Tyler M. Tomita

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Research Interests

artificial intelligence and machine learning, cognitively- and neurally-inspired deep learning, representation learning, transfer learning, continual learning, multi-task learning, decision trees, ensemble learning, biomedical data science, psychological and neural data science, human memory and learning

Education

2011–2018 Johns Hopkins University, Baltimore, MD
Ph.D. in Biomedical Engineering
Thesis Title: Generalized Linear Splitting Rules in Decision Tree Ensembles
Advisor: Joshua T. Vogelstein

2005–2010 University of California, Davis
B.S. in Biomedical Engineering and Biological Systems Engineering, *cum laude*

Research Experience

2018–present **Department of Psychological and Brain Sciences, Johns Hopkins University**
Postdoctoral Research Associate
Research Advisor: Christopher J. Honey

- Developed a cognitively-inspired representation learning algorithm to improve continual learning in machines.
- Developed a novel similarity and metric learning method, motivated by problems in psychology and cognitive neuroscience.
- Collected, cleaned, and analyzed complex data sets derived from human psychology experiments.
- Communicated research to diverse audiences.
- Mentored junior researchers.
- Generated research funds via grant proposals.
- Organized meetings for planning an artificial intelligence institute at Johns Hopkins.

2011–2018 **Department of Biomedical Engineering, Johns Hopkins University**
Doctoral Research
Research Advisor: Joshua T. Vogelstein

- Developed a novel machine learning algorithm called Sparse Projection Oblique Randomer Forest (SPORF) for general-purpose classification.
- Investigated the statistical and computational properties of ensemble machine learning algorithms.
- Applied machine learning methods to identify key cancer biomarkers in data obtained from biomedical science collaborators.
- Published results in machine learning and data science venues.
- Co-wrote and documented open-source software packages.

Teaching Experience

2021–2022 **Department of Psychological and Brain Sciences, Johns Hopkins University**

Guest Lecturer for "AS.200.329 Real-World Human Data: Analysis & Visualization"

- Taught key concepts in data science.
- Facilitated class discussions pertaining to real-world data science.
- Wrote and led a markdown-based tutorial on quality assessment and analysis of large data sets.

2013–2014 **Department of Biomedical Engineering, Johns Hopkins University**

Teaching Assistant for "EN.580.321 Statistical Mechanics and Thermodynamics"

- Led discussion sections for reviewing and reinforcing concepts presented in lecture and reading materials.
- Held weekly office hours for meeting with students.
- Graded weekly assignments and exams.

Manuscript Preprints

[1] Vogelstein, J., Dey, J., Helm, H., Levine, W., Mehta, R, **Tomita, T.M.**, Xu, H. Geisa, A., van de Ven, G., Chang, E., Gao, C., Yang, W., Tower, B., Larson, J., White, C.M., and Priebe, C.E. (2022). Representation Ensembling for Synergistic Lifelong Learning with Quasilinear Complexity. Submitted. http://tyler-tomita.github.io/files/llf.pdf

[2] Perry, R., Li, A., Huynh, C., **Tomita, T.M.**, Mehta, R., Arroyo, J., Patsolic, J., Falk, B. and Vogelstein, J.T., 2022. Manifold Oblique Random Forests: Towards Closing the Gap on Convolutional Deep Networks. arXiv. URL: https://arxiv.org/pdf/1909.11799.pdf

[3] **Tomita, T.M.**, Barense, M.D., Honey, C.J. (2021). The Similarity Structure of Real-World Memories. bioRxiv. URL: https://www.biorxiv.org/content/10.1101/2021.01.28.428278v1

[4] **Tomita, T.M.**, Vogelstein, J.T. (2020). Robust Similarity and Distance Learning via Decision Forests. arXiv. URL: https://arxiv.org/abs/2007.13843

Peer-Reviewed Publications

[1] **Tomita, T.M.** (2022). Contextual Representation Ensembling. Conference on Cognitive Computational Neuroscience 2022. https://2022.ccneuro.org/proceedings/0000134.pdf

[2] Dima, D.C., **Tomita, T.M.**, Honey, C.J., Isik, L. (2022). Social-affective features drive human representations of observed actions. Elife, 11, e75027.

[3] Dima, D.C., **Tomita, T.M.**, Honey, C.J., Isik, L. (2020). The representational space of action perception. Journal of Vision, 20(11), 1161-1161.

[4] **Tomita, T.M.**, Browne, J., Shen C., Pasolic, J.L., Yim, J., Priebe, C.E., Burns, R., Maggioni, M., Vogelstein, J.T. Sparse Projection Oblique Randomer Forests. The Journal of Machine Learning Research, 21(104):1−39.

[5] Browne, J., Mhembere, D., **Tomita, T.M.**, Burns, R., Vogelstein, J.T. Forest Packing: Fast, Parallel Decision Forests. Proceedings of the 2019 SIAM International Conference on Data Mining, 46-54. URL: https://epubs.siam.org/doi/pdf/10.1137/1.9781611975673.6

[6] **Tomita, T.M.**, Maggioni, M., Vogelstein, J.T. (2017). ROFLMAO: Robust Oblique Forests with Linear Matrix Operations. Proceedings of the 2017 SIAM International Conference on Data Mining, 498-506. URL: https://epubs.siam.org/doi/pdf/10.1137/1.9781611974973.56

[7] Wang, Q., Zhang, M., **Tomita, T.**, Vogelstein, J.T., Zhou, S., Papadopoulos, N., Kinzler, K.W., Vogelstein, B. (2017) Selected Reaction Monitoring Approach for Validating Peptide Biomarkers. Proceedings of the National Academy of Sciences , 114(51), 13519-13524.

[8] Masica, D.L., Dal Molin, M., Wolfgang, C.L., **Tomita, T.**, Ostovaneh, M.R., Blackford, A., Moran, R.A., Law, J.K., Barkley, T., Goggins, M. Irene Canto, M. (2016). A novel approach for selecting combination clinical markers of pathology applied to a large retrospective cohort of surgically resected pancreatic cysts. Journal of the American Medical Informatics Association, 24(1), 145-152.

[9] Springer, S., Wang, Y., Dal Molin, M., Masica, D.L., Jiao, Y., Kinde, I., Blackford, A., Raman, S.P., Wolfgang, C.L., **Tomita, T.**, Niknafs, N. (2015). A combination of molecular markers and clinical features improve the classification of pancreatic cysts. Gastroenterology, 149(6), 1501-1510.

[10] Sumida, G.M., **Tomita, T.M.**, Shih, W., Yamada, S. (2011). Myosin II activity dependent and independent vinculin recruitment to the sites of E-cadherin-mediated cell-cell adhesion. BMC cell biology, 12(1), 48.

Contributed Presentations

Tomita, T.M, Barense, M.D., Honey, C.J. (2019, May). Similarity Structure of Real-World Episodic Memories. 2019 Contextual and Episodic Memory Symposium, Philadelphia, PA, USA.

Tomita, T.M., Maggioni, M., Vogelstein, J.T. (2017, April). ROFLMAO: Robust Oblique Forests with Linear Matrix Operations. 2017 SIAM Interational Conference on Data Mining, Houston, TX, USA.

Posters

Tomita, T.M (2022, August). Contextual Representation Ensembling. Conference on Cognitive Computational Neuroscience 2022, San Francisco, CA, USA.

Tomita, T.M, Barense, M.D., Honey, C.J. (2019, March). Similarity Structure of Real-World Episodic Memories. 29th Annual Rotman Research Institute Conference, Toronto, Ontario, CA.

Tomita, T.M., Maggioni, M., Vogelstein, J.T. (2017, April). ROFLMAO: Robust Oblique Forests with Linear Matrix Operations. 2017 SIAM Interational Conference on Data Mining, Houston, TX, USA.

Honors and Awards

2009 Tau Beta Pi Engineering Honor Society inductee

2008 Robert Roy Owen Scholarship recipient

Peer Reviewer

- IEEE Transactions on Pattern Analysis and Machine Intelligence
- Memory

Skills

Programming Languages:	Python, R, MATLAB, C++, JavaScript, HTML, CSS, Linux, git, LaTeX
ML Frameworks:	Pytorch, Tensorflow, scikit-learn
Conceptual/Theoretical:	Deep learning, Representation Learning, Continual Learning, Transfer Learning, Similarity Learning, Ranking, Statistical Theory, Statistical Inference, Nonparametric Statistics
Software:	MS Office, Adobe Illustrator, Amazon Mechanical Turk, Prolific
Experimental Psychology:	Autobiographical Memory, Category Learning, Multi-task Learning, Task Switching, Transfer