detection algorithm," in *IEEE Symposium on Computational Intelligence in Dynamic and Uncertain Environments*, 2011, Paris, France, pp. 41–48.
- **G. Ditzler**, J. Ethridge, R. Polikar, and R. Ramachandran, "Fusion methods for boosting performance of speaker identification systems," in *Asia Pacific Conference of Circuits and Systems*, 2010, Kuala Lampur, Malaysia, pp. 116–119.
- **G. Ditzler**, R. Polikar, and N. V. Chawla, "An incremental learning algorithm for nonstationary environments and imbalanced data," in *International Conference on Pattern Recognition*, 2010, Istanbul, Turkey, pp. 2997–3000.
- J. Ethridge, **G. Ditzler**, and R. Polikar, "Optimal ν-SVM parameter estimation using multi-objective evolutionary algorithms," in *IEEE Congress on Evolutionary Computing*, 2010, Barcelona, Spain, pp. 3570–3577.

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- **G. Ditzler** and R. Polikar, "An incremental learning framework for concept drift and class imbalance." in *IEEE/INNS International Joint Conference on Neural Networks*, 2010, Barcelona, Spain, pp. 736-743.
- **G. Ditzler**, M. Muhlbaier, and R. Polikar, "Incremental learning of new classes in unbalanced data: Learn^{++}.UDNC," in *International Workshop on Multiple Classifier Systems*, 2010, Lecture Notes in Computer Science, N. El. Gayer *et al*, vol. 5997, Cairo, Egypt, pp. 33–42.

Other: Workshops, Theses, and Non-Peer Reviewed Abstracts

- **G. Ditzler** and G. Rosen, "Scalable Subset Selection Using Filters and its Applications," *DTRA/NSF Algorithms Workshop*, Arlington, VA, 2015.
- **G. Ditzler**, "Scalable Subset Selection Using Filters and its Applications," *PhD Thesis*, Drexel University, 2015.
- **G. Ditzler**, "Scaling Up Subset Selection and the Microbiome," *IEEE SSCI Doctoral Consortium*, Orlando, FL, 2014.
- **G. Ditzler**, J. Calvin Morrison, and G. Rosen, "FizzyQIIME: Feature Selection for Metagenomics," *Genomic Science Annual Contractor-Grantee Meeting/USDA-DOE Plant Feedstock Genomics for Bioenergy*, Bethesda, MD, 2014.
- **G. Ditzler**, R. Polikar, and G. Rosen, "Application of a post-hoc Neyman-Pearson hypothesis test for identifying variable importance in comparative metagenomics," *DTRA/NSF/NGA Algorithms Workshop*, Boulder, CO, 2014.
- J.-L. Bouchot, **G. Ditzler**, and G. Rosen, "The Earth Microbiome Project from a Data Science Perspective", *DTRA / NSF / NGA Algorithms Workshop*, Boulder, CO, 2014.
- **G. Ditzler**, Y. Lan, and G. Rosen, "Functional feature selection over varying sample phenotypes: Integration of feature selection methods into KBase," *Genomic Science Annual Contractor-Grantee Meeting/USDA-DOE Plant Feedstock Genomics for Bioenergy*, Bethesda, MD, 2013.
- **G. Ditzler** and G. Rosen, "Deep Learning of Features and Structure of Soil Samples," *DTRA/NSF/NGA Algorithms Workshop*, San Diego, CA, 2012. (**travel award**)
- **G. Ditzler**, "Incremental Learning of Concept Drift from Imbalanced Data," *Master's Thesis*, Rowan University, 2011.

Invited Talks / Panel Discussions

- **G. Ditzler**, "Big Data Panel," *Annual Conference of the Prognostics and Health Management Society*, Denver, CO, 2016.
- **G. Ditzler**, "Feature Selection: With and Without an Adversary," *Air Force Research Laboratory*, Rome, NY, 2016.
- **G. Ditzler**, "Feature selection and learning in nonstationary environments," *Rincon Research Corporation*, Tucson, AZ, 2016.
- **G. Ditzler**, "Scaling up feature subset selection," *Raytheon Information Systems and Computing Symposium*, Desert Diamond Casino Conference Center, Tucson, AZ, 2016.
- **G. Ditzler**, "Scalable machine learning and its applications to life science," *University of Arizona*, Dept. of SIE, Tucson, AZ, 2015.
- **G. Ditzler**, "Scalable machine learning and its applications to life science," *University of Arizona*, Dept. of ECE, Tucson, AZ, 2015.
- **G. Ditzler**, "An introduction to learning in nonstationary environments," *IEEE Symposium Series on Computational Intelligence*, South Africa, 2015. (with G. Boracchi)
- **G. Ditzler**, "An introduction to MapReduce," *Drexel University's Center Biological Discovery from Big Data*, Philadelphia, PA, 2015.
- **G. Ditzler**, "Scalable machine learning for knowledge discovery and prediction," *University of Arizona*, Tucson, AZ, 2014.
- **G. Ditzler**, "Scalable machine learning for knowledge discovery and prediction," *Rowan University*, Glassboro, NJ, 2014.
- **G. Ditzler**, "Feature Subset Selection for Inferring Relative Importance of Taxonomy," *ACM International Workshop on Big Data in Life Sciences*, Newport Beach, CA, 2014. (with G. Rosen)

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- **G. Ditzler**, "Generic language modeling using deep neural networks," *AT&T Shannon Research Labs*, Florham Park, NJ, August 2013.
- **G. Ditzler**, "Functional feature selection over varying sample phenotypes: Integration of feature selection methods into KBase," *Genomic Science Annual Contractor-Grantee Meeting/USDA-DOE Plant Feedstock Genomics for Bioenergy*, Washington, DC, November 2013. (with G. Rosen and Y. Lan)

Teaching Experience

The number in parenthesis is the number of students enrolled in the course.

Graduate

- ECE-541a: Automatic Control — The University of Arizona
  F2015 (13)

Undergraduate

- ECE-175: Computer Programming For Engineering Applications — The University of Arizona
  Sp2016 (242); F2016 (200)
- ECE-441a: Automatic Control — The University of Arizona
  F2015 (29)
- ENGR-01401: Jr./Sr. Engineering Clinic — Rowan University
  F2013, Sp2014, F2014, Sp2015
- ECE-09202: Networks II — Rowan University
  F2010

Activities

Journal Reviewer

- ACM Computing Surveys
- BMC Bioinformatics
- BMC Genomics
- Elsevier Neurocomputing
- IEEE Computational Intelligence Magazine
- IEEE Transactions on Industrial Informatics
- IEEE Transactions on Knowledge and Data Engineering
- IEEE Transactions on Systems, Man, and Cybernetics: Part B
- IEEE Transactions on Neural Networks and Learning Systems
- IET Generation, Transmission & Distribution
- Springer Neural Computing & Applications Journal
- Springer Neural Processing Letters Journal
- Springer Pattern Analysis & Applications Journal

Conference Organizer

- IJCNN: Special Session of Concept Drift, Domain Adaptation and Learning in Nonstationary Environments 2016

Conference Reviewer

- Artificial Intelligence Applications and Innovations Conference 2013
- IEEE International Joint Conference on Neural Networks 2011-15
- IEEE International Symposium of Circuits & Systems 2011
- IEEE Symposium on Computational Intelligence in Dynamic & Uncertain Environments 2013-15
- International Workshop on Learning Strategies and Data Processing in Nonstationary Environments 2013

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Technical Program Committee Member

- ACM International Workshop on Big Data in Life Sciences 2015
- IEEE/INNS International Joint Conference on Neural Networks 2014/15
- IEEE Symposium Series on Computational Intelligence 2013–15
- International Conference on Contemporary Computing (IC3) 2015

University of Arizona Service

- UA ECE Executive Committee 2016/17
- UA ECE Instructional Equipment and Software Planning Committee 2015/16

Other Service

- IEEE Computational Intelligence Society Graduate Research Fellowships Committee 2016–Present
- IEEE Computational Intelligence Society Webinars Subcommittee 2016–Present
- Drexel IEEE Graduate Forum Board Member (Vice President) 2013/14
- IEEE Region 2 Student Activities Conference Planning Committee 2008
- Penn College IEEE Branch Vice Chair 2007/8

Advising

PhD

- Douglas Todd (2016–Present), The University of Arizona (ECE)
  Topic: *Applied Machine Learning and Information Theory to 'omics Data*
- Sam Hess (2016–Present), The University of Arizona (ECE)
  Topic: *Latency Verification and Learning in Non-stationary Environments*
- Heng Liu (2015–Present), The University of Arizona (ECE)
  Topic: *Large Scale and Distributed Subset Selection*

MSc

- Jonathon Gill, The University of Arizona (ECE)

Undergraduate

- Sean Miller (2016/17), The University of Arizona

Independent Study

- Fabian de la Peña Montero, The University of Arizona (ECE)

Exam Committees Served

PhD Proposal

- Shu Yang, The University of Arizona (Civil) 2016

Written Comprehensive

- Rodrigo Savage, The University of Arizona (ECE) 2016
- Jesus Horacio Pacheco-Ramirez, The University of Arizona (ECE) 2016
- Matthew Bunting, The University of Arizona (ECE) 2016

MSc Thesis Defense

- Victor Carluccio, Rowan University (ECE) 2016
- Shuqing Gu, The University of Arizona (ECE) 2016

Funding

Funded Total: $65k

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- **Tactical Immune System**
  Army Research Office, Small Business Technology Transfer (STTR)
  Total Award amount: $50k (50% effort)
  Role: Co-PI
  2016/17
- **Analysis of Large Data Sets**
  Air Force Office of Scientific Research, Summer Faculty Fellowship Program
  Total Award amount: $15k (100% effort)
  Role: PI
  2016

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