

Michael S. Gashler, Ph.D.

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RESEARCH FOCUS

My research is centered in machine learning. I am especially interested in systems that learn to perceive meaning embedded within high dimensional data such as digital images, sensor arrays, and documents. Most of my innovations involve novel training methodologies and structural variations for deep artificial neural networks that make them more effective at perception tasks. My work falls in the proximity of deep neural networks, time-series prediction, non-linear dimensionality reduction, inference of intrinsic feature representations, black-box system identification, and cognitive architectures. Ultimately, I seek to enable machines to operate more autonomously with a greater diversity of problems, and I am interested in any challenge that will lead toward this end.

EDUCATION

Ph.D. in Computer Science, 2012.
[Advancing the effectiveness of nonlinear dimensionality reduction techniques](#)
Brigham Young University, Provo, UT 84602
Advisor: Tony Martinez

M.S. in Computer Science, 2007.
[Manifold Sculpting](#)
Brigham Young University, Provo, UT 84602

B.S. in Computer Science, 2001,
Brigham Young University, Provo, UT 84602

EMPLOYMENT APPOINTMENTS

2012 – Present	University of Arkansas	Assistant professor in the Department of Computer Science and Computer Engineering.
2006 – 2012	Neural Networks and Machine Learning Lab	Ph.D. Candidate and Research Assistant for Dr. Tony Martinez in machine learning at Brigham Young University.
2004 – 2006	Edumetrics Institute	Worked as a development lead and engineer to build an interpreter training program and a decentralized multi-player Internet game.
2001 – 2004	Microsoft	Worked for Microsoft on the Common Language Runtime (the .NET virtual machine.) I developed Code Access Security, and the PE file Verifier.

PEER REVIEWED

[J7] Godfrey, Luke B. and Gashler, Michael S. [Neural Decomposition of Time-Series Data for Effective Generalization](#). *IEEE Transactions on Neural Networks and*

Learning Systems (TNNLS), Volume 29, No. 7, p. 2973–2985, 2018. (TNNLS is the top IEEE journal in neural networks. Its impact factor is 4.37 according to Google.)

- [J6] Pierson, Harry A. and Gashler, Michael S. “[Deep Learning in Robotics: A Review of Recent Research](#).” **Advanced Robotics** 31, no. 16, 821-835. Taylor & Francis. 2017.
- [J5] Gashler, Michael S. and Stephen C. Ashmore. “[Modeling time series data with deep Fourier neural networks](#).” **Neurocomputing** 188: p. 3-11. May 2016. (The impact factor of Neurocomputing is 2.005 according to Google.)
- [J4] Gashler, Michael S. and Smith, Michael R. and Morris, Richard and Martinez, Tony. [Missing Value Imputation With Unsupervised Backpropagation](#). Vol. 31(1). page 165. 2014. **Computational Intelligence**. DOI: 10.1111/coin.12048. (2014 Impact factor: 1.0.)
- [J3] Gashler, Michael S. and Martinez, Tony. [Robust Manifold Learning With CycleCut](#). **Connection Science**, Vol. 24(1). pages 57–69. 2012. DOI: 10.1080/09540091.2012.664122. (2012 Impact factor: 0.706.)
- [J2] Gashler, Michael S. [Waffles: A machine learning toolkit](#). **Journal of Machine Learning Research**, 12:2383–2387, July 2011. ISSN 1532–4435. <http://www.jmlr.org/papers/volume12/gashler11a/gashler11a.pdf>. (This journal had a 5-year impact factor of 4.967 in 2010 according to ISI.)
- [J1] Gashler, Michael S. and Ventura, Dan and Martinez, Tony. [Manifold Learning by graduated optimization](#). **IEEE Transactions on Systems, Man, and Cybernetics, Part B**, PP(99):1–13, 2011. ISSN 1083–4419. DOI: 10.1109/TSMCB.2011.2151187. (This journal had a 5-year impact factor of 3.274 in 2010 according to ISI.)

- [C19] Luke Godfrey, Michael Gashler, “[Leveraging Product as an Activation Function in Deep Neural Networks](#)”. **IEEE Systems, Man, and Cybernetics**. IEEE Press. Miyazaki, Japan, October, 2018.
- [C18] Luke Godfrey, Michael Gashler, Zhenghui Sha. “[Modeling Sequential Design Decisions Using Fine-Grained Empirical Data](#)”. **Design Science Research 2018**: Workshop on Data Driven Design and Learning. August 23-25, 2018, Montreal, Canada.
- [C17] Hammer, Jon C., and Michael S. Gashler. “[Learning Resolution-independent Image Representations](#).” In *2018 IEEE 17th International Conference on Cognitive Informatics & Cognitive Computing (ICCI*CC)*, pp. 408-416. IEEE, 2018.
- [C16] Molla Rahman, Zhenghui Sha, Michael Gashler. “[Automatic Clustering of Sequential Design Behaviors Based on Function-Behavior-Structure Ontology](#).” Proceedings of the ASME 2018 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference. **IDETC/CIE**. August 26-29, 2018, Quebec city, Canada.
- [C15] Cambria, J., Pierson, H., Turner, R., Yang, L., Berta, J., & Gashler, M. “Tinkering Belles and Rocking Robots: Demystifying robotics club and STEM aspirations.”

Accepted by the 2018 **Annual Meeting of the American Psychological Association**, San Francisco, CA.

- [C14] Joshua R. Smith and Michael S. Gashler. "[An Investigation of How Neural Networks Learn From the Experiences of Peers Through Periodic Weight Averaging.](#)" 16th **IEEE International Conference on Machine Learning and Applications (ICMLA)**, Dec., 2017, Cancun, Mexico.
- [C13] Godfrey, Luke B. and Gashler, Michael S. "[Neural Decomposition of Time-Series Data.](#)" *IEEE Systems, Man, and Cybernetics*. IEEE Press. Banff, Canada, October, 2017.
- [C12] Godfrey, Luke B. and Gashler, Michael S. "[A parameterized activation function for learning fuzzy logic operations in deep neural networks.](#)" *IEEE Systems, Man, and Cybernetics*. IEEE Press. Banff, Canada, October, 2017.
- [C11] Ashmore, Stephen C., and Gashler, Michael S. "[Practical Techniques for Using Neural Networks to Estimate State from Images.](#)" *15th IEEE International Conference on Machine Learning and Applications (ICMLA)*. IEEE. Pages 916-919. Anaheim, California. December, 2016. (Acceptance rate: 24.69%)
- [C10] Pierson, Harry A. and Gashler, Michael S. [Deep Learning for Smart Robotics: A Review.](#) (Invited paper.) **2016 Sino-American Technology & Engineering Conference**. Shenyang, China, May, 2016.
- [C9] Godfrey, Luke B. and Gashler, Michael S. [A Continuum among Logarithmic, Linear, and Exponential Functions, and Its Potential to Improve Generalization in Neural Networks.](#) In *Proceedings of the 7th International Joint Conference on Knowledge Discovery, Knowledge Engineering and Knowledge Management: KDIR, pages 481-486*. Lisbon, Portugal, November, 2015.
- [C8] Ashmore, Stephen C. and Gashler, Michael S. [A Method for Finding Similarity between Multi-Layer Perceptrons by Forward Bipartite Alignment.](#) In *Proceedings of the IEEE International Joint Conference on Neural Networks IJCNN'15*. IEEE Press, Killarney, Ireland, July, 2015.
- [C7] Gashler, Michael S. and Zachariah Kindle. [A Minimal Architecture for General Cognition.](#) In *Proceedings of the IEEE International Joint Conference on Neural Networks IJCNN'15*. IEEE Press, Killarney, Ireland, July, 2015.
- [C6] Michael R. Smith and Gashler, Michael S. and Martinez, Tony. [A Hybrid Latent Variable Neural Network Model for Item Recommendation.](#) In *Proceedings of the IEEE International Joint Conference on Neural Networks IJCNN'15*. IEEE Press, Killarney, Ireland, July, 2015.
- [C5] Gashler, Michael S. and Ashmore, Stephen C. [Training Deep Fourier Neural Networks To Fit Time-Series Data.](#) In *Lecture Notes in Computer Science 8590*, pages 48–55, Springer, Proceedings of the **International Conference on Intelligent Computing**, Taiyuan, China. August, 2014. (Received a distinguished paper award, which was awarded to the top 15% of papers published in this conference.)
- [C4] Gashler, Michael S. and Martinez, Tony. [Temporal nonlinear dimensionality reduction.](#) In *Proceedings of the IEEE International Joint Conference on Neural*

Networks IJCNN'11, pages 1959–1966. IEEE Press, San Jose, California, August, 2011.

[C3] Gashler, Michael S. and Martinez, Tony. [Tangent space guided intelligent neighbor finding](#). In Proceedings of the *IEEE International Joint Conference on Neural Networks* IJCNN'11, pages 2617–2624. IEEE Press, San Jose, California, August, 2011.

[C2] Gashler, Michael S. and Giraud-Carrier, Christophe and Martinez, Tony. [Decision Tree Ensemble: Small Heterogeneous Is Better Than Large Homogeneous](#). In The *IEEE Seventh International Conference on Machine Learning and Applications* ICMLA'08, Pages 900–905. IEEE Press. San Diego, California, December, 2008. DOI 10.1109/ICMLA.2008.154. (Known citations: **90**.)

[C1] Gashler, Michael S. and Ventura, Dan and Martinez, Tony. [Iterative non-linear dimensionality reduction with manifold sculpting](#). In Platt, J.C. and Koller, D. and Singer, Y. and Roweis, S., editor, *Advances in Neural Information Processing Systems 20*, pages 513–520, MIT Press, Cambridge, MA, Vancouver, B.C., 2008. (NIPS is the top conference on neural networks. Known citations: **42**.)

PATENTS

[P2] Lange, Sebastian and Fee, Gregory D and Goldfeder, Aaron and Medvedev, Ivan and Gashler, Michael. [Security requirement determination](#). June 2010. US Patent 7,743,423.

[P1] Brumme, Christopher W and Lange, Sebastian and Fee, Gregory D and Gashler, Michael and Prakriya, Mahesh. [Hosted code runtime protection](#). Jan 2010. US Patent 7,647,629.

AWARDS

[A2] Outstanding Teacher Award, Department of Computer Science and Computer Engineering, College of Engineering, University of Arkansas, 2016-2017. (One individual in each department was selected to receive this award. My department had 17 eligible faculty members at the time.)

[A1] Outstanding Teacher Award, Department of Computer Science and Computer Engineering, College of Engineering, University of Arkansas, 2014-2015. (One individual in each department was selected to receive this award. My department had 16 eligible faculty members at the time.)

GRANTS

[G6] Feb 2018 – Feb 2019. \$1,000. **Advisor**. Internal grant awarded by the Honor's College at University of Arkansas to support research by Austin Kreulach. "Application of Concurrent Recursive Neural Networks to the Creation of Music".

[G5] Jun 2017 – May 2018. \$139,676. **Co-PI**. Grant awarded by J.B. Hunt Corporation. "Machine Learning-based Recommendation Engine for Load Matching".

[G4] May 2017 – Apr 2018. \$24,948. **Co-PI**. Internal grant awarded by a College of Engineering initiative called Engineering Research and Innovation Seed Funding. "Mining and Modeling Engineering Design Thinking Using Big Data Analytics".

[G3] Nov 2016. \$2000. **Co-PI**. Internal grant awarded by the Provost's office at University of Arkansas. "Listening to their Voices: Children tell us what works about robotics competitions and their motivation for STEM".

[G2] May 2015 – Apr 2016. \$17,841. **PI**. Internal grant awarded by a College of Engineering initiative at University of Arkansas called Engineering Research and Innovation Seed Funding. "A Deep Learning Approach for Training Robots by Example".

[G1] Nov 2014 – Oct 2015. \$2750. **Advisor**. NSF SURF fellowship to support Sarah Stolze's research in my lab. "Unspoken Speech Recognition with Artificial Neural Networks and Electroencephalography".

DONATIONS
RECEIVED FOR
MY RESEARCH
LAB

[D1] Mar 2014. Tesla K40 GPGPU donated by NVIDIA Corporation to support development of my Waffles machine learning toolkit. Worth \$5499 at time of donation.

MACHINE
LEARNING
TOOLKIT

Developed an open source toolkit of machine learning and data mining algorithms, called [Waffles](#).

- Contains well over 100,000 lines (about 2,000 printed pages) of source code implementing algorithms for a wide variety of machine learning applications.
- Includes tools for classification, regression, collaborative filtering, non-linear dimensionality reduction, clustering, Bayesian graphical models, ensemble methods, data visualization, sparse matrix processing, optimization, reinforcement learning, and deep neural network learning.
- Received contributions from over 20 developers, unsolicited notes of thanks from more than 25 researchers, and two awards.
- Effective vehicle for disseminating my research contributions.

COURSE
MATERIALS
DEVELOPED

[M2] Gashler, Michael S. [A Tour of Machine Learning](#). A freely-available compilation of my lecture notes. Contains 216 pages of dense instructional content on machine learning.

[M1] Developed an open source package of [Teaching Tools](#). This package includes tools for automating lecture recording, assignment submission, plagiarism detection, auto-grading, grade tracking, and collaborative content development.

COURSE
EVALUATIONS

Semester

Course

(Each course and instructor is rated anonymously by students on a scale from 0 to 5.)

Enrollment

Course Ratings

Dept. Average

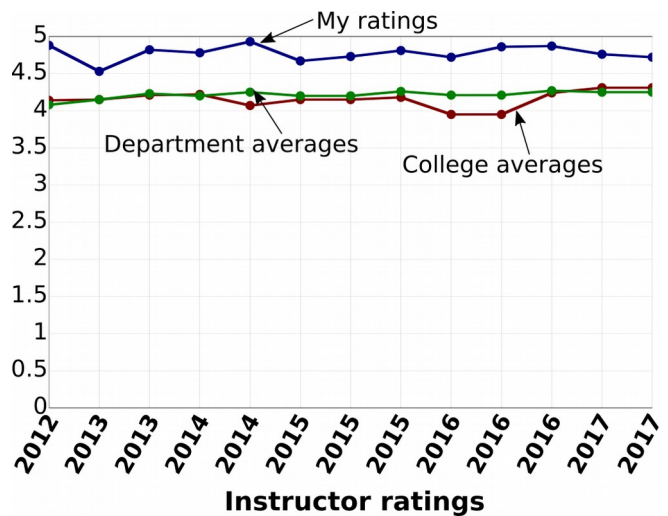
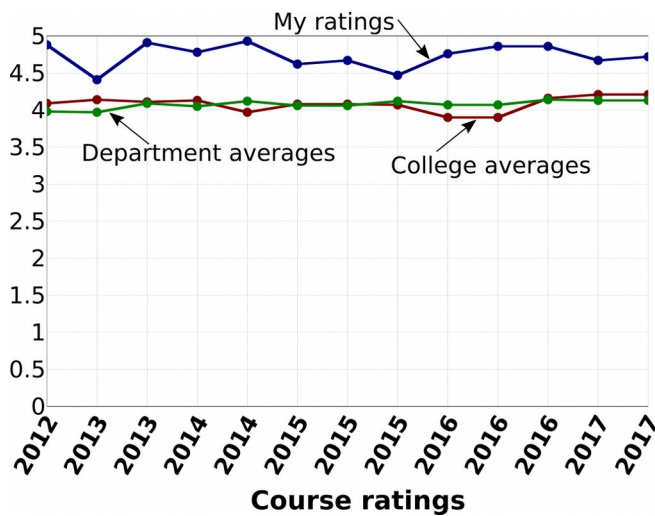
College Average

Instructor Ratings

Dept. Average

College Average

2012 Fall	Machine Learning	19	4.88	4.09	3.98	4.88	4.14	4.08
2013 Spring	Programming Paradigms	38	4.41	4.14	3.97	4.53	4.15	4.15
2013 Fall	Data Mining	13	4.91	4.11	4.09	4.82	4.21	4.23
2014 Spring	Programming Paradigms	42	4.78	4.13	4.05	4.78	4.22	4.20
2014 Fall	Machine Learning	18	4.93	3.97	4.12	4.93	4.07	4.25
2015 Spring	Programming Paradigms	60	4.62	4.08	4.06	4.67	4.15	4.20
2015 Spring	Artificial Intelligence	55	4.67	4.08	4.06	4.73	4.15	4.20
2015 Fall	Adv. Artificial Intel.	20	4.47	4.07	4.12	4.81	4.18	4.26
2016 Spring	Programming Paradigms	61	4.76	3.90	4.07	4.72	3.95	4.21
2016 Spring	Artificial Intelligence	55	4.86	3.90	4.07	4.86	3.95	4.21
2016 Fall	Machine Learning	35	4.86	4.16	4.14	4.87	4.24	4.27
2017 Spring	Programming Paradigms	59	4.67	4.21	4.13	4.76	4.31	4.25
2017 Spring	Artificial Intelligence	77	4.72	4.21	4.13	4.72	4.31	4.25
2017 Fall	Adv. Artificial Intel.	10	5.0	4.06	4.09	5.0	4.09	4.23



Ph. D.
STUDENTS
GRADUATED

Jon Hammer, Spring 2018, *Improving the Efficacy of Context-Aware Applications*.

Luke B. Godfrey, Spring 2018, *Parameterizing and Aggregating Activation Functions in Deep Neural Networks*.

M. S.

Erzen Komoni, Spring 2018, *A Continuous Space Generative Model*.

STUDENTS
GRADUATED

James B. Holliday, Spring 2018, *Follow Then Forage Exploration: Improving Asynchronous Advantage Actor Critic*.

Zac Kindle, Spring 2017, *Differing Methods of Object Recognition; Domain Specific Models versus General Algorithms*.

Joshua R. Smith, Spring 2017, *An investigation of how neural networks learn from experiences of peers through periodic weight averaging*.

Alex Cardiel, Spring 2017, Non-thesis: *Determining when to prune neurons in neural networks*.

Paul Walton, Summer 2016, Non-thesis: *A closed-form method for training neural networks*.

Luke B. Godfrey, Fall 2015, *Neural Decomposition of Time-Series Data for Effective Generalization*.

Stephen C. Ashmore, Fall 2015, *Evaluating the intrinsic similarity between neural networks*.

Meshal Alfarhood, Spring 2015, M.S. Non-thesis: *Augmenting matrix factorization with unstructured information*.

HONORS
STUDENTS
GRADUATED

Meenakshi Manavazhahan, Spring 2017, *A Study of Activation Functions for Neural Networks*.

Seok Lee, Spring 2016, *Inferring Intrinsic Beliefs from Digital Images Using a Deep Autoencoder*.

Sarah Stolze, Spring 2016, *Improving Electroencephalography-Based Imagined Speech Recognition with a Simultaneous Video Data Stream*.

Rachel Findlay, Spring 2016, *Ant Colony Optimization for Continuous Spaces*.

Sawyer Anderson, Fall 2015, *The Information of Spam: Can spam increase the accuracy of market predictions?*

Grant Slatton, Spring 2014, *A Comparison of Dropout and Weight Decay for Regularizing Deep Neural Networks*.

INVITED
LECTURES

[L10] March 2018, Nowhere Developers Conference, Bentonville, AR. "[Using Neural Networks to Solve Non-Traditional Challenges](#)".

[L9] June 2017, Little Rock Science Cafe, Little Rock, AR. Served as a panelist to discuss the role of artificial intelligence in cyber warfare.

[L8] April 2017, Occam's Razors, Fayetteville, AR, "[Some Philosophical Ramifications of the Ongoing Advancement of Artificial Intelligence](#)".

- [L7] July 2016, NWA Data Science Meetup, Fayetteville, AR. Gave a presentation titled, “The Surprising Flexibility of Neural Nets”.
- [L6] April 2015, Walmart Headquarters, Bentonville, Arkansas. Led a workshop on time-series prediction at a company event titled, “Models, Machine Learning, and Applications 2”.
- [L5] January 2015, WalMart Headquarters, Bentonville, Arkansas. Presented two talks at an event titled, “Models, Machine Learning, and Applications”: One talk was about using deep neural networks to predict time series. The other was about my machine learning toolkit, Waffles.
- [L4] March 2012, Utah State University, Logan Utah. Presented research on using non-linear dimensionality reduction techniques to model dynamical systems.
- [L3] March 2012, Washington State University, Pullman, Washington. Presented research on using non-linear dimensionality reduction techniques to model dynamical systems.
- [L2] February 2012, California State University Channel Islands, Camarillo, California. Presented research on advances in non-linear dimensionality reduction techniques.
- [L1] September, 2011, Decision Sciences Corporation, Poway, California. Seminar and consulting visit about using my machine learning tools in nuclear research.

SERVICE FOR
INTERNATIONAL
CONFERENCES

- Jun 2017 – Ongoing. Serving on the Program Committee for the International Conference on Knowledge Discovery and Information Retrieval.
- May 2017. Served on the Technical Program Committee for the 2017 IEEE Conference on Systems, Man, and Cybernetics.
- Jun 2016 – Nov 2016. Served on the Program Committee for the International Conference on Knowledge Discovery and Information Retrieval. Porto, Portugal.
- Jul 2015. Chairman for the oral session on “Financial and Commercial Applications of Neural Networks” at the IEEE International Joint Conference on Neural Networks.
- Jun 2015 – Nov 2015. Served on the Program Committee for the International Conference on Knowledge Discovery and Information Retrieval. Lisbon, Portugal.
- Jan 2015 – Aug 2015. Served as **Special Issue Co-Chairman** for the International Conference on Intelligent Computing.
- Sep 2014 – Jul 2015. Served on the **organizing committee** as **Special Session Co-chairman** for the IEEE International Joint Conference on Neural Networks.
- Aug 2014. Chairman for the oral session on “Neural Networks” at the International Conference on Intelligent Computing. Taiyuan, China.

INVITED
MANUSCRIPT
REVIEWS

Performed numerous manuscript reviews for:

- Advanced Robotics
- Computational Intelligence

- Computer Vision and Image Understanding
- Expert Systems With Applications
- IEEE International Conference on Computer Communications (INFOCOM)
- IEEE Internet Computing
- IEEE Conference on Systems, Man, and Cybernetics
- IEEE Transactions on Knowledge and Data Engineering
- IEEE Transactions on Neural Networks and Learning Systems
- IET Computer Vision
- International Conference on Knowledge Discovery and Information Retrieval (KDIR)
- Journal of Machine Learning Research
- Neural Information Processing Systems
- Neural Networks
- Neural Processing Letters
- Neurocomputing
- Quantum Information Processing
- Sustainable Computing Informatics and Systems

OTHER
SERVICE
ACTIVITIES

Summer 2017. Taught a computer programming course to Arkansas high school teachers as part of a program called Training Arkansas Computing Teachers (TACT).

Summer 2016. Designed and taught a computer programming course to Arkansas high school teachers as part of a program called Training Arkansas Computing Teachers (TACT).

Spring 2016. Served as a volunteer judge in the FIRST LEGO League robotics competition.

Spring 2014. Served as a volunteer judge in the state science fair at University of Arkansas.