**Data Sheet for Project for radar in assisted living – Micro-Doppler signatures using STFT vs IAA**

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**This document is for the snapshot data collected in Enlighten 848 (https://researchdata.gla.ac.uk/848/) and continuous data collected in July 2018at the University of Glasgow.**

**Participant Activities and Data Collection**

**Participants were instructed to perform three repetitions of six distinct activities for the snapshot data. These activities included walking back and forth, sitting down on a chair, standing up, bending to pick up an object, and drinking from a cup or glass. Each activity was performed separately from the others. Data for the 'fall' activity was collected under controlled laboratory conditions and was limited to a subset of participants for safety considerations.**

**For the continuous data, participants were asked to perform three repetitions of the same six activities as in the snapshot experiment. However, in this instance, activities were performed continuously without separation. While no specific time length was designated for each activity, the total recording time was 35 seconds. The sequence of activities was fixed, following the order: walking, sitting down, standing up, picking up an object, drinking water, and falling.**

**Objective**

**The objective of this new released dataset is to develop a system comprising a device and accompanying algorithms capable of monitoring the activity levels and patterns of individuals from micro-Doppler signatures.**

**The system aims to:**

* **Precisely detect and monitor human daily activity routines and critical events.**
* **Learn and establish baseline activity levels to promptly identify deviations, facilitating discussions with the individual and, when necessary, healthcare professionals. This includes assessing whether the person is walking less than usual, exhibiting increased sedentary behaviour, or displaying more erratic activity patterns.**

**We propose utilising radar as the primary sensor due to its contactless nature, eliminating the need for individuals to wear or interact with sensors. Additionally, radar technology offers greater privacy compliance compared to cameras, as it does not capture identifiable images or videos of faces or private spaces.**

**Innovations Compared to Previous Enlighten 848 Results**

**This study builds upon the Enlighten 848 (https://researchdata.gla.ac.uk/848/) snapshot data by incorporating a series of continuous data and introducing two key innovations: iterative adaptive approach methods and an accurate labelling system.**

1. **Iterative Adaptive Approach (IAA) Methods for Spectrogram Generation:**

**The dataset was created using IAA methods to generate spectrograms, representing a significant improvement over the traditional spectrogram generation technique. This approach enhances the quality and accuracy of the spectrograms, enabling more precise analyses. For the full details of the techniques, please refer to:**

* **Akaydin, A. and Le Kernec, J. (2024) Micro-Doppler Super-Resolution Using Iterative Adaptive Approach. In: 2024 International Conference on Radar (RADAR 2024), Rennes, France, 21-25 Oct 2024.**
* **Akaydin, Abdullah, Li, Zhenghui, Robertson, Andrew, Romain, Olivier and Le Kernec, Julien (2025) Enhancing human activity recognition with iterative adaptive approach in assisted living. IEEE Sensors Journal**
* **The detailed implementation is also shared in the sample code for IAA**

1. **Enhanced Labelling System:**

**A novel, accurate labelling system has been implemented in this dataset. Each data instance can possess multiple labels, providing a more robust classification framework. This system increases the granularity and depth of the dataset, allowing for more detailed and comprehensive analyses.**

**Data Organisation and File Naming Convention**

**The data have been organised into separate folders containing .mat files for each data collection session, with detailed descriptions provided in the remainder of this document. The naming convention for the data files follows the format xKPXXAYYRZZ, where:**

* **The digits K (1, 2, 3, 4, 5, and 6) at the beginning indicate the activities: walking, sitting down, standing up, picking up an object, drinking water, and falling, respectively. They represent the activities that were recorded including performing individual activities and the idle times when nothing happens.**
* **The characters XX denote the subject ID (e.g., 01, 02, etc.).**
* **The characters YY represent the specific activity being performed (e.g., A01, A02, A03, A04, A05, and A06). This is a repetition of the information given by K.**
* **The characters ZZ (sometimes only one Z) signify the repetition of the activity (e.g., R01, R02, etc. – when only one Z** 🡪 **R1 means repetition 1).**

**Additional information about the subjects, including age, height, gender, and dominant hand, is also included in this document as metadata. It should be noted that in some cases, not all information was available, and these missing data points have been marked as 'n/a' for the relevant subjects.**

**For example: x1P01A01R01 or x1P01A01R1,**

* **x1 means Activity No.1**
* **P01 means Person No.1**
* **A01 means Activity No.1**
* **R1 and R01 means repetition 1.**

**File Storage:**

**The dataset is organised into 5 distinct folders:**

1. **Continuous Micro-Doppler Signature: This folder contains the continuous micro-Doppler signature data.**
2. **Micro-Doppler Signature using IAA Algorithm: This folder includes micro-Doppler signature data generated using the Iterative Adaptive Approach (IAA) algorithm, accompanied by our accurate labelling system.**
3. **Micro-Doppler Signature using STFT Algorithm: This folder holds the micro-Doppler signature data generated using the Short-Time Fourier Transform (STFT) algorithm, also with our accurate labelling system.**
4. **Labels: This folder contains the labels for all the other data.**
5. **Codes: This folder contains Matlab codes for data processing.**

**Datasets:**

**The dataset comprises two distinct subsets. The first subset is the snapshot dataset Enlighten 848, accessible at Enlighten 848 Dataset (**[**https://researchdata.gla.ac.uk/848/**](https://researchdata.gla.ac.uk/848/)**). Detailed information about the snapshot radar data can be found through this link. The second subset is the continuous dataset, details of which are provided as follows:**

1. **Experimental Environment:**

**The experimental setup is located in the common room on the 3rd floor of JWS, near the vending machine. Two laptops are required: one designated as the group laptop and the other as a personal laptop. A blocking line on the 6th floor is used to divide the room into two sections. The inner section is dedicated to testing, while the outer section remains available for normal usage.**

1. **Activities to record**

**We propose recording six sessions. The first three sessions will follow the same protocol as the previous data collection, involving six activities with intervals between each activity.**

1. **Sequence of data collection:**

**1st round (R1): walking/sitting/standing/picking up/drinking/fall.**

**2nd round (R2): drinking /picking up/sitting/standing/walking/fall.**

**3rd round (R3): picking up/drinking/walking/sitting/standing/fall.**

1. **The recording time**

**No specific time length is designated for each activity. Participants are instructed to perform each activity as naturally as possible, with the total recording time set at 35 seconds.**

1. **Participants:**

**The study involves 16 participants for the 'radar antenna parallel to the ground' test, including one female and fifteen males, aged between 23 and 36 years.**

**Table 1. The details of the continuous data participants.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Subject ID*** | ***Age*** | ***Height*** | ***RH/LH*** | ***Actions*** |
| P57 | 32 | 170 | RH | All |
| P58 | 25 | 168 | RH | All |
| P59 | 32 | 168 | LH | All |
| P60 | 25 | 170 | RH | All |
| P61 | 27 | 173 | RH | All |
| P62 | 26 | 173 | RH | All |
| P63 | 27 | 178 | RH | All |
| P64 | 28 | 177 | RH | All |
| P65 | 23 | 180 | RH | All |
| P66 | 26 | 180 | RH | All |
| P67 | 27 | 165 | RH | All |
| P68 | 25 | 180 | RH | All |
| P69 | 36 | 182 | RH | All |
| P70 | 26 | 180 | RH | All |
| P71 | 24 | 178 | RH | All |
| P72 | 28 | 168 | RH | All |