Gregory Charles Ditzler

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Career Goals

- Act as a leader in the development of solutions to real-world problems using high-performance computing, engineering optimization and machine learning.
- Engage engineering students, at both the graduate and undergraduate levels, in research-based education in both the classroom and laboratory setting. Provide undergraduate students the opportunity to be involved and contribute to open research problems.
- Perform collaborative research and provide a positive impact on fundamental and translational research.

Research Interests

- **Active**: high performance computing, big data, data mining, machine learning, comparative metagenomics, bioinformatics, data science, engineering optimization
- **Future**: cyber-security, information forensics, smart grid optimization

Teaching Interests

electrical circuit analysis, control systems, introductory/advanced digital signal processing, digital & embedded systems, parallel & high performance computing, machine learning, data science, optimization theory, bioinformatics, engineering mathematics

Education

PhD **Drexel University (2011 – Present; expected April 2015)**
Electrical & Computer Engineering
Thesis advisor: Gail Rosen, Ph.D.
Research areas: online learning, feature subset selection, and metagenomic data analysis

MSc **Rowan University (2009 – 2011)**
Electrical & Computer Engineering
Thesis area: *Incremental learning of concept drift from imbalanced data*
Thesis advisor: Robi Polikar, Ph.D.

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

Employment

Graduate Research Assistant — **June 2011 – Present**
Teaching Assistant — **Sept. 2011 – April 2013**
Drexel University, Dept. of Electrical & Computer Engineering — Philadelphia, PA

Adjunct Professor — **Sept. 2010 – Present**
Graduate Research Assistant — **May 2009 – July 2011**
Rowan University, Dept. of Electrical & Computer Engineering — Glassboro, NJ

Research Intern - Technical II — **May 2013 – Aug. 2013**
AT&T Research Labs, Shannon Laboratory — Florham Park, NJ

Electronics Systems Engineer — **May 2008 – May 2009**
Electronics Systems Intern — **March 2007 – May 2008**
QorTek Inc. — Williamsport, PA

Teaching Experience

Summer (Su), Spring (Sp), Fall (F), Winter (W)

Course Title	Teaching Role	Date(s) Taught	Institution
Jr./Sr. Engineering Clinic	Adjunct Professor	F–2013, Sp–2014	Rowan University
Signals, Systems & Transforms	Teaching Assistant	Sp–2012, F–2012	Drexel University
Introduction to Digital Signal Processing	Teaching Assistant	Su–2012, W–2013	Drexel University
Advanced Digital Signal Processing	Teaching Assistant	W–2012	Drexel University
Linear Engineering Systems	Teaching Assistant	F–2011	Drexel University
Networks II	Adjunct Professor	F–2010	Rowan University

Awards/Honors

1. IEEE Computational Intelligence Society Travel Award (Beijing, China) 2014
2. Nihat Bilgutay Research Excellence Award 2013
3. Koerner Family Engineering Research Award 2013
4. Defense Threat Reduction Agency & NSF Algorithms Workshop Travel Grant (San Diego, CA) 2012
5. Graduate Research and Teaching Fellowship, Drexel University 2011–14
6. Student Travel Award for the IJCNN, National Science Foundation (San Jose, CA) 2011
7. Graduate Research Achievement Award[1], Rowan University 2011
8. Graduate Research Assistantship, Rowan University 2009–11
9. Award for Outstanding Leadership & Service to the Pennsylvania College of Technology IEEE Branch 2007/8
10. Penn College Award for Leadership to the College and Community 2008

Professional Affiliations

IEEE Student Member 2004 – Present
IEEE Signal Processing Society 2008 – Present
IEEE Computational Intelligence Society 2009 – Present

Publications

In Preparation / Submitted / Under Revision (4)

- **G. Ditzler**, R. Polikar, and G. Rosen, "Learning features and environmental structure across metagenomic samples using deep learning," *IEEE/ACM Transactions on Computational Biology*, 2014, Submitted.
- **G. Ditzler**, M. Austen*, R, Polikar, and G. Rosen, "Scalable Subset Selection and Variable Importance," 2014, In Preparation. (* denotes an undergraduate student author)
- **G. Ditzler**, J. Calvin Morrison, Y. Lan, and G. Rosen, "Fizzy: Feature Selection for Metagenomics," 2014, In Preparation.
- **G. Ditzler**, G. Rosen and R. Polikar, "Passive–aggressive online learning of multiple experts for large volume data streams," 2014, In Preparation.

Peer Reviewed & Published (19)

Book Chapters (3)

- 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*, Springer, 2014, In Press.
- **G. Ditzler**, Y. Lan, J.-L. Bouchot, and G. Rosen, "Feature selection for metagenomic data analysis," *Encyclopedia of Metagenomics*, 2014, In Press.
- 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, 2014, To Appear.

Journals (2)

- **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*, 2014, In Press.
- **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.

[1] Only one research achievement award is issued to the entire graduate school each year.

Conference Proceedings (14)

- **G. Ditzler**, G. Rosen, and R. Polikar, “Domain Adaptation Bounds for Multiple Expert Systems Under Concept Drift,” *International Joint Conference on Neural Networks*, 2014, Beijing, China, Accepted. *(student travel award)*
- **G. Ditzler**, G. Rosen, and R. Polikar, “Incremental learning of new classes with unbalanced data,” *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 *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 *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.
- **G. Ditzler** and R. Polikar, “An incremental learning framework for concept drift and class imbalance." in *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.

Non-Peer Reviewed Abstracts, Workshops and Theses (6)

- **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*, 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*, 2014.
- J.-L. Bouchot, **G. Ditzler**, and G. Rosen, “The Earth Microbiome Project from a Data Science Perspective”, *DTRA/NSF/NGA Algorithms Workshop*, 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*, 2013.
- **G. Ditzler** and G. Rosen, “Deep Learning of Features and Structure of Soil Samples,” *DTRA/NSF/NGA Algorithms Workshop*, 2012. *(student travel award)*
- **G. Ditzler**, “Incremental Learning of Concept Drift from Imbalanced Data," *Master’s Thesis*, Rowan University, 2011.

Invited Talks (2)

- **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*, November 2013 (Invited).

Grant & Proposal Writing Experience

RP: Research Proposal (not funded); RS: Research Proposal Submitted (under review); RF: Research Proposal Funded

RS2013 **Sponsor**: National Science Foundation
Title: Sequential Learning, Variable Selection, and Knowledge Discovery in High Dimensional Data

PI: Gail Rosen (Drexel)
Role: Senior Personnel: Core problems addressed in the proposal were inspired by my PhD research proposal. I provided significant contributions to the formulation of the problem and writing the proposal.
Date: 1/2014

RP2013 **Sponsor**: Navy
Title: On-Board Data Handling for Longer Duration Autonomous Systems on Expeditionary Missions
PI: Gregory Bower (QorTek, Inc.)
Role: Senior Personnel: I provided input to develop algorithms for a specific problem QorTek was encountering. I contributed to developing a general algorithmic framework for QorTek and aided in writing the proposal.
Date: 3/2013

RP2012 **Sponsor**: National Science Foundation
Title: An Online Learning Framework for Analysis of High-volume [Genomic] Data
PI: Gail Rosen (Drexel)
Role: Senior Personnel: Formulated the idea of a novel online learning algorithm for predicting genomic sequence taxonomy. I played a large role in the content of, and writing, the proposal.
Date: 7/2012

RP2012 **Sponsor**: Department of Homeland Security
Title: Detecting Novel and Engineered Organisms through Ensembles of Metagenomic Sequence Classifiers and Environmental Profiles
PI: Gail Rosen (Drexel)
Role: Senior Personnel: I worked with Dr. Rosen to apply novel machine learning algorithms to detect a novel DNA sequence's taxonomy, while providing a statistical confidence in the prediction. I contributed to writing the proposal.
Date: 8/2012

RP2012 **Sponsor**: National Institute of Health
Title: Optimizing feature selection for discovering taxonomic and functional features relevant to microbiome phenotypes
PI: Gail Rosen (Drexel)
Role: Senior Personnel: I contributed to the design of fundamental research in subset selection, which had a direct application in detecting important taxonomic and functional features. I contributed to writing the proposal.
Date: 10/2012

RF2009 **Sponsor**: Missile Defense Agency
Title: Production Enhancements for Integrated Anti-Tamper Technologies (Phase II)
PI: Gareth Knowles (QorTek)
Role: I provided significant contributions to the Phase II component to this program after successfully acting as the senior personnel on the Phase I program. I played a large role in the development of the project and writing the proposal.
Amount: $998,251.00
Date: 2009

RF2009 **Sponsor**: Missile Defense Agency
Title: Anti-Tamper Printed Circuit Boards (AT-PCB's) (Phase I)
PI: Gareth Knowles (QorTek)
Role: Senior Personnel: Significant contributions to the goals of the project and writing the proposal.
Amount: $99,992.00
Date: 2009

RF2008 **Sponsor**: Office of the Secretary of Defense
Title: Non-Energetics-Based Self-Destruct Mechanisms (Phase II)
PI: Gareth Knowles (QorTek)
Role: Senior Personnel
Amount: $750,000.00
Date: 2008

RF2008 **Sponsor**: Missile Defense Agency
Title: Production Enhancements for Integrated Anti-Tamper Technologies (Phase I)
PI: Gareth Knowles (QorTek)
Role: Senior Personnel: Acted as the lead engineer assigned to the project. Program was renewed for a Phase II.
Amount: $99,967.00
Date: 2008

Activities

Journal Reviewer	
BMC Bioinformatics	2012
BMC Genomics	2014
Elsevier Neurocomputing	2014
IEEE Transactions on Knowledge and Data Engineering	2013/14
IEEE Transactions on Systems, Man, and Cybernetics: Part B	2013
IEEE Transactions on Neural Networks and Learning Systems	2012–14
Springer Neural Computing & Applications Journal	2012
Springer Neural Processing Letters Journal	2012–14
Springer Pattern Analysis & Applications Journal	2012–14
Conference Reviewer	
Artificial Intelligence Applications and Innovations Conference	2013
IEEE International Joint Conference on Neural Networks	2011-14
IEEE International Symposium of Circuits & Systems	2011
IEEE Symposium on Computational Intelligence in Dynamic & Uncertain Environments	2013
International Workshop on Learning Strategies and Data Processing in Nonstationary Environments	2013
Technical Program Committee	
IEEE/INNS WCCI Session: Concept Drift, Domain Adaptation & Learning in Dynamic Environments	2014
IEEE Symposium on Computational Intelligence in Dynamic & Uncertain Environments	2013
Service	
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

High Performance Computing and Programming Expertise

High Performance Computing:

- **HTCondor**: I have experience with HTCondor from research performed at Drexel University and AT&T Research Labs. I have used the HTCondor queuing system to distribute hundreds of parallel jobs across multiple servers.
- **Univa Grid Engine**: Formally known as Sun Grid Engine, I have experience with Grid Engine through Drexel University's research computing facility. I have a working knowledge of the queuing system and other basic functionality.
- **Python**: Python provides a builtin multiprocessing library, which allows for basic parallel processing on a single computing node. I have lightly used this functionality on projects I have been involved with for my PhD. I am also familiar with GPU computing using the Theano module, which I took advantage of at AT&T Research Labs for training recurrent neural networks.
- **Matlab**: I have extensive experience with the parallel computing tools within Matlab's parallel and distributed computing toolboxes. My research has taken advantage of parallel operations on a single computing node, and I am familiar with GPU computing with Matlab.

Programming Languages: Matlab, Python, Bash, Java, C, C#, LabVIEW, Lua, Verilog HDL, VHDL, and R.
Hardware Programming: Xilinx Spartan/Virtex FPGAs, TI DSPs, microcontrollers (HC12, Silicon Labs, Microchip), Microchip DSPics, Actel FPGAs
General Software: Matlab, Eclipse IDE, Xilinx Platform Studio, LabVIEW, Cadsoft EAGLE, Visual Studio, Actel Libero IDE
Other: Linux/Mac/Windows operating systems, LaTeX, Weka, Massive Online Analysis (MOA), QIIME, Torch7, Theano

References

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Shreekanth Mandayam, PhD (Vice President for Research): Rowan University
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More references are available upon request.