Dr. Randal S. Olson

Contact Information

Email rso@randalolson.com

GitHub https://www.github.com/rhiever

Twitter @randal_olson

Website http://www.randalolson.com

Extended Portfolio http://www.randalolson.com/blog/

Research Specialties

Artificial Intelligence Machine learning, evolutionary computation, and neuroevolution

Data Science Large-scale data analysis, statistics, and data visualization

Biology Artificial life, neuroscience, and the evolution of intelligence

Education

Michigan State University, East Lansing, MI
Dual-major PhD in Computer Science and Ecology, Evolutionary Biology, & Behavior (2015)
Doctoral Advisor: Prof. Christoph Adami
Thesis Title: "Elucidating the evolutionary origins of collective animal behavior"

University of Central Florida, Orlando, FL
Computer Science B.S. with Honors in Major (2010)
Undergraduate Advisor: Prof. Kenneth Stanley
Honors Thesis Title: "A step toward evolving biped walking behavior through indirect encoding"

Technical Skills

Software Engineering I have been an open source software developer for over a decade and work comfortably with a broad spectrum of languages including bash, C, C++, C#, Java, Python, R, SQL, HTML, CSS, and JavaScript. I work in a variety of development environments, including XCode (Mac), emacs/vim in the terminal (Mac/Linux), Microsoft Visual Studio (Windows), and the Jupyter Notebook (web browser). I also hold workshops to teach researchers basic software skills for scientific computing, including software engineering best practices, version control, continuous integration, unit testing, and data management.

High-Performance Computing I have considerable experience with high-performance computing for artificial life, computational biology, and machine learning research at the Michigan State University and University of Pennsylvania's HPC centers, as well as cloud computing services such as Amazon EC2 and Google Cloud Computing.

Statistics My research benefits from the application of experimental design and various statistical analyses, primarily with frequentist methods for hypothesis testing, including non-parametric tests and multiple comparisons. I regularly hold workshops to teach students the basic statistical skills they require for their research.

Machine Learning I am an expert at applying and developing machine learning algorithms in both research and business settings. I primarily use scikit-learn and have developed numerous custom machine learning and data science tools in the Python scientific computing ecosystem.

Data Visualization I am an expert at analyzing and visualizing data at both the large and small scale, with tools including Python (matplotlib, Seaborn, and Bokeh), JavaScript (D3.js), Excel, Tableau, and Gephi. I created a commercial data visualization course for O'Reilly, and hold workshops to teach data visualization skills to scientists and analysts.

Professional Experience

Absci, May 2021 – present
Senior AI Scientist, AI Group

FOXO Technologies, June 2021 – present
Technical Advisor, Machine Learning & AI Applications

FOXO Technologies, Jan. 2018 – May 2021
Chief Data Scientist, Machine Learning & AI Applications

Computational Genetics Laboratory at Uni. of Pennsylvania, Aug. 2016 – Jan. 2018
Senior Data Scientist, Machine Learning & AI Research

Robins Air Force Base, June 2010 – Aug. 2011
Civilian Software Engineer, Electronic Warfare systems

United Space Alliance, Jan. 2008 – Aug. 2008
Co-op Software Engineer, Space Simulator Department

Accounting Systems Technology, Inc., Jan. 2007 – Jan. 2008
Junior Software Engineer / Technical Asst., Healthcare Billing Software

Research Experience

Postdoctoral Research Fellow, June 2015 – Aug. 2016
Computational Genetics Laboratory
University of Pennsylvania, Philadelphia, PA

Graduate Research Assistant, Aug. 2011 – May 2015
Adami Laboratory & Digital Evolution Laboratory
Michigan State University, East Lansing, MI

Undergraduate Research Assistant, May 2009 – May 2010
Evolutionary Complexity Laboratory
University of Central Florida, Orlando, FL

Teaching Experience

Michigan State University 2013 – 2014
Class co-instructor: CSE 801 Intro Computational Science for Evolutionary Biologists
Guest instructor: CSE 891 Computational Techniques for Large-Scale Data Analysis

Software Carpentry Jan. 2013 – Present
Workshop instructor: University of Chicago, University of Notre Dame, Michigan State University, US Army Corps ERDC, MIT, Stony Brook University, Plant Biology 2014 Conference, & University of Pennsylvania

BEACON Center for the Study of Evolution in Action Aug. 2012 – Jan. 2013
Workshop instructor: data management, analysis, and visualization in IPython Notebook

University of Central Florida Jan. 2009 – May 2009
Undergraduate teaching assistant: Systems Software course

Research Grant Participation

NSF BEACON "Transfer of Information Through Hierarchical Social Systems."
PI: H. Hofmann, Co-PIs: C. Adami, A. Jordan, and **R. Olson**.
Funded: 2014–2015, $109,576.

NSF BEACON "Leveraging Human Computation Markets to Evolve Complex Behaviors."
PI: J. Lehman, Co-PIs: R. Miikkulainen, C. Adami, and **R. Olson**.
Funded: 2013–2014, $33,812.

Results of my research were included as preliminary studies in the following proposals:

NSF BEACON "Evolution of cognition, communication, and social coordination – Year 2."
PI: F. Dyer, Co-PIs: F. Bartlett, P. Stone, D. Knoester, A. Hintze, R. Pennock, L. Grabowski, and C. Adami.
Funded: 2013–2014, $131,278.

Honors and Awards

Best Paper Nomination July 2017
Nominated for best paper in the GECCO 2017 Evolutionary Machine Learning track

Best Paper Award July 2016
Award for best paper in the GECCO 2016 Evolutionary Machine Learning track

Best Paper Award March 2016
Award for best paper in EvoBIO 2016

Best Paper Award March 2016
Award for best paper in EvoGAMES 2016

MSU Graduate School Dissertation Completion Fellowship Jan. 2015
$4,900 to partially cover tuition while completing PhD dissertation

BEACON Mini-sabbatical Fellowship May 2014
$1,000 to take a week-long sabbatical at the University of Texas at Austin

Fulbright Research Fellowship Finalist Mar. 2014
Recommended for 9-month research fellowship in The Netherlands

Travel Grants 2012 – 2014
$8,000+ in travel grants from NSF BEACON, the MSU CSE & EEBB programs, and others

Best Paper Award July 2013
Award for best paper in the GECCO 2013 Artificial Life track

IHPC Workshop Fellowship May 2013
Full fellowship to attend workshop on high-performance computing at University of Iowa

Honors in Major May 2010
Recognition for completing undergraduate research thesis

Department of Defense SMART Scholarship Aug. 2009 – May 2010
National scholarship: $25,000 annual stipend and full tuition costs

FAEDS Dr. Robert W. Sims Memorial Scholarship Aug. 2009 – Dec. 2009
State scholarship: $3,000 one-time award for outstanding Computer Science student

Florida Bright Futures Scholarship Aug. 2005 – May 2010
State scholarship: 75% of all tuition costs for entire undergraduate degree

Peer Reviewed Publications

J.H. Moore, **R.S. Olson**, P. Schmitt, Y. Chen, and E. Manduchi (2020). How computational experiments can improve our understanding of the genetic architecture of common human diseases. *Artificial Life* 26: pp. 23–37.

Y. Lo, S.F. Lynch, R.J. Urbanowicz, **R.S. Olson**, A.Z. Ritter, C.R. Whitehouse, M. O'Connor, S.K. Keim, M. McDonald, J.H. Moore, and K.H. Bowles (2019). Using Machine Learning on Home Health Care Assessments to Predict Fall Risk. *Studies in Health Technology and Informatics* 264: pp. 684–688.

J.H. Moore, **R.S. Olson**, Y. Chen, and M. Sipper. Automated discovery of test statistics using genetic programming. *Genetic Programming and Evolvable Machines* 20, pp. 127–137

R.J. Urbanowicz, **R.S. Olson**, P. Schmitt, M. Meeker, and J.H. Moore (2018). Benchmarking relief-based feature selection methods for bioinformatics data mining. *Journal of Biomedical Informatics* 85: pp. 168–188.

R.J. Urbanowicz, M. Meeker, W. La Cava, **R.S. Olson**, and J.H. Moore (2018). Relief-based feature selection: Introduction and review. *Journal of Biomedical Informatics* 85: pp. 189–203.

J.H. Moore, R.S. Olson, P. Schmitt, Y. Chen, and E. Manduchi (2018). How computational thought experiments can improve our understanding of the genetic architecture of common human diseases. *Proceedings of the 2018 Conference on Artificial Life*, pp. 23–30.

P. Gijsbers, J. Vanschoren, and R.S. Olson (2018). Layered TPOT: Speeding up tree-based pipeline optimization. *arXiv Preprint*.

J.H. Moore, M. Shestov, P. Schmitt, and **R.S. Olson** (2018). A heuristic method for simulating open-data of arbitrary complexity that can be used to compare and evaluate machine learning methods. *Pacific Symposium on Biocomputing 2018*, pp. 259–267.

A. Orlenko, J.H. Moore, P. Orzechowski, **R.S. Olson**, J. Cairns, P.J. Caraballo, R.M. Weinshilboum, L. Wang, and M.K. Breitenstein (2018). Considerations for automated machine learning in clinical metabolic profiling: Altered homocysteine plasma concentration associated with metformin exposure. *Pacific Symposium on Biocomputing 2018*, pp. 460–471.

R.S. Olson, W. La Cava, Z. Mustahsan, A. Varik, and J.H. Moore (2018). Data-driven Advice for Applying Machine Learning to Bioinformatics Problems. *Pacific Symposium on Biocomputing 2018*, pp. 192–203.

C. Skarke, N.F. Lahens, S.D. Rhoades, A. Campbell, K. Bittinger, A. Bailey, C. Hoffmann, **R.S. Olson**, L. Chen, G. Yang, T.S. Price, J.H. Moore, F.S. Bushman, C.S. Greene, G.R. Grant, A.M. Weljie, and G.A. FitzGerald (2017). A pilot characterization of the human chronobiome. *Scientific Reports* 7: 17141.

A. Hintze, J.A. Edlund, **R.S. Olson**, D.B. Knoester, J. Schossau, L. Albantakis, A. Tehrani-Saleh, P. Kvam, L. Sheneman, H. Goldsby, C. Bohm, and C. Adami (2017). Markov brains: A technical introduction. *arXiv Preprint*.

M. Sipper, **R.S. Olson**, and J.H. Moore (2017). Evolutionary computation: the next major transition of artificial intelligence? *BioData Mining* 10: 26.

J.H. Moore, P.C. Andrews, **R.S. Olson**, S.E. Carlson, C.R. Larock, M.J. Bulhoes, J.P. O'Connor, E.M. Greytak, and S.L. Armentrout (2017). Grid-based stochastic search for hierarchical gene-gene interactions in population-based genetic studies of common human diseases. *BioData Mining* 10: 19.

R.S. Olson, M. Sipper, W. La Cava, S. Tartarone, S. Vitale, W. Fu, P. Orzechowski, R.J. Urbanowicz, J.H. Holmes, and J.H. Moore (2017). A System for Accessible Artificial Intelligence. *Genetic Programming Theory and Practice Workshop 2017*.

R.S. Olson, W. La Cava, P. Orzechowski, R.J. Urbanowicz, and J.H. Moore (2017). PMLB: A Large Benchmark Suite for Machine Learning Evaluation and Comparison. *BioData Mining* 10: 36.

A. Sohn, **R.S. Olson**, and J.H. Moore (2017). Toward the automated analysis of complex diseases in genome-wide association studies using genetic programming. *Proceedings of the Genetic and Evolutionary Computation Conference 2017 (GECCO 2017)*, pp. 489–496.
Nominated for best paper award in the Evolutionary Machine Learning track.

R.J. Urbanowicz, **R.S. Olson**, and J.H. Moore (2016). Pareto inspired multi-objective rule fitness for noise-adaptive rule-based machine learning. *Proceedings of Parallel Problem Solving from Nature 2016*, pp. 514–524.

R.S. Olson, J.H. Moore, and C. Adami (2016). Evolution of active categorical image classification via saccadic eye movement. *Proceedings of Parallel Problem Solving from Nature 2016*, pp. 581–590.

R.S. Olson and J.H. Moore (2016). TPOT: A Tree-based Pipeline Optimization Tool for Automating Machine Learning. *Workshop on Automatic Machine Learning at ICML 2016*, pp. 66–74.

R.S. Olson and J.H. Moore (2016). Identifying and Harnessing the Building Blocks of Machine Learning Pipelines for Sensible Initialization of a Data Science Automation Tool. *Genetic Programming Theory and Practice Workshop 2016*.

R.S. Olson, N. Bartley, R.J. Urbanowicz, and J.H. Moore (2016). Evaluation of a Tree-based Pipeline Optimization Tool for Automating Data Science. *Proceedings of the Genetic and Evolutionary Computation Conference 2016 (GECCO 2016)*, pp. 485–492.
Best paper award in the Evolutionary Machine Learning track.

R.S. Olson, A. Hintze, F.C. Dyer, J.H. Moore, and C. Adami (2016). Exploring the coevolution of predator and prey morphology and behavior. *Proceedings of the 15th International Conference on the Synthesis and Simulation of Living Systems (ALIFE 2016)*, pp. 250–257. Acceptance Rate: 44%.

A. Tehrani-Saleh, **R.S. Olson**, and C. Adami (2016). Flies as Ship Captains? Digital Evolution Unravels Selective Pressures to Avoid Collision in Drosophila. *Proceedings of the 15th International Conference on the Synthesis and Simulation of Living Systems (ALIFE 2016)*, pp. 554–561. Acceptance Rate: 44%.

R.S. Olson, R.J. Urbanowicz, P.C. Andrews, N.A. Lavender, L.C. Kidd, and J.H. Moore (2016). Automating biomedical data science through tree-based pipeline optimization. *Applications of Evolutionary Computation*, pp. 123–137.
Best paper award in the EvoBio track. Oral Acceptance Rate: 50.4%.

A. Hintze, **R.S. Olson**, and J. Lehman (2016). Orthogonally Evolved AI to Improve Difficulty Adjustment in Video Games. *Applications of Evolutionary Computation*, pp. 525–540.
Best paper award in the EvoGames track. Oral Acceptance Rate: 50.4%.

R.S. Olson, D.B. Knoester, and C. Adami (2016). Evolution of swarming behavior is shaped by how predators attack. *Artificial Life* 22: 299–318.

R.S. Olson, P.B. Haley, F.C. Dyer, and C. Adami (2015). Exploring the evolution of a trade-off between vigilance and foraging in group-living organisms. *Journal of the Royal Society Open Science* 2.

R.S. Olson and Z.P. Neal (2015). Navigating the massive world of reddit: Using backbone networks to map user interests in social media. *PeerJ Computer Science* 1: e4.

A. Hintze, **R.S. Olson**, C. Adami, and R. Hertwig (2015). Risk sensitivity as an evolutionary adaptation. *Scientific Reports* 5.

P.B. Haley, **R.S. Olson**, F.C. Dyer, and C. Adami (2015). Evolving an optimal group size in groups of prey under predation. *Proceedings of the 13th European Conference on the Synthesis and Simulation of Living Systems (ECAL 2015)*, p. 620.
Oral Acceptance Rate: 66.4%.

P.B. Haley, **R.S. Olson**, F.C. Dyer, and C. Adami (2014). Exploring conditions that select for the evolution of cooperative group foraging. *Proceedings of the 14th International Conference on the Synthesis and Simulation of Living Systems (ALIFE 2014)*, pp. 310–311.
Oral Acceptance Rate: 49.8%.

R.S. Olson, A. Hintze, F.C. Dyer, D.B. Knoester, and C. Adami (2013). Predator confusion is sufficient to evolve swarming behavior. *Journal of the Royal Society Interface* 10: 20130305.

R.S. Olson, M. Mirmomeni, T. Brom, E. Bruger, A. Hintze, D.B. Knoester, and C. Adami (2013). Evolved digital ecosystems: Dynamic steady state, not optimal fixed point. *Proceedings of the 12th European Conference on Artificial Life (ECAL 2013)*, pp. 126–133.
Acceptance Rate: 48.3%.

R.S. Olson, D.B. Knoester, and C. Adami (2013). Critical interplay between density-dependent predation and the evolution of the selfish herd. *Proceedings of the 15th Annual Conference on Genetic and Evolutionary Computation (GECCO 2013)*, pp. 247–254.
Best paper award in the Artificial Life track. Acceptance Rate: 35.8%.

R.S. Olson, C. Adami, F.C. Dyer, and A. Hintze (2012). A Bottom-Up Approach to the Evolution of Swarming. *Proceedings of the 13th International Conference on the Synthesis and Simulation of Living Systems (ALIFE 2012)*, pp. 567–568.
Acceptance Rate: 50%.

R.S. Olson (2010). A step toward evolving biped walking behavior through indirect encoding. Undergraduate Honors Thesis, University of Central Florida.

Science Journalism

R.S. Olson (2015). "Rethinking the population pyramid." *Significance Magazine*.

R.S. Olson (2015). "How Machines Learn (And You Win)." *Harvard Business Review*.

R.S. Olson (2015). "How I found the optimal *Where's Waldo?* strategy." *Wired*.

R.S. Olson (2014). "A tech-focused guide to increasing your influence on Twitter." *FastCo.Labs*.

R.S. Olson (2014). "A data scientist explains what makes a viral Reddit post." *Business Insider*.

R.S. Olson (2014). "Infographics lie. Here's how to spot the B.S." *FastCo.Design*.

Selected Press Coverage

Discovery News, 2015. "How to Really Drive Across the U.S. Hitting Major Landmarks."

The Atlantic, 2014. "The Myth of Working Your Way Through College."

Huffington Post, 2014. "Google Reveals What People Really Think About Europe And Asia."

Wired Design, 2014. "Fascinating Graphs Show How Reddit Got Huge by Going Mainstream."

Fast Company Design, 2013. "This Brilliant Visualization Could Build A Better Reddit."

Science Daily, 2013. "Discovering One Reason Why Swarming Evolved Offers Tantalizing Clues On How Intelligence Developed."

Science News, 2013. "Video: When Predators Attack."

Presentations

"Evaluation of a Tree-based Pipeline Optimization Tool for Automating Data Science."
GECCO 2016, July 2016. Denver, CO. **Best paper award for this talk.**

"Exploring the coevolution of predator and prey morphology and behavior."
ALIFE 2016, July 2016. Cancun, Mexico.

"TPOT: A Tree-based Pipeline Optimization Tool for Automating Data Science."
Automated Machine Learning workshop at ICML 2016, June 2016. New York, NY.

"Automating biomedical data science through tree-based pipeline optimization."
Society of Actuaries Spring Health Meeting, June 2016. Philadelphia, PA.

"Do's and don'ts of data visualization."
Society of Actuaries Spring Health Meeting, June 2016. Philadelphia, PA.

"Identifying and Harnessing the Building Blocks of Machine Learning Pipelines for Sensible Initialization of a Data Science Automation Tool."
Genetic Programming Theory and Practice Workshop, May 2016. Ann Arbor, MI.

Invited keynote talk: "Getting to the point in data visualization."
Qlik Qonnections 2016, May 2016. Orlando, FL.

"Automating biomedical data science through tree-based pipeline optimization."
EvoBIO 2016, March 2016. Porto, Portugal. **Best paper award for this talk.**

Invited talk: "Automating data science through tree-based pipeline optimization."
DataPhilly Monthly Meeting, Feb. 2016. Philadelphia, PA.

Invited talk: "Automating biomedical data science through tree-based pipeline optimization."
EDGE Workshop, Feb. 2016. Key West, FL.

Invited talk: "The myth of working your way through college."
Michigan Interscholastic Press Association (MIPA) Annual Journalism Contest, Apr. 2014. Lansing, MI.

"Evolution of swarming is shaped by how predators attack."
MSU Graduate Academic Conference, Mar. 2014. East Lansing, MI.

"Exploring the coevolution of predator and prey behavior and morphology in a digital model."
BEACON Seminar, Dec. 2013. East Lansing, MI.

"Studying the Evolution of Swarm Behavior in Action."
Workshop on Collective Behaviours at ECAL 2013, Sept. 2013. Taormina, Italy.

"Evolve & Conquer: Teaching evolution using an interactive 3D video game."
BEACON Congress, Aug. 2013. East Lansing, MI.

"Using digital models of evolution to study how animal behavior evolves: a case study with the predator confusion effect."
Behaviour 2013, Aug. 2013. Newcastle, United Kingdom.

"Critical interplay between density-dependent predation and the evolution of the selfish herd."
GECCO 2013, July 2013. Amsterdam, The Netherlands. **Best paper award for this talk.**

"Critical interplay between density-dependent predation and the evolution of the selfish herd."
BEACON Seminar, July 2013. East Lansing, MI.

"Evolve & Conquer: Using video games to teach evolution."
BEACON Seminar, Nov. 2012. East Lansing, MI.

"Predator confusion is sufficient to evolve swarming."
BEACON Seminar, Oct. 2012. East Lansing, MI.

"Predator confusion is sufficient to evolve swarming."
SwarmFest, July 2012. Charlotte, NC.

"aBeeDa: A bottom-up approach to the evolution of swarming."
BEACON Congress, July 2012. East Lansing, MI.

Service and Outreach

Reddit Dec. 2013 – Present
Head moderator and community leader for /r/DataIsBeautiful

Referee / Reviewer Jan. 2013 – Present
Scientific Reports, AutoML workshop at ICML 2016, Journal of the Royal Society Interface, Frontiers in Robotics and AI, Ecological Modelling, GECCO 2016–2018, ALIFE/ECAL 2014–2018, ANTS 2014–2016, NSF BEACON Center, and many others

DataPhilly Data Science Meetup Group Mar. 2016 – Jan. 2018
Event co-organizer

University of Pennsylvania Jan. 2016 – Jan. 2018
Undergraduate & graduate student research mentor

Software Carpentry Jan. 2013 – May 2015
Workshop organizer & instructor

Michigan State University Jan. 2012 – May 2015
Undergraduate research mentor

University of Central Florida Burnett Honors College Oct. 2011 – May 2013
Honors undergraduate e-mail mentor

NSF BEACON Blog Aug. 2012 – May 2015
Write about evolution & outreach as a guest blogger at www.beacon-center.org

MSU Undergraduate Research and Arts Forum Apr. 4, 2014
Poster presentation judge

BEACON Congress Aug. 13, 2013
Workshop organizer: Using video games to teach evolution

Mid-SURE Symposium July 24, 2013
Poster presentation judge

BEACON Evolved Art Competition Mar. 2013 – June 2013
Challenged public to evolve art pieces on Picbreeder.org. URL: http://bit.ly/19zOrpw

Darwin Discovery Day at Michigan State University Museum Feb. 12, 2012 & 2013
BEACON representative

NSF BEACON July 27, 2012
Presenter and tour guide for international students

MSU CS&E Summer Undergraduate Research Forum July 24, 2012
Presentation moderator and judge

Capital Area Humane Society Jan. 2012 – Jan. 2013
Canine behavior trainer / behavior staff assistant