Generating Massive Synthetic RF Data for RF Sensing Applications

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OTHER INFORMATION

KEYWORDS

rf signals, rf sensing, synthetic data, smart health, smart buildings, smart home, health monitoring, mental health

CATEGORIZED AS

- **Communications**
  - Other

RELATED CASES

2025-337-0

BACKGROUND

There is considerable interest in using off-the-shelf communication signals, such as WiFi or mmWave signals for sensing applications including health monitoring, activity recognition, gesture recognition, smart home, and smart spaces. Body motion is an important indicator for many physical and mental health conditions, and it can be used as a general measure of the well-being of an individual. It can also indicate different activities and provide context, for instance for smart home applications It would therefore be beneficial to provide a low-cost system and method that is able to provide monitoring and evaluation of body movements without requiring specialized sensors or equipment Commodity RF signals, such as WiFi, have increasingly been explored as a means for enabling such sensing in recent years as part of RF sensing revolution. However, effective training, analysis, and learning with these signals require large RF datasets that capture a wide range of body motion activities. Currently, such comprehensive datasets are lacking, and training learning systems on small datasets often leads to poor generalization and limited robustness.

DESCRIPTION

Researchers at the University of California, Santa Barbara have proposed a novel method of generating realistic synthetic RF data by using available videos of body motions/activities of interest. This efficient method leverages the fact that there is an abundance of available videos of many different body activities and motions. It then proposes a method for translating the content of a given video of a human activity to the corresponding received RF signal that would have been measured if there was a link near the human activity event in the video. The translation pipeline uses advances in both areas of vision and RF. The synthetic RF output can then be used to design an RF-based system that can distinguish between different body motion-related conditions and events. For instance, it can be used for training machine learning pipelines. Overall, using the proposed method enables substantial data sets to be created quickly, aiding in the design of any system that leverages RF signals to sense and interpret body motion. These data sets can be utilized for training, analysis, and testing.

ADVANTAGES

- Enables generalizable and robust RF sensing systems
- Can quickly create large RF data sets for training, analysis, or testing purposes from related vision datasets
- Facilitates many different applications in RF sensing such as non-invasive health assessments, or activity recognition for smart home/space

APPLICATIONS

- Gesture recognition
- Activity recognition
- Physical and mental health monitoring
- Elder health
- Mental health
- Vestibular health
- Gait health
- Smart health
- Smart home
- Smart buildings

PATENT STATUS

Patent Pending

RELATED TECHNOLOGIES

- RF Signal-Based Human Context Inference for Health and Safety Monitoring

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- RF Signal-Based Human Context Inference for Health and Safety Monitoring
- Sensing with RF Signals by Exploiting Diffraction
- RF Signals for Crowd Analytics and Collective Behavior
- A Novel Method for RF Field Programming and Intelligent Surface Design Using Diffraction-Inducing Elements

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