

Adel Ardalan

Curriculum Vitæ

Princeton Neuroscience Institute
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Current Positions

- 2021-Present Associate Research Scholar, Buschman Lab, Princeton Neuroscience Institute
Mentor: Tim Buschman
- Building mechanistic models of cognitive control in the brain using compositional architectures

Education

- 2018 Ph.D. in Computer Sciences, University of Wisconsin-Madison
Dissertation Title: Large-Scale Information Extraction Using Rules, Machine Learning and Human Computation
- 2008 M.Sc. in Information Technology, University of Tehran, Iran
Thesis Title: Bioinformatics Database Integration Using a Data Fusion Approach
- 2005 B.Sc. in Computer Software Engineering, University of Tehran, Iran

Research Interests and Activities

- Computational cognitive neuroscience
 - Building mechanistic models of cognitive control in the brain using compositional representations, transformations and dynamics
 - Studying the role of symmetry in brain computation and development
- Motor challenges in individuals with autism spectrum disorder (ASD)
 - Analysis of movement data for diagnosis and treatment of motor challenges in youth with ASD
 - Using pose estimation algorithms and computational pipelines to enable ecological and accessible gait assessment and monitoring, focusing on analyzing synchrony and balance in individuals with ASD

Publications

- S. Tafazoli, F. M. Bouchacourt, A. Ardalan, N. T. Markov, M. Uchimura, M. G. Mattar, N. D. Daw, T. J. Buschman. Building compositional tasks with shared neural subspaces. *Nature*, 2025.
- A. Ardalan, K. A. Pickett, A. Assadi, A. Resnick, A. Gomez, K. Bietz, S. Lutman, K. Peters, M. Walczak, J. Gutkes, A. Block, B. G. Travers. Motor rainsuit assessment during dressing (M-RAD): Towards mechanistic quantification of motor features during dressing. *SSRN 5289477*, 2025.
- C. J. MacDowell, A. Libby, C. I. Jahn, S. Tafazoli, A. Ardalan, T. J. Buschman. Multiplexed subspaces route neural activity across brain-wide networks. *Nature Communications*, 16, 3359, 2025.

- S. Tafazoli, A. Ardalan, T. J. Buschman. Cognitive neuroscience: How the brain navigates abstract task spaces. *Current Biology*, 35, 2, 1, 2025.
- Q. Wan, A. Ardalan, J. M. Fulvio, B. R. Postle. Representing context and priority in working memory. *Journal of Cognitive Neuroscience*, 2024.
- D. R. Hocking, A. Ardalan, H. Farhat, A. Andoni, R. Lenroot, S. Kachnowski. Feasibility of a Low-cost Motion Capture and Virtual Reality-based Motor Intervention for Improving Gross Motor Skills in Youth with Autism Spectrum Disorder. *J Neuroeng Rehabil*, 19(1), 2022.
- A. Ardalan, D. Paulsen, A. S. Saini, W. Cai, A. Doan. Toward Data Cleaning with a Target Accuracy: A Case Study for Value Normalization. *IEEE Intl. Conf. Big Data*, 2022 (Technical Report: arXiv:2101.05308).
- C. J. Cueva, A. Ardalan, M. Tsodyks, N. Qian. Recurrent neural network models for working memory of continuous variables: activity manifolds, connectivity patterns, and dynamic codes. *arXiv:2111.01275*, 2021.
- A. Ardalan, N. Yamane, A. K. Rao, J. Montes, S. Goldman. Analysis of Gait Synchrony and Balance in Neurodevelopmental Disorders Using Computer Vision Techniques. *Health Informatics Journal*, 27(4), 2021.
- J. M. Bain, A. Ardalan, S. Goldman. Deliberate Paradigm Shift in Research in Rare Neurodevelopmental Disorders. *Orphanet J. Rare Dis.*, 16:263, 2021.
- A. Ardalan, A. H. Assadi, O. J. Sargent, B. G. Travers. Whole-Body Movement during Videogame Play Distinguishes Youth with Autism from Youth with Typical Development. *Nature Sci. Rep.*, 9(1):20094, 2019.
- Y. Govind, P. Konda, P. Suganthan G. C., P. Martinkus, P. Nagarajan, A. Soundararajan, H. Li, S. Mudgal, J. Ballard, H. Zhang, A. Ardalan, S. Das, D. Paulsen, A. Singh Saini, E. Paulson, Y. Park, M. Carter, M. Sun, G. Fung, A. Doan. Entity Matching Meets Data Science: A Progress Report from the Magellan Project. *SIGMOD*, 2019.
- P. Suganthan G. C., A. Ardalan, A. Doan, A. Akella. Smurf: Self-Service String Matching Using Random Forests. *Intl. Conf. on Very Large Data Bases*, 2019.
- D. Mahajan, J. K. Kim, J. Sacks, A. Ardalan, A. Kumar and H. Esmaeilzadeh. In-RDBMS Hardware Acceleration of Advanced Analytics. *Intl. Conf. on Very Large Data Bases*, 2018.
- A. Doan, P. Konda, P. Suganthan G. C., A. Ardalan, J. Ballard, S. Das, Y. Govind, H. Li, P. Martinkus, S. Mudgal, E. Paulson, H. Zhang. Toward a System Building Agenda for Data Integration (and Data Science). *IEEE Data Eng. Bull.*, 41(2):37-49, 2018.
- P. Konda, S. Das, P. Suganthan G. C., P. Martinkus, A. Doan, A. Ardalan, J. Ballard, Y. Govind, H. Li, F. Panahi, H. Zhang, J. Naughton, S. Prasad, G. Krishnan, R. Deep, and V. Raghavendra. Magellan: Toward Building Entity Matching Management Systems. *SIGMOD Record*, 2018.
- A. Doan, A. Ardalan, J. Ballard, S. Das, Y. Govind, P. Konda, H. Li, S. Mudgal, E. Paulson, P. Suganthan G. C., H. Zhang. Human-in-the-Loop Challenges for Entity Matching: A Midterm Report. *Workshop on Human-in-the-loop Data Analytics*, 2017.
- P. Konda, S. Das, P. Suganthan G. C., A. Doan, A. Ardalan, J. Ballard, H. Li, F. Panahi, H. Zhang, J. Naughton, S. Prasad, G. Krishnan, R. Deep, and V. Raghavendra. Magellan: Toward Building Entity Matching Management Systems. *Intl. Conf. on Very Large Data Bases*, 2016.

- P. Konda, S. Das, P. Suganthan G. C., A. Doan, A. Ardalán, J. Ballard, H. Li, F. Panahi, H. Zhang, J. Naughton, S. Prasad, G. Krishnan, R. Deep, and V. Raghavendra. Magellan: Toward Building Entity Matching Management Systems over Data Science Stacks. *Intl. Conf. on Very Large Data Bases*, (demo), 2016.
- X. Chai, O. Deshpande, N. Garera, A. Gattani, W. Lam, D. S. Lamba, L. Liu, M. Tiwari, M. Tourn, Z. Vacheri, S. Prasad, S. Subramaniam, V. Harinarayan, A. Rajaraman, A. Ardalán, S. Das, P. Suganthan G. C., and A. Doan. Social Media Analytics: The Kosmix Story. *IEEE Data Eng. Bull.*, 36(3):4-12, 2013.
- A. Sangari, A. Ardalán, L. Lambe, H. Eghbalnia, and A. H. Assadi. Mathematical Analysis and Computational Integration of Massive Heterogeneous Data from the Human Retina. *Doctoral Conf. on Computing, Electrical and Industrial Systems*, 2012.
- A. Ardalán, E. S. Selen, H. T. Dashti, A. Talaat, and A. H. Assadi. Design and Applications of Intelligent Systems in Identifying Future Occurrence of Tuberculosis Infection in Population at Risk. *Doctoral Conf. on Computing, Electrical and Industrial Systems*, 2011.
- H. T. Dashti, A. Ardalán, A. F. Siahpirani, J. Tonejc, I. V. Uilecan, T. Simas, B. Miranda, R. A. Ribeiro, L. Wang, and A. H. Assadi. Pattern Recognition in Collective Cognitive Systems: Hybrid Human-Machine Learning (HHML) by Heterogeneous Ensembles. *Intl. Conf. on Artificial Intelligence*, 2010.
- H. T. Dashti, J. Tonejc, A. Ardalán, A. F. Siahpirani, S. Guettes, Z. Sharif, L. Wang, and A. H. Assadi. Applications of Machine Learning Methods to Quantifying Phenotypic Traits That Distinguish the Wild Type from the Mutant Arabidopsis Thaliana Seedlings During Root Gravitropism. *Intl. Conf. on Bioinformatics & Computational Biology*, 2010.
- A. Sabouri, A. Ardalán, and R. Shahidi-Nejad. Prediction of Protein Secondary Structure Based on NMR Chemical Shift Data using Support Vector Machines. *Intl. Conf. on Computer Modeling and Simulation*, 2010.
- M. Emadi, M. Rahgozar, A. Ardalán, A. Kazerani, and M. M. Arian. A Comparative Study of DTD-Independent XML Data Storage Approaches. In *Intl. CSI Computer Conf.*, 2006.
- M. Emadi, M. Rahgozar, A. Ardalán, A. Kazerani, and M. Ariyan. Storage Approaches for DTD-Independent XML Data. *Iranian Conf. on Electrical Engineering*, 2006.
- M. Emadi, M. Rahgozar, A. Ardalán, A. Kazerani, and M. M. Ariyan. Approaches and Schemes for Storing DTD-Independent XML Data in Relational Databases. *Trans. on Engineering, Computing and Technology*, 2006.

Work Experience

- 2018-2021 Postdoctoral Research Scientist, Qian Lab, Zuckerman Institute, Columbia University
Mentor: Ning Qian
 - Analyzing recurrent units' activities and connectivities in recurrent networks of firing rate units, to explain the mechanics of the retrospective Bayesian decoding framework for visual perception and working memory
- 2017 Lecturer, Department of Computer Sciences, University of Wisconsin-Madison
Database Management Systems: Design and Implementation (CS 564)

- 2012-2018 Research Assistant, Department of Computer Sciences, University of Wisconsin-Madison
Supervisor: AnHai Doan
 - Large-scale human-in-the-loop information extraction and integration
 - Attribute value extraction from product titles in e-commerce catalogs
 - Event extraction in the Twittersphere from legacy tweet stores
- 2011 Research Assistant, Department of Mathematics, University of Wisconsin-Madison
Supervisor: Amir H. Assadi
 - Systems biology of Mycobacterium Tuberculosis for preventive and personalized medicine
- 2011 Research Assistant, Department of Computer Sciences, University of Wisconsin-Madison
Supervisor: Christopher Ré
 - Machine reading project, slot filling task, feature extraction using logistic regression
- 2014 Summer Intern, @WalmartLabs, Mountain View, CA
 - Attribute value extraction from product titles in e-commerce catalogs, in collaboration with Product Classification and Segmentation (PCS) team
- 2018 Teaching Assistant, Department of Computer Sciences, University of Wisconsin-Madison
Database Management Systems: Design and Implementation (CS 564)
- 2012 Teaching Assistant, Department of Computer Sciences, University of Wisconsin-Madison
Introduction to Programming (CS 302)
- 2011-2012 Teaching Assistant, Department of Mathematics, University of Wisconsin-Madison
Calculus I and II (Math 221 and Math 222)
- 2019 Volunteer Computer Programming Facilitator, Girls Who Code, Zuckerman Institute, Columbia University
 - Working with students from Harlem high-schools on learning computer programming basics

———— Honors and Awards

- 2025 Trainee Professional Development Award, Society for Neuroscience
- 2025 Princeton AI Lab Seed Grant, for the Project “Generalization and Compositionality in Natural and Artificial Minds Through the Lens of Symmetry”
- 2019 ACM Research Highlight Award, for the Article “Magellan: Toward Building Entity Matching Management Systems”
- 2018 SIGMOD Research Highlight Award, for the Article “Magellan: Toward Building Entity Matching Management Systems”
- 2004 Award for academic excellence, ranked in top 3 student GPAs, class of 2000, Electrical and Computer Engineering Department, University of Tehran, Iran
- 2003 Award for academic excellence, ranked in top 3 student GPAs, class of 2000, Electrical and Computer Engineering Department, University of Tehran, Iran
- 2000 Ranked 67 out of approximately 140,000 students taking the Iranian university entrance exam (zone #2)

———— Professional Services

- 2024 Reviewer, COSYNE
- 2022 Reviewer, Cell Reports and PLoS Computational Biology
- 2021 Reviewer, Nature Scientific Reports and Autism Research

- 2017 External Reviewer, ACM SIGMOD 2018
2016 External Reviewer, VLDB 2016
2013, 2015 External Reviewer, The Journal of Supercomputing, Springer
2013 External Reviewer, Data Engineering Bulletin Special Issue on Social Media and Data Analysis, IEEE Computer Society

Technical Skills

- Programming languages and modeling tools: Python, Java, C++, Cython, HTML, JavaScript, SQL, Matlab, Git
- Data science tools: Pandas, TensorFlow, Pytorch, Scikit-learn, Jupyter, Matplotlib
- Distributed processing frameworks: Hadoop, Amazon Web Services, Google Cloud Platform, Condor
- Web development frameworks: Django Framework, Play Framework, D3.js
- Database management systems: PostgreSQL, MySQL, Oracle, Microsoft SQL Server
- Operating systems: Linux, Windows, Mac OS

Personal Activities and Hobbies

- Music and Dance ○ Iranian traditional music – play Daf (Persian frame drum), Tambur (ancient middle-eastern lute), and perform in various venues and concerts
○ Argentine tango
- Reading ○ Philosophy, sociology and semiotics (esp. works of R. Barthes)
○ Literature, particularly Farsi poetry
- Workout ○ Running (NYC marathon (2023), Madison marathon (2016) and several half-marathons)
○ Triathlon (Maine 70.3, Atlantic City 70.3, Door County 70.3, and several olympic and sprint distance races)

Languages

English, Farsi, Kurdish

References

Available upon request