

# Tyler M. Tomita

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## Professional Interests

artificial intelligence and machine learning, data science, computer vision, cognitively- and neurally-inspired deep learning, representation learning, knowledge representation, transfer learning, continual learning, multi-task learning, decision trees, ensemble learning, human memory and learning

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## 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*

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## 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 continual machine learning algorithm for visual classification.
  - 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.

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## 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.

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## 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>

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## 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.

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## Contributed Presentations

**Tomita, T.M.**, Barensse, 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 International Conference on Data Mining, Houston, TX, USA.

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## Posters

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

**Tomita, T.M.**, Barensse, 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 International Conference on Data Mining, Houston, TX, USA.

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## Honors and Awards

2009 Tau Beta Pi Engineering Honor Society inductee

2008 Robert Roy Owen Scholarship recipient

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## Peer Reviewer

- IEEE Transactions on Pattern Analysis and Machine Intelligence
- Memory

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## 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

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