

**CHENNAI – PONDICHERRY**

**Compressive Representation for Device-Free Activity Recognition with Passive RFID Signal Strength**

**Abstract:**

Understanding and recognizing human activities is a fundamental research topic for a wide range of important applications such as fall detection and remote health monitoring and intervention. Despite active research in human activity recognition over the past years, existing approaches based on computer vision or wearable sensor technologies present several significant issues such as privacy (e.g., using video camera to monitor the elderly at home) and practicality (e.g., not possible for an older person with dementia to remember wearing devices). In this paper, we present a low-cost, unobtrusive and robust system that supports independent living of older people. The system interprets what a person is doing by deciphering signal fluctuations using radio-frequency identification (RFID) technology and machine learning algorithms. To deal with noisy, streaming, and unstable RFID signals, we develop a compressive sensing, dictionary-based approach that can learn a set of compact and informative dictionaries of activities using an unsupervised subspace decomposition. In particular, we devise a number of approaches to explore the properties of sparse coefficients of the learned dictionaries for fully utilizing the embodied discriminative information on the activity recognition task. Our approach achieves efficient and robust activity recognition via a more compact and robust representation of activities. Extensive experiments conducted in a real-life residential environment demonstrate that our proposed system offers a good overall performance and shows the promising practical potential to underpin the applications for the independent living of the elderly.

**Existing System:**

Activity recognition is a core aspect of ubiquitous computing as many application scenarios require an intelligent environment to infer what a person is doing or attempting to do. Essential to realizing these applications is activity recognition, which is emerging as an important research area in recent years. In general, activity recognition techniques have mainly focused on the direct observation of people and their behaviors with cameras or wearable sensors (e.g., accelerometer, gyro). To date, many efforts have been made to learn human activities by mining from a broad range of signal sources, such as videos and images, radio frequency of wearable or wireless sensors, and even object vibration fluctuations.

Recognizing activity from wearable sensors has become a popular research topic in the past few years. This approach typically requires human subjects to wear a number of sensors. Hence, it has two main shortcomings. It may be impractical to require people wearing sensor devices all the time, and the other obstacle is that those sensor devices typically need regular maintenance (e.g., battery replacement). As a result, sensor based activity recognition is not always practical, particularly in monitoring elderly people with cognitive disabilities.

**Proposed System:**

We develop a compressive sensing dictionary-based learning approach to uncover structural information among RFID signals of different activities. Compared to existing approaches, our approach achieves more compact representation of activities while preserving richer information and uncovering invariant patterns, thereby underpinning an efficient and robust activity recognition system. We show that, even using noisy and uncertain RSSI signals, our algorithm still achieves good performance in terms of both person-independent and person-dependent activities.

We propose a lightweight but effective feature selection method to assist the extraction of more discriminative signal patterns from noisy RFID streams. We particularly exploit an unsupervised and filter-based feature selection approach based on CCA, which not only retains the natural assignment of feature components, but also uncovers the interdependency between feature components.

We validate and evaluate our system through prototype applications and conduct extensive experiments in both office and home settings. Our experimental results demonstrate the effectiveness and efficiency of the proposed techniques.