Deriving Effective Human Activity Recognition (HAR) Systems through Objective Task Complexity Assessment (#8563)

A framework for task categorization and practitioner guidelines

This framework for evaluating human activity recognition (HAR) systems for body-worn wearable devices is designed to help users make informed decisions about whether the specific system is suitable for a given application. The first-of-its-kind innovation from Georgia Tech helps address the knowledge gap typically encountered at the onset of considering HAR systems by providing recognition performance estimates and HAR configurations for novel tasks before dedicating resources to solve them. This may help domain experts, rather than technology developers, make intelligent choices about whether to invest in a HAR system they may be considering.

Georgia Tech's framework presents tasks as a small pilot dataset, recorded and annotated prior to a planned deployment. Off-the-shelf analysis tools measure the complexity of each task according to an eight-dimension computation. Mapping a complete analysis task to this numerical representation enables quantification of the complexity and challenges associated with each HAR task. It also enables comparison of unknown tasks to existing ones that already have optimized analysis workflows. This robust categorization aims to provide concrete and actionable guidelines for practitioners regarding specific HAR deployments.

Benefits/Advantages

- **Novel:** Provides a framework designed to address a major challenge associated with HAR deployment decisions, for which there is no prior state of the art
- **Insightful:** Fills a knowledge gap with information about how well a HAR system is suited to an application before investing in it, helping users make intelligent decisions that may save time and resources
- **Practical:** Employs off-the-shelf analysis methods and therefore may not require a data expert at the pilot stage
- **Robust:** Uses multidimensional numerical computation to help accurately categorize HAR task complexity

Potential Commercial Applications

This innovation may be suitable for a broad range of activity recognition and research applications that use HAR systems in body-worn sensing wearable devices, including:

- Clinical assessments
- Health monitoring
- Sports and fitness monitoring
- Human-computer interaction research

Background/Context for This Invention

Activity recognition using HAR systems is of great research interest for analyzing human activities, behaviors, and routines. However, at the onset of deploying such systems, there is typically very little knowledge about how well a task can be solved and what would be a recognition estimate that can be obtained on the task. Without a realistic assessment of the complexity of an analysis task, modifications required to develop problem-specific data analysis pipelines can either turn out to be impossible or may require substantial resources with no performance guarantees. Georgia Tech's framework uniquely addresses this challenge, with no other comparable method currently available.

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More Information

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Publications

[Deriving Effective Human Activity Recognition Systems through Objective Task Complexity Assessment](#)
, Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies, December 2020

For more information about this technology, please visit:
https://licensing.research.gatech.edu/technology/deriving-effective-human-activity-recognition-har-systems-through-objective-task

Images:

The automated sequential delivery of multiple fluids. A varying number of delay gates imprinted in the branches are shown in the figure.

COVID-19 and flu saliva test on paper: (A) The automatic sequential delivery of multiple reagents required for virus test; (B) Water pouring into the device triggers the virus assay, allowing the presence of SARS-CoV-2 and influenza A & B viruses to be visually identified by the color changes in the corresponding detection spot