

# SANA TONEKABONI

Postdoctoral Fellow, Broad Institute of MIT and Harvard

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## EDUCATION

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| Doctorate of Philosophy in Computer Science<br>University of Toronto - Advisor: Dr. Anna Goldenberg | 2023 |
| Master of Science in Computer Science<br>University of Toronto - Advisor: Dr. Michael Brudno        | 2019 |
| Bachelor of Electrical Engineering with honors<br>University of Toronto (Minor in Bioengineering)   | 2017 |

## RESEARCH INTERESTS

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Machine learning, Computational medicine, Time-series modelling and analysis, Self-supervised representation learning, Multimodal learning, Bayesian modelling, Uncertainty, Explainability in AI, Signal processing

## HONORS AND AWARDS

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| Rising Star in Computational and Data Sciences   | April 2023         |
| Apple's scholars in AI/ML Fellowship   | September 2021     |
| Canada Doctoral Graduate Scholarships<br>Natural Sciences and Engineering Research Council of Canada (NSERC) | May 2021           |
| Health System Impact Fellowship, Canadian Institute of Health Research (CIHR)                                | September 2019     |
| Queen Elizabeth II graduate scholarships in science and technology   | September 2019     |
| General Motors women in electrical and mechanical engineering award  | July 2015 and 2016 |
| NSERC undergraduate student research award (USRA)  | May 2015 and 2016  |

## WORK EXPERIENCE

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| <b>Postdoctoral Fellow</b><br>Broad institute of MIT and Harvard  | 2024 - present          |
| <b>Research Intern - Apple</b><br>Apple health research team  | Summer 2022             |
| <b>Research Intern - Google</b><br>Google research cloud AI team  | Summer 2021             |
| <b>Applied Research Scientist Intern - Element AI</b><br>Uncertainty-aware classification models                          | Fall 2018 - Summer 2019 |
| <b>Undergraduate Research Assistant - University of Toronto</b><br>Wireless communication lab - Advisor: Dr. Elvino Sousa | Summer 2016             |
| Intelligent sensory microsystem lab - Advisor: Dr. Roman Genov  | Summer 2015             |

## TEACHING EXPERIENCE

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| <b>Lecturer (Basic principles of machine learning in biomedical research-LMP1210)</b><br>University of Toronto [webpage]              | Spring 2024        |
| <b>Lecturer (Full-day practical session on machine learning for time series in health)</b><br>AI4Health Summer School (Paris, France) | July 2023          |
| <b>Teaching Assistant - Tutorial (Statistical methods for machine learning)</b><br>University of Toronto                              | Spring 2022        |
| <b>Teaching Assistant - Tutorial/Grading (Algorithms - Machine learning)</b><br>University of Toronto                                 | Fall 2019 - 2020   |
| <b>Teaching Assistant - Tutorial/Course development (Computing for medicine)</b><br>University of Toronto                             | Fall - Spring 2020 |

## PUBLICATIONS

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- [J3] **S. Tonekaboni**, S. L. Friedman, X., Zhang, M. Maddah, C. Uhler, (2024), *A Multimodal Representation Learning Framework to Learn a Unified Representation of Patients' Health with Dissentangled Modality-specific and Shared Information* . In submission to Nature Methods.
- [C10] C. Wang, S. Gupta, X. Zhang, **S. Tonekaboni**, S. Jegelka, T. Jaakkola, C. Uhler, *An Information Criterion for Controlled Disentanglement of Multimodal Data*, Under review for ICLR2025.
- [C9] S. Nagaraj, W. Gerych, **S. Tonekaboni**, A. Goldenberg, B. Ustun, T. Hartvigsen, *Learning under Temporal Label Noise*, Under review for ICLR2025.
- [J2] A. Nazaret\*, **S. Tonekaboni\***, G. Darnell, S. Ren, G. Sapiro, A. Miller (2023), *Modeling Personalized Heart Rate Response to Exercise and Environmental Factors with Wearables Data*. npj Digital Medicine. 6, 207
- [C8] J. Yu, T. Behrouzi, K. Garg, A. Goldenberg, **S. Tonekaboni** (2023). *Dynamic Interpretable Change Point Detection for Physiological Data Analysis*. In Machine Learning for Health (ML4H). (pp. 636-649). PMLR.
- [C7] **S. Tonekaboni**, C.L Li, S. Arik, A. Goldenberg, T. Pfister. (2022). *Decoupling Local and Global Representations of Time Series*. In conference on Artificial Intelligence and Statistics (AISTAS 2022).
- [C6] **S. Tonekaboni**, G. Morgenshtern, A. Assadi, A. Pokhrel, X. Huang, A. Jayarajan, R. Greer, G. Pekhimenko, M. McCradden, F. Chevalier, M. Mazwi, A. Goldenberg. (2022). *How to validate Machine Learning Models Prior to Deployment: Silent trial protocol for evaluation of real-time models at the ICU*. In Conference on Health, Inference, and learning (CHIL 2022).
- [C5] A. Weatherhead, R. Greer, M. Moga, M. Mazwi, D. Eytan, A. Goldenberg, **S. Tonekaboni**. (2022). *Learning Unsupervised Representations for ICU Timeseries*. In Conference on Health, Inference, and learning (CHIL 2022).
- [C4] **S. Tonekaboni**, D. Eytan, A. Goldenberg (2021). *Unsupervised Representation Learning for Time Series with Temporal Neighborhood Coding*. International Conference on Learning Representations (ICLR 2021).
- [C3] **S. Tonekaboni**, S. Joshi, K. Campbell, D. Duvenaud, A. Goldenberg (2020). *What went wrong and when? Instance-wise feature importance for time-series black-box models*. Advances in Neural Information Processing Systems, 33. presented at the Conference on Neural Information Processing Systems (NeurIPS 2020).
- [C2] **S. Tonekaboni**, S. Joshi, M.D. McCradden, A. Goldenberg (2019). *What Clinicians Want: Contextualizing Explainable Machine Learning for Clinical End Use*. vol. 106 of *Proceedings of Machine Learning Research* (PMLR). pp. 359-380.  
presented at the Conference on Machine Learning for Healthcare (MLHC 2019).
- [C1] **S. Tonekaboni**, M. Mazwi, P. Laussen, D. Eytan, R. Greer, S. Goodfellow, M. Brudno, A. Goldenberg. (2018). *Prediction of Cardiac Arrest from Physiological Signals in the Pediatric ICU*. vol. 85 of *Proceedings of*

*Machine Learning Research* (PMLR). pp. 534-550.

presented at the Conference on Machine Learning for Healthcare (MLHC 2018).

[J1] H. Kassiri, **S. Tonekaboni**, N. Soltani, M. Tariqus Salam, J. Perez Velazquez, R. Genov. (2016). *Closed-Loop Neurostimulators: A Survey and A Seizure Predicting Design Example for Intractable Epilepsy Treatment*. IEEE Transactions on Biomedical Circuits and Systems

Peer Reviewed workshops/short papers:

C. Wang, S. Gupta, X. Zhang, S. Tonekaboni, S. Jegelka, T. Jaakkola, C. Uhler (2024), *An Information Criterion for Controlled Disentanglement of Multimodal Data*, Workshop on Unifying Representations in Neural Models NeurIPS 2024 . (Hounorable mention)

S. Nagaraj, W. Gerych, S. Tonekaboni, A. Goldenberg, B. Ustun, T. Hartvigsen (2024), *Time Series under Temporal Label Noise*, Workshop on Time Series in the Age of Large Models at NeurIPS 2024. (Spotlight)

G. Morgenshtern, A. Verma, S. Tonekaboni, R. Greer, J. Bernard, M. Mazwi, A. Goldenberg, and F. Chevalier (2023), *RiskFix: Supporting Expert Validation of Predictive Timeseries Models in High-Intensity Settings*, at EuroViz 2023

A. Nazaret, S. Tonekaboni, G. Darnell, S. Ren, G. Sapiro, A. Miller (2022), *Modeling Heart Rate Response to Exercise with Wearables Data*, In Learning from Time series in Health Workshop at NeurIPS 2022.

B. Naida, A. Weatherhead, S. Tonekaboni, A. Goldenberg (2022), *Continual Learning on Auxiliary tasks via Replayed Experiences: CLARE*, In Learning from Time series in Health Workshop at NeurIPS 2022.

S. Tonekaboni, S. Joshi, A. Goldenberg (2019), *Individualized Feature Importance for Time Series Risk Prediction Models*, In Machine Learning for Health Workshop at NeurIPS 2019.

M. McCradden, S. Tonekaboni, S. Joshi, A. Goldenberg (2019), *Five Pillars of Explainable Clinical Machine Learning*, In Frontier of AI-Assisted Care (FAC) Scientific Symposium.

## RESEARCH FUNDING

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**Enhancing Clinical Trust in AI: A Comprehensive Framework for Uncertainty Quantification and Communication**

Agency: ARPA-H - Role: Key personnel - Amount: 5.1M (USD)      *Under review; submitted November 2024*

**Utilizing high resolution physiological data and artificial intelligence to develop a pediatric cardiac arrest prediction tool for integration into bedside clinical practice**

Agency: CIHR/NSERC - Role: Contributor - Amount: 950k (CAD)      2019

## INVITED TALKS

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**Invited speaker - AI for Science Summit** (Cambridge, UK)      *November 2024*

Title: Decoupled Multimodal Representation Learning for clinical data

**Guest lecturer - University of Toronto**      *October 2023*

Course: Topics in Machine Learning for Healthcare, Department of computer science

Title: Learning Representations for Time Series in Healthcare

**Guest lecturer - University of Toronto**      *April 2022*

Course: Intelligent medicine and machine learning, Dalla Lana school of public health

Title: Deployment of Machine Learning tools in clinical practice

**Invited speaker - Toronto Deep Learning Series** (Toronto, Canada)      *October 2018*

Title: Prediction of cardiac arrest from physiological signals

**Invited speaker - Toronto Rehabilitation Institute research round** (Toronto, Canada)      *November 2018*

Title: Prediction models for longitudinal data

**Invited lecturer - Vector Institute, endless summer school** (Toronto, Canada)

*November 2018*

Title: Time-series analysis and prediction

## **ACADEMIC SERVICE**

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Organizing committee:

- Machine Learning for Healthcare symposium 2024
- Human-Centric Representation Learning - AAAI 2024
- Learning from time series in health - ICLR 2024
- Learning from time series in health - NeurIPS 2023 (Founding co-chair)

Scholarship selection committee at the Vector institute, Canada

*March 2024*

Program committee (Reviewer): NeurIPS (top reviewer recognition), ICLR, AISTATS, CHIL, MLHC, TMLR.

Program committee (Area chair): CHIL conference, ML4H symposium

Poster session chair for Pan-Canadian SOCMLx conference

*November 2019*

## **STUDENT SUPERVISION AND MENTORING**

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### **Student supervision during Postdoc at the Broad institute of MIT and Harvard**

Yoanna Turura, Hector Salma - Undergraduate students

Quixuan Jin, Chenyu Wang, Yuxin Xiao - PhD students

### **Student supervision during PhD at the University of Toronto**

Addison Weatherhead - Undergraduate student

Kopal Garg, Jenny Yu, Tina Behrouzi - Master students

Xi Huang, Aslesha Pokhrel - Undergraduate student

### **Mentor at HER code camp**

A computer science camp for senior high school students from underrepresented groups