William La Cava

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Education

2012 - 2016	Ph.D., Mechanical Engineering, University of Massachusetts Amherst
2009 - 2010	M.Eng., Mechanical Engineering, Cornell University
2005 - 2009	B.S., Mechanical Engineering, Cornell University

Research Interests

Machine learning, data science, genetic and evolutionary computation, biomedical informatics, dynamical systems, wind energy, artificial intelligence and artificial life

Research Experience

2016 -	**Post-Doctoral Fellow, Epistasis Laboratory, University of Pennsylvania** *Advisor: Jason Moore* Institute for Biomedical Informatics Fellow, Warren Center for Network and Data Sciences
2012 - 2016	**PhD Student, University of Massachusetts Amherst** *Committee: Kourosh Danai, Lee Spector, Matthew Lackner* Fellow, NSF IGERT Offshore Wind Energy Program
Jun–Aug 2015	**Visiting Researcher, Laboratory of Agent Modeling, University of Lisbon** *Hosts: Sara Silva, Leonardo Vanneschi* Subject: Multiclass classification of complex systems using genetic programming
2010 - 2012	**Research Scientist, National Renewable Energy Laboratory (NREL)** *Supervisors: Paul Veers, Jonathan Keller* Lead engineer for the Gearbox Reliability Collaborative, a consortium involved in wind turbine gearbox testing, data analysis, and numerical modeling Designed and conducted drivetrain simulation and testing programs for a 3 MW wind turbine R&D project

2008 - 2010	**Lead Engineer of Mechanical Power Systems, Cornell 100+ MPG Team** *Advisor: Albert George* Design, fabrication and testing for a hybrid-electric vehicle that competed in the Automotive X-Prize and won the 2011 Green Grand Prix, achieving over 120 MPG equivalent
2007 - 2008	**Independent Research, Cornell Computational Synthesis Laboratory** *Advisor: Hod Lipson* Built and trained a mobile robot with a 5 degree-of-freedom arm and gripper to retrieve objects

Publications

Citations: 521, h-index: 13, i10-index: 16 (source: Google Scholar)

Articles in Review

[1] William La Cava and Jason H. Moore. "Stochastic optimization approaches to learning concise representations". In: (2018). arXiv: 1807.00981. In Review.

Journal Articles

[1] William La Cava, Thomas Helmuth, Lee Spector, and Jason H. Moore. "A probabilistic and multi-objective analysis of lexicase selection and epsilon-lexicase selection". In: *Evolutionary Computation* (May 2018), pp. 1–28. DOI: 10.1162/evco_a_00224.

[2] William La Cava, Sara Silva, Kourosh Danai, Lee Spector, Leonardo Vanneschi, and Jason H. Moore. "Multidimensional genetic programming for multiclass classification". In: *Swarm and Evolutionary Computation* (Apr. 2018). DOI: 10.1016/j.swevo.2018.03.015.

[3] Ryan J. Urbanowicz, Melissa Meeker, William La Cava, Randal S. Olson, and Jason H. Moore. "Relief-Based Feature Selection: Introduction and Review". In: *Journal of Biomedical Informatics* (2018). arXiv: 1711.08421. In Press.

[4] William G. La Cava, Kushal Sahare, and Kourosh Danai. "Restructuring Controllers to Accommodate Plant Nonlinearities". In: *Journal of Dynamic Systems, Measurement, and Control* 139.8 (2017), pp. 081004–081004–10. DOI: 10.1115/1.4035870.

[5] Randal S. Olson, William La Cava, Patryk Orzechowski, Ryan J. Urbanowicz, and Jason H. Moore. "PMLB: A Large Benchmark Suite for Machine Learning Evaluation and Comparison". In: *BioData Mining* (2017). In Press. arXiv: 1703.00512.

[6] William La Cava, Kourosh Danai, and Lee Spector. "Inference of compact nonlinear dynamic models by epigenetic local search". In: *Engineering Applications of Artificial Intelligence* 55 (2016), pp. 292–306. DOI: 10.1016/j.engappai.2016.07.004.

[7] William La Cava, Kourosh Danai, Lee Spector, Paul Fleming, Alan Wright, and Matthew Lackner. "Automatic identification of wind turbine models using evolutionary multiobjective optimization". In: *Renewable Energy* (Nov. 2015). DOI: 10.1016/j.renene.2015.09.068.

[8] William G. La Cava and Kourosh Danai. "Gradient-based adaptation of continuous dynamic model structures". In: *International Journal of Systems Science* 47 (1 Aug. 2015), pp. 249–263. DOI: 10.1080/00207721.2015.1069905.

[9] Yi Guo, Jonathan Keller, and William LaCava. "Planetary gear load sharing of wind turbine drivetrains subjected to non-torque loads". In: *Wind Energy* 18 (Mar. 2014), pp. 757–768. DOI: 10.1002/we.1731.

[10] William LaCava, Yi Guo, Chris Marks, Yihan Xing, and Torgeir Moan. "Three-dimensional bearing load share behaviour in the planetary stage of a wind turbine gearbox". In: *IET Renewable Power Generation* 7.4 (July 2013), pp. 359–369. DOI: 10.1049/iet-rpg.2012.0274.

Peer-reviewed Conference Proceedings

[1] William La Cava and Jason H. Moore. "An Analysis of epsilon-lexicase Selection for Large-scale Many-objective Optimization". In: *Proceedings of the Genetic and Evolutionary Computation Conference Companion*. GECCO '18. Kyoto, Japan: ACM, 2018, pp. 185–186. DOI: 10.1145/3205651.3205656.

[2] William La Cava and Jason H. Moore. "Behavioral search drivers and the role of elitism in soft robotics". In: *The 2018 Conference on Artificial Life*. 2018, pp. 206–213. DOI: 10.1162/isal_a_00044. eprint: https://www.mitpressjournals.org/doi/pdf/10.1162/isal_a_00044.

[3] Patryk Orzechowski, William La Cava, and Jason H. Moore. "Where are we now? A large benchmark study of recent symbolic regression methods". In: *GECCO 2018: Proceedings of the 2018 Genetic and Evolutionary Computation Conference*. Apr. 2018. DOI: 10.1145/3205455.3205539. arXiv: 1804.09331. **Best Paper Nominee**.

[4] William La Cava and Jason Moore. "A general feature engineering wrapper for machine learning using ϵ-lexicase survival". In: *20th European Conference on Genetic Programming*. Springer, 2017, pp. 80–95. DOI: 10.1007/978-3-319-55696-3_6. **Best Paper Nominee**.

[5] William La Cava and Jason Moore. "Ensemble representation learning: an analysis of fitness and survival for wrapper-based genetic programming methods". In: *GECCO '17: Proceedings of the 2017 Genetic and Evolutionary Computation Conference*. ACM, 2017. arXiv: 1703.06934.

[6] William La Cava, Sara Silva, Leonardo Vanneschi, Lee Spector, and Jason Moore. "Genetic programming representations for multi-dimensional feature learning in biomedical classification". In: *European Conference on the Applications of Evolutionary Computation*. Springer. 2017, pp. 158–173. DOI: 10.1007/978-3-319-55849-3_11.

[7] Randal S. Olson, William La Cava, Zairah Mustahsan, Akshay Varik, and Jason H. Moore. "Data-driven Advice for Applying Machine Learning to Bioinformatics Problems". In: *Pacific Symposium on Biocomputing (PSB)*. 2017. arXiv: 1708.05070.

[8] William La Cava, Lee Spector, and Kourosh Danai. "Epsilon-Lexicase Selection for Regression". In: *Proceedings of the 2016 on Genetic and Evolutionary Computation Conference*. ACM. 2016, pp. 741–748. DOI: 10.1145/2908812.2908898.

[9] Semyung Park, Matthew A Lackner, John Cross-Whiter, A Rodriguez Tsouroukdissian, and William La Cava. "An Investigation of Passive and Semi-Active Tuned Mass Dampers for a Tension Leg Platform Floating Offshore Wind Turbine in ULS Conditions". In: *ASME 2016 35th International Conference on Ocean, Offshore and Arctic Engineering*. American Society of Mechanical Engineers. 2016, V003T02A061–V003T02A061.

[10] Arturo Rodriguez Tsouroukdissian, Mathew Lackner, John Cross-Whiter, Se Myung Park, Pariya Pourazarm, William La Cava, and Sungho Lee. "Smart Novel Semi-Active Tuned Mass Damper for Fixed-Bottom and Floating Offshore Wind (Paper)". In: *Offshore Technology Conference*. Houston, TX: U.S. DOE Office of Science and Technical Information, 2016. PDF.

[11] Y Guo, J Keller, W La Cava, J Austin, AR Nejad, C Halse, L Bastard, and J Helsen. "Recommendations on Model Fidelity for Wind Turbine Gearbox Simulations". In: *Conference for Wind Power Drives (CWD) 2015*. AAchen, Germany, 2015.

[12] William La Cava and Kourosh Danai. "Model Structure Adaptation: A Gradient-based Approach". In: *ASME 2015 Dynamic Systems and Control Conference*. Columbus, Ohio: ASME, Oct. 2015.

[13] William La Cava, Kourosh Danai, Lee Spector, Paul Fleming, Alan D. Wright, and Matthew Lackner. "Automated Identification of Closed-Loop Wind Turbine Dynamics via Genetic Programming". In: *ASME 2015 Dynamic Systems and Control Conference*. Columbus, Ohio: ASME, Oct. 2015.

[14] William La Cava, Thomas Helmuth, Lee Spector, and Kourosh Danai. "Genetic Programming with Epigenetic Local Search". In: *Proceedings of the Genetic and Evolutionary Computation Conference*. GECCO 2015. Madrid, Spain: ACM Press, 2015, pp. 1055–1062. DOI: 10.1145/2739480.2754763. **Best Paper Nominee**.

[15] William La Cava, Lee Spector, Kourosh Danai, and Matthew Lackner. "Evolving differential equations with developmental linear genetic programming and epigenetic hill climbing". In: *Companion proceedings of the 2014 conference on Genetic and Evolutionary Computation*. GECCO 2014. Vancouver, B.C.: ACM Press, 2014, pp. 141–142. DOI: 10.1145/2598394.2598491.

[16] Yi Guo, Jonathan Keller, and William LaCava. "Combined effects of gravity, bending moment, bearing clearance, and input torque on wind turbine planetary gear load sharing". In: *AGMA Fall Technical Meeting*. Dearborn, MI: AGMA, 2012.

[17] Jonathan Keller, Hal F. Link, Yi Guo, William LaCava, and Brian P. McNiff. "Gearbox reliability collaborative phase 1 and 2: testing and modelling results". In: *Conference proceedings of ISMA2012-USD2012*. International Conference on Noise and Vibration engineering. Leuven, Belgium, 2012.

[18] William LaCava, Jonathan Keller, and Brian McNiff. "Gearbox reliability collaborative: test and model investigation of sun orbit and planet load share in a wind turbine gearbox". In: *AIAA 53rd Structures, Structural Dynamics, and Materials and Colocated Conferences*. Honolulu, Hawaii, 2012.

[19] William LaCava, Y. Xing, Y. Guo, and Torgeir Moan. "Determining wind turbine gearbox model complexity using measurement validation and cost comparison". In: *European Wind Energy Association annual event*. Copenhagen, Denmark, 2012.

[20] William LaCava, B McNiff, and J van Dam. "NREL Gearbox Reliability Collaborative: Comparing In-field Gearbox Response to Different Dynamometer Test Conditions". In: AWEA Windpower 2011. Anaheim, California: AWEA, 2011.

Book Chapters

[1] Randal S Olson, Moshe Sipper, William La Cava, Sharon Tartarone, Steven Vitale, Weixuan Fu, John H Holmes, and Jason H Moore. "A System for Accessible Artificial Intelligence". In: *Genetic Programming Theory and Practice XV*. Springer, 2018, pp. 121–134. arXiv: 1705.00594.

[2] Lee Spector, William La Cava, Saul Shanabrook, Thomas Helmuth, and Edward Pantridge. "Relaxations of Lexicase Parent Selection". In: *Genetic Programming Theory and Practice XV*. Cham: Springer International Publishing, 2018, pp. 105–120.

[3] Karthik Kannappan, Lee Spector, Moshe Sipper, Thomas Helmuth, William La Cava, Jake Wisdom, and Omri Bernstein. "Analyzing a Decade of Human-Competitive ("HUMIE") Winners: What Can We Learn?" In: *Genetic Programming Theory and Practice XII*. Springer, 2015, pp. 149–166.

[4] William La Cava and Lee Spector. "Inheritable Epigenetics in Genetic Programming". In: *Genetic Programming Theory and Practice XII*. Ed. by Rick Riolo, William P. Worzel, and Mark Kotanchek. Cham: Springer, 2015, pp. 37–51.

Dissertations

[1] William G La Cava. "Automatic Development and Adaptation of Concise Nonlinear Models for System Identification". In: *Doctoral Dissertations May 2014 - current.* Vol. 731. 2016. PhD Dissertation, University of Massachusetts Amherst. URL: http://scholarworks.umass.edu/dissertations_2/731/.

Technical Reports

[1] William La Cava and Matthew Lackner. *Theory manual for the tuned mass damper module in FAST 8.* Tech. rep. University of Massachusetts Amherst, Mar. 2015. DOI: DOI:10.13140/rg.2.1.4565.9684. PDF.

[2] Hal Link, W LaCava, J van Dam, B McNiff, S Sheng, R Wallen, M McDade, S Lambert, S Butterfield, and F Oyague. *Gearbox reliability collaborative project report: findings from phase 1 and phase 2 testing.* Tech. rep. NREL/TP-5000-51885. National Renewable Energy Laboratory, 2011.

[3] S Sheng, H Link, W LaCava, J Van Dam, B McNiff, P Veers, J Keller, S Butterfield, and F Oyague. *Wind turbine drivetrain condition monitoring during GRC phase 1 and phase 2 testing.* Tech. rep. NREL/TP-5000-52748. National Renewable Energy Laboratory, 2011.

Press

[1] Rachel Ewing. *Penn's New Artificial Intelligence Assistant.* Penn Medicine News. Nov. 20, 2017. URL: https://www.pennmedicine.org/news/news-blog/2017/november/penns-new-artificial-intelligence-assistant (visited on 11/27/2017).

[2] Jordan Pearson. *These Researchers Want the People to Seize the Means of AI Production.* Motherboard. May 3, 2017. URL: https://motherboard.vice.com/en_us/article/z4jb9j/researchers-want-people-to-seize-the-means-of-ai-production-penn-ai (visited on 09/16/2017).

[3] Anne Ju. *Sleek, Cornell-red 100 mpg car is ready for public debut.* Cornell Chronicle. Apr. 22, 2010. URL: http://news.cornell.edu/stories/2010/04/cornell-100-mpg-car-painted-ready-race (visited on 11/27/2017).

[4] Anne Ju. *Cornell 100+ MPG Team accelerates forward in $10 million Automotive X Prize competition.* Cornell Chronicle. Oct. 20, 2009. URL: http://news.cornell.edu/stories/2009/10/cornell-100-mpg-car-makes-cut-competition (visited on 11/27/2017).

[5] Anne Ju. *Students work day and night to make 100 mpg car a reality.* Cornell Chronicle. July 29, 2009. URL: http://news.cornell.edu/stories/2009/07/100-mpg-car-taking-shape-over-summer (visited on 11/27/2017).

[6] Erin McCarthy. *Cornell Students Seek 100-mpg Auto X Prize (and PM Sponsors Them).* Popular Mechanics. Oct. 1, 2009. URL: http://www.popularmechanics.com/cars/news/4220598 (visited on 11/27/2017).

Software

[1] William La Cava. *FEW.* Dec. 2016. DOI: 10.5281/zenodo.205105.

[2] William La Cava. *ellenGP.* Jan. 2015. DOI: 10.5281/zenodo.13927.

[3] William La Cava and Matthew Lackner. *Tuned Mass Damper Module for FAST v8.* Mar. 2015. URL: https://nwtc.nrel.gov/tmd.

Video

[1] La Cava, William. *Visualizing Genetic Programming Genomes*. 2015. URL: http://www.williamlacava.com/gp-genomes.

[2] La Cava, William. *Offshore Wind in the Caribbean*. 2013 IGERT Video and Poster Competition. May 2013. URL: https://vimeo.com/65178378.

Invited Talks

[1] William La Cava. *Multidimensional Feature Learning for Biomedical Classification*. Penn Genetics and Computational Biology Retreat, College of Physicians. 2017.

[2] William La Cava. *Symbolic Representation Learning*. EDGE 2017 Workshop. 2017.

[3] William La Cava. *Developing compact nonlinear dynamic models with biologically inspired algorithms*. Computer Science and Artificial Intelligence Laboratory, Massachusetts Institute of Technology. 2015.

[4] William La Cava. *Genetic programming with epigenetic local search*. Laboratory of Agent Modeling, University of Lisbon. 2015.

[5] William La Cava. *Intelligible system modeling with applications to wind energy (and genomics!)* Institute for Biomedical Informatics, University of Pennsylvania. 2015.

[6] William La Cava. *Gearbox Reliability Collaborative: Findings from Phase 1 and 2*. Norwegian University of Science and Technology. 2013.

Teaching Experience

2017 -	**Module Lecturer, University of Pennsylvania** Courses: Data Science for Biomedical Informatics; Special Topics in Biomedical Informatics Topics: Supervised and Unsupervised Machine Learning; Complex Systems; Evolutionary Computation
2014 - 2016	**Guest Lecturer, University of Massachusetts Amherst** Courses: System Dynamics; Control Systems Laboratory; Offshore Wind Energy Design Topics: linearization; state-space representations; system identification; parameter estimation; and wind turbine control design
2014 - 2015	**Teaching Assistant, University of Massachusetts Amherst** Control Systems Laboratory
2007	**Lab Technician, Cornell University** Designed and built robotic platforms for a graduate level artificial intelligence course

Mentoring Experience

Jun 2017 -	**Research Assistant Mentor, University of Pennsylvania** Students: Tilak Raj Singh (M.S., CIS); Rishabh Gupta (M.S., CIS); Sophia Moses (B.S.); James P. Taggart (B.S., CIS)
Jun - Aug 2015	**NSF REU Mentor, University of Massachusetts Amherst** Student: Branch Vincent (B.S.). Project: Using genetic programming to automatically develop models from observational data

Awards

2018	Best Paper Nomination, Genetic and Evolutionary Computation Conference (GECCO)
2017	Best Paper Nomination, European Conference on Genetic Programming (EuroGP)
2016	Postdoctoral Fellowship, Warren Center for Network and Data Sciences
2016	Student Travel Grant, Genetic and Evolutionary Computation Conference
2015	Student Travel Grant, ASME Dynamic Systems and Controls Conference
2015	Best Paper Nomination, Genetic and Evolutionary Computation Conference (GECCO)
2014	XSEDE Startup Allocation Award: Automatic Identification of Dynamic Models for Complex Systems (PI)
2012	NSF Fellowship, IGERT: Offshore Wind Energy Engineering, Environmental Science, and Policy
2011	First Place, Cornell 100+ MPG Team, Green Grand Prix Competition

Service

Organizer	New Standards for Benchmarking in Evolutionary Computation Research, GECCO Workshop, Berlin, Germany (2017,2018)
	Collaboration with University of Maine's Advanced Structures and Composites Center (2014)
	Gearbox Reliability Collaborative Annual Meeting, National Renewable Energy Laboratory (2011, 2012)
Committee Member	International Workshop on Benchmarking of Computational Intelligence Algorithms, ICACI (2018)
Member	Association of Computing Machinery (ACM)
	International Society for Computational Biology (ISCB)
	American Society of Mechanical Engineers (ASME)
	American Institute of Aeronautics and Astronautics (AIAA)
Referee	Renewable Energy Journal
	Wind Energy Journal
	Information Journal
	GECCO (2017)
	AIAA Wind Energy Symposium (2014)
	ASME Dynamic Systems and Controls Conference (2015)

Volunteer & Outreach Activities

2016	**Science Fair Judge, Hampshire Regional High School**
2013 - 2014	**Invited Science Teacher, Four Rivers Charter School**
	Taught two classes on wind energy to high school students
2011 - 2012	**Volunteer, Boulder Food Rescue**
	This organization has saved hundreds of thousands of pounds of left over food from grocery stores and bakeries and delivered it to homeless shelters and other community food stations.
2001 - 2005	**American Cancer Society Relay for Life**

Other Interests

Film	I write, direct, and produce short fictional films, including:
	"MADG" (2014), *Sound on Sound Film Festival* (premiere), *Florence Night Out*
	"Vacuumland Trilogy" (2008), *The Project TV Competition*
Music	VP, Fanclub Collective, a music promotion agency in Ithaca, NY (2005 - 2010)
	I have written, recorded, and produced several albums
Language	Spanish (advanced), Portuguese and Italian (beginner)
Sports	Muay Thai, rock climbing, soccer