Harish Haresamudram

hharesamudram3@gatech.edu | harkash.github.io | Harish Haresamudram

Research Summary

I work extensively with data collected from movement sensors (e.g., accelerometers and gyroscopes), which are onboard commodity wearables like smartphones and smartwatches. My research has two broad objectives: first, to develop systems and methods that can elevate every day wearable devices (e.g., smartwatches) to be capable of performing complex tasks such as behavior modeling and longitudinal health monitoring; and second, to empower users to interact directly with their own sensor data, leading to enhanced interpretability and insights about well-being. To this end, I develop novel self-supervised, multi-modal, and foundational models of sensor data, to address key challenges such as noisy labels and data, as well as scarcity of annotations.

Education

Georgia Institute of Technology *Atlanta, USA*

PhD in Electrical and Computer Engineering *Aug 2019 - Current*

- **Advisors:** Prof. Thomas Plötz and Prof. Irfan Essa
- **PhD Dissertation:** *Learning Representations for Sensor Based Human Activity Recognition for Challenging Application Scenarios*

Georgia Institute of Technology *Atlanta, USA*

MS in Electrical and Computer Engineering *Aug 2017 - May 2019*

- **Advisors:** Prof. Thomas Plötz and Prof. David Anderson
- **MS Thesis:** *The Role of Representations in Human Activity Recognition*

PES Institute of Technology *Bangalore, India*

BEng in Electrical and Electronics Engineering *Sep 2011 - May 2015*

Publications

Journal Articles

[Sensors] Towards Learning Discrete Representations via Self-Supervision for Wearables-Based Human Activity Recognition
Harish Haresamudram, Irfan Essa, Thomas Plötz
Sensors 24.4 (2024) p. 1238. Multidisciplinary Digital Publishing Institute, 2024

[TIST] Cross-domain har: Few shot transfer learning for human activity recognition
Megha Thukral, **Harish Haresamudram**, Thomas Ploetz
ACM Transactions on Intelligent Systems and Technology (2023). ACM New York, NY, 2023

[IMWUT] Assessing the state of self-supervised human activity recognition using wearables
Harish Haresamudram, Irfan Essa, Thomas Plötz
Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies 6.3 (2022) pp. 1–47. ACM New York, NY, USA, 2022

[IMWUT] Contrastive predictive coding for human activity recognition
Harish Haresamudram, Irfan Essa, Thomas Plötz
Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies 5.2 (2021) pp. 1–26. ACM New York, NY, USA, 2021

[IMWUT] IMUTube: Automatic extraction of virtual on-body accelerometry from video for human activity recognition
Hyeokhyen Kwon, Catherine Tong, **Harish Haresamudram**, Yan Gao, Gregory D Abowd, Nicholas D Lane, Thomas Ploetz
Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies 4.3 (2020) pp. 1–29. ACM New York, NY, USA, 2020

Conference Proceedings

[ABC] A Washing Machine is All You Need? On the Feasibility of Machine Data for Self-Supervised Human Activity Recognition
Harish Haresamudram, Irfan Essa, Thomas Plötz

2024 International Conference on Activity and Behavior Computing (ABC), 2024

[ISWC] How Much Unlabeled Data is Really Needed for Effective Self-Supervised Human Activity Recognition?
Sourish Gunesh Dhekane, **Harish Haresamudram**, Megha Thukral, Thomas Plötz
Proceedings of the 2023 ACM International Symposium on Wearable Computers, 2023, Cancun, Quintana Roo, Mexico

[PerCom] Investigating enhancements to contrastive predictive coding for human activity recognition
Harish Haresamudram, Irfan Essa, Thomas Plötz
2023 IEEE International Conference on Pervasive Computing and Communications (PerCom), 2023

[ISWC] Clustering of Human Activities from Wearables by Adopting Nearest Neighbors
Abrar Ahmed, **Harish Haresamudram**, Thomas Ploetz
Proceedings of the 2022 ACM International Symposium on Wearable Computers, 2022

[ISWC] A personalized approach for developing a snacking detection system using earbuds in a semi-naturalistic setting
Mehrab Bin Morshed, **Harish Haresamudram**, Dheeraj Bandaru, Gregory D Abowd, Thomas Plötz
Proceedings of the 2022 ACM International Symposium on Wearable Computers, 2022

[ISWC] On the role of features in human activity recognition
Harish Haresamudram, David V Anderson, Thomas Plötz
Proceedings of the 23rd International Symposium on Wearable Computers, 2019

[ICASSP] Factor analysis methods for joint speaker verification and spoof detection
BK Dhanush, S Suparna, R Aarthy, C Likhita, D Shashank, **H Harish**, Sriram Ganapathy
2017 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2017

[InterSpeech] IITG-Indigo system for NIST 2016 SRE challenge
Nagendra Kumar, Rohan Kumar Das, Sarfaraz Jelil, BK Dhanush, **H Kashyap**, K Sri Rama Murty, Sriram Ganapathy, Rohit Sinha, SR Mahadeva Prasanna
Proceedings of the Annual Conference of the International Speech Communication Association, INTERSPEECH, 2017

Preprints

[ArXiv] Limitations in Employing Natural Language Supervision for Sensor-Based Human Activity Recognition–And Ways to Overcome Them
Harish Haresamudram, Apoorva Beedu, Mashfiqui Rabbi, Sankalita Saha, Irfan Essa, Thomas Ploetz
arXiv preprint arXiv:2408.12023 (2024). 2024

[ArXiv] Large Language Models Memorize Sensor Datasets! Implications on Human Activity Recognition Research
Harish Haresamudram, Hrudhai Rajasekhar, Nikhil Murlidhar Shanbhogue, Thomas Ploetz
arXiv preprint arXiv:2406.05900 (2024). 2024

[ArXiv] Past, Present, and Future of Sensor-based Human Activity Recognition using Wearables: A Surveying Tutorial on a Still Challenging Task
Harish Haresamudram, Chi Ian Tang, Sungho Suh, Paul Lukowicz, Thomas Ploetz
arXiv preprint arXiv:2411.14452 (2024). 2024

[ArXiv] Layout Agnostic Human Activity Recognition in Smart Homes through Textual Descriptions Of Sensor Triggers (TDOST)
Megha Thukral, Sourish Gunesh Dhekane, Shruthi K Hiremath, **Harish Haresamudram**, Thomas Ploetz
arXiv preprint arXiv:2405.12368 (2024). 2024

Patents

Method and system for automatic extraction of virtual on-body inertial measurement units
Hyeokhyen Kwon, Gregory D Abowd, **Harish Haresamudram**, Thomas Ploetz, Eu Gen Catherine Tong, Yan Gao, Nicholas Lane
US Patent App. 17/464,488, 2022

Tutorials, Workshops, and Magazines

[Ubicomp] Solving the Sensor-Based Activity Recognition Problem (SOAR): Self-Supervised, Multi-Modal Recognition of Activities from Wearable Sensors
Harish Haresamudram, Chi Ian Tang, Sungho Suh, Paul Lukowicz, Thomas Plötz
Companion of the 2024 on ACM International Joint Conference on Pervasive and Ubiquitous Computing, 2024, Melbourne VIC, Australia

[ACII] Investigating self-supervised learning for predicting stress and stressors from passive sensing

Harish Haresamudram, Jina Suh, Javier Hernandez, Jenna Butler, Ahad Chaudhry, Longqi Yang, Koustuv Saha, Mary Czerwinski
2023 11th International Conference on Affective Computing and Intelligent Interaction Workshops and Demos (ACIIW), 2023

[Ubicomp] Solving the Sensor-based Activity Recognition Problem (SOAR): Self-supervised, Multi-modal Recognition of Activities from Wearable Sensors
Harish Haresamudram, Chi Ian Tang, Sungho Suh, Paul Lukowicz, Thomas Ploetz
Adjunct Proceedings of the 2023 ACM International Joint Conference on Pervasive and Ubiquitous Computing & the 2023 ACM International Symposium on Wearable Computing, 2023

[GetMobile] Can You See It? Good, So We Can Sense It!
Hyeokhyen Kwon, Catherine Tong, **Harish Haresamudram**, Yan Gao, Gregory D. Abowd, Nicholas D. Lane, Thomas Ploetz
GetMobile: Mobile Comp. and Comm. 25.2 (Sept. 2021) pp. 38–42. Association for Computing Machinery, 2021

[DL-HAR] Personalization Models for Human Activity Recognition with Distribution Matching-Based Metrics
Huy Thong Nguyen, Hyeokhyen Kwon, **Harish Haresamudram**, Andrew F Peterson, Thomas Plötz
Deep Learning for Human Activity Recognition: Second International Workshop, DL-HAR 2020, Held in Conjunction with IJCAI-PRICAI 2020, Kyoto, Japan, January 8, 2021, Proceedings 2, 2021

Work Experience

Georgia Institute of Technology
Atlanta, USA

Graduate Research Assistant
Jan 2022 - current

- Established the feasibility of unsupervised learning for recognizing activities from wearable sensor data streams.
- Designed and developed state-of-the-art self-supervised pretext tasks for learning representations.
- Currently investigating the potential and effectiveness of self-supervision for behavior understanding and change detection.
- Previously supported by the NSF AI CARING Institute.
- Currently supported by a grant from Optum Research.

Microsoft Research Redmond
Atlanta, USA (remote)

Research Intern
May 2022 - Aug 2022

- **Mentors:** Dr. Jina Suh, Dr. Javier Hernandez, Dr. Jenna Butler, and Dr. Mary Czerwinski
- Investigated the potential and feasibility of utilizing self-supervised learning for predicting end-of-day workplace stress levels and contributors to stress from passively sensed application usage and telemetry data.
- Assessed state-of-the-art methods by pre-training on tabular usage telemetry data, and evaluated prediction of stress and contributing stressors on study data from approx. 50 participants.
- First paper to study the feasibility of self-supervision for predicting stress from passively sensed telemetry data.

Georgia Institute of Technology
Atlanta, USA

Graduate Teaching Assistant
Aug 2018 - Dec 2021

- Graduate Teaching Assistant for the online graduate Computer Vision course.
- Responsibilities: grading assignments and projects, holding office hours and moderating discussions on Piazza for classes of 200-400 students.

Facebook Reality Labs
Atlanta, USA (remote)

Research Intern
May 2021 - Aug 2021

- **Mentor:** Dr. Dustin Freeman
- Developed approaches to reduce false positives during gesture-based interactions with an EMG-based wrist-worn wearable device.
- Focused on techniques that specifically did not require re-training of existing models, but rather could gate and aid in improving predictions.

Asurion *Nashville, USA*

Data Science Intern *May 2019 - Aug 2019*

- **Mentors:** Sundar Kuppuswamy and Dr. Peng Xie
- Ranked user photos based on quality (Neural Image Assessment (NIMA)) and memorability, for suggesting best photos for printing into frames and photobooks.
- Outcome: Small collection of photos from user libraries which are the most likely candidates for printing.
- Outcome: Another collection of photos which are poor quality and are suggested as candidates for deletion.

Asurion *Nashville, USA*

Data Science Intern *May 2018 - Aug 2018*

- **Mentors:** Sundar Kuppuswamy, Damien Thioulouse, and Dr. Peng Xie
- Clustered sentence embeddings for identifying a distinct, concise list of questions asked in customer chat sessions over past few months.
- Utilized in production as part of a customer facing autocomplete feature.

Service

Reviewing

* Outstanding reviews

- PACM IMWUT (2021, 2022*, 2023, 2024***)
- PACM TIST (2023)
- PACM CHI (2023*)
- ISWC (2021, 2022, 2023, 2024)
- SIGKDD (2021, 2022)
- UIST 2022
- ACII 2023
- IEEE TAFFC 2023
- AAAI AI4AtHome2023
- IJCAI 2024

Technical Program Committee

- ISWC 2023, ISWC 2024

Mentoring

* Co-authors on research papers

- Huy Thong Nguyen* – PhD student, now SWE at Google.
- Raviteja Uppalapati – MS student (online), now Staff Data Scientist at Walmart Global Tech.
- Abrar Ahmed* – BS/MS student, now Machine Learning Research Scientist at Peraton Labs.
- Megha Thukral* – MS student, now PhD student at Georgia Institute of Technology.
- Sourish Dhekane* – MS student, now PhD student at Georgia Institute of Technology.
- Madhurya Gajula – BS student, now SWE at Microsoft.
- Richard Goldman – currently an MS student (online).
- Elizabeth Bruda – currently a BS/MS student.

Organizing

- SOAR 2023, SOAR 2024: Conceptualized, developed, and was the main organizer of the Ubicomp tutorial on SOlving the sensor-based Activity Recognition problem (SOAR): self-supervised, multi-modal recognition of activities from wearable sensors. Both tutorials were very well attended, with a great discussions about the current state and the future of the field.
- Lab meeting coordinator, CBA Lab, 2019-2020.