

# Keynote: Data Scarcity in Sensor-Based Human Activity Recognition

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## KEYNOTE ABSTRACT

Sensor-based Human Activity Recognition (HAR) is a research field that has been widely studied in Pervasive Computing. Due to its many applications from healthcare to well-being, sensor-based HAR has been proposed to recognize high-level activities considering smart-homes environmental sensors as well as low-level activities using wearable sensors.

The most effective solutions presented so far rely on supervised learning approaches, that have the potential of reaching high recognition rates. However, such approaches assume that large amounts of labeled data are available.

Annotating human activities is costly, time-consuming, intrusive, and often prohibitive. Considering the high variability of activity execution among different subjects, methods that are capable of personalizing to each subject with limited labeled data are needed.

In the last few years, several research groups are indeed working hard trying to mitigate this problem. However, data scarcity still remains an open challenge in sensor-based HAR.

This talk presents latest research efforts on these topics. In particular, the talk will cover: a) purely knowledge-based approaches enhanced with active learning for smart-home sensor data, b) hybrid data-driven and knowledge-based approaches relying on context data to mitigate data scarcity in mobile settings, and c) semi-supervised federated learning approaches. We will discuss the above-mentioned challenges, report our experience and identify critical aspects which still need to be investigated.

## SPEAKER'S BIOGRAPHY



Gabriele Civitarese is an assistant professor at the Department of Computer Science, University of Milan, Italy. He got his Ph.D. in 2018 with a thesis titled “Human Activity Recognition in Smart-Home Environments for Health-Care Applications” at the same university. He is a member of the EveryWare laboratory since 2014. His main research interests cover context-awareness, sensor-based human activity recognition, and behavioral monitoring in smart homes for healthcare applications.

On these topics, he published more than 30 papers in prestigious journals (e.g., IEEE TKDE, Knowledge-Based Systems) and conferences (e.g., IEEE PerCom, ACM UbiComp).

## RECENT KEY PUBLICATIONS

- [1] C. Bettini, G. Civitarese, and R. Presotto, “Caviar: Context-driven active and incremental activity recognition,” *Knowledge-Based Systems*, vol. 196, p. 105816, 2020. [Online]. Available: <https://www.sciencedirect.com/science/article/pii/S0950705120301969>
- [2] G. Civitarese, C. Bettini, T. Sztylek, D. Riboni, and H. Stuckenschmidt, “newnectar: Collaborative active learning for knowledge-based probabilistic activity recognition,” *Pervasive and Mobile Computing*, vol. 56, pp. 88–105, 2019. [Online]. Available: <https://www.sciencedirect.com/science/article/pii/S1574119218303572>
- [3] R. Presotto, G. Civitarese, and C. Bettini, “Federated clustering and semi-supervised learning: A new partnership for personalized human activity recognition,” *Pervasive and Mobile Computing*, vol. 88, p. 101726, 2022. [Online]. Available: <https://www.sciencedirect.com/science/article/pii/S1574119222001390>