Megha Thukral

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Research Summary

My research focuses on building generalizable models for human activity recognition using different modalities including wearables (IMU data) and ambient sensors. I tackle data scarcity through transfer learning, self-supervised learning, and synthetic sensor data generation using large language models.

Education

Georgia Institute of Technology Atlanta, USA
PhD Machine Learning - School of Interactive Computing GPA 3.92/4 *Aug 2023-Present*

Georgia Institute of Technology Atlanta, USA
Masters in Computer Science GPA 4/4 *Aug 2021-May 2023*

Punjabi University Patiala, India
Bachelor of Technology in Computer Engineering GPA: 4/4 *July 2011 - June 2015*

Publications

Journal Articles

[IMWUT] Layout Agnostic Human Activity Recognition in Smart Homes through Textual Descriptions Of Sensor Triggers
Megha Thukral*, Sourish Dhekane*, Shruthi Hiremath, Harish Haresamudram, Thomas Ploetz
Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies, Volume 9, Issue 1, 2025

- Designed a **generalizable smart home HAR model** by encoding sensor trigger data into explainable text descriptions and using pretrained language models (LLMs), enabling it to work across different floorplans, sensor types, and residents.

[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, Volume 16, Issue 1 Article No.: 22, Pages 1 - 35, 2025

- Developed a transfer learning approach that integrates **self-training and self-supervised learning** to enable activity recognition models for IMU sensors to adapt to new sensor positions and activities, using only a few labeled target data points.

Conference Proceedings

[ISWC] How Much Unlabeled Data is Really Needed for Effective Self-Supervised Human Activity Recognition?
Sourish Dhekane, Harish Haresamudram, **Megha Thukral**, Thomas Ploetz
*Proceedings of the 2023 ACM International Symp*osium on Wearable Computers Pages 66 - 70, 2023

- Studied data efficiency in self-supervised learning for IMU based HAR, showing that **Contrastive Predictive Coding (CPC) is highly data-efficient**, achieving SOTA performance with minimal pre-training data

Experience

Georgia Institute of Technology Atlanta, USA
Graduate Research Assistant *Aug 2023 -Present*

As part of the NSF AI Caring project, I work on developing layout-agnostic human activity recognition using multiple modalities (e.g., ambient and IMU sensors) to support the elderly healthcare ad behavioral monitoring.

Bloomberg LP - AI Group New York, USA

Software Engineer(ML) Intern *May 2022 - July 2022*

- Developed and deployed an FAQ Retrieval Model using pre-trained Sentence BERT for the ML Platform's chatbot.
- Automated the train-deploy-infer ML workflow, enabling other teams to build and onboard bots with minimal effort.
- Tools: PyTorch, scikit-learn, KServe, Argo, Kubernetes, KServe, CI/CD Jenkins, Python unit testing

Georgia Institute of Technology Atlanta, USA

Graduate Teaching Assistant *Aug 2021 -Present*

- I worked as a Teaching Assistant for multiple courses including Graduate Artificial Intelligence, Introduction to Artificial Intelligence, and Computer Networks.

Indian Oil Corporation Limited New Delhi, India

Assistant Manager/Officer - Information Sytems *Sept 2015 - Aug 2021*

- Developed and optimized multiple in-house applications/software modules to streamline workflows, enhance data integration, and meet business needs.

Projects

Scaling Virtual Sensor Data Generation using LLMs in Simulated Home Environments *Present*

- Leverage LLMs to simulate diverse daily routines and behaviors in VirtualHome which will be used to generate synthetic low-level smart home and wearable sensor data

Real-world Deployment of TDOST based HAR models in GT Aware Home *Aug 2024-Present*

- Deployed a HAR model using our Layout-Agnostic TDOST-based approach, trained on public CASAS ambient sensor datasets, now successfully operating in the GT AWARE Home without labeled data.
- Currently enhancing model robustness and planning expansion to additional sites.

Transfer learning for Plankton Image Classification *Aug 2022 - Dec 2022*

- Developed a transfer learning model for plankton image classification, surpassing few-shot supervised baselines by 10-20% and naive transfer by 1-2%.

Where to put it? Best on-body IMU sensor placement *Jan 2022 - May 2022*

- Investigated optimal on-body IMU sensor placement for human activity recognition and analyzed data from 7 users across 6 activities,

Visual Question Answering *Sept 2021 - Dec 2021*

- Developed a visual question answering system using InceptionV3 for visual features and BERT for text, refined with k-means clustering and t-SNE visualization.

Scholastic Achievements

- Secured **Meritorious Student Scholarship** from undergrad institute Punjabi University, Patiala (2012 to 2015)
- Achieved **All India Rank of 62** among 100000 candidates in GATE, CS - National Level Graduate Entrance Exam (2015)