

Data Set Information Sheet: 5G-Enabled Contactless Multi-User Presence and Activity Detection for Independent Assisted Living

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GENERAL INFORMATION

Title of Dataset

5G-Enabled Contactless Multi-User Presence and Activity Detection for Independent Assisted Living

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Date of data collection:

The data was collected over the first week of May 2021.

Geographic location of data collection:

Scotland 5G Centre, James Watt South Building, Glasgow, G12 8QQ, United Kingdom

Information about funding sources that supported the collection of the data:

EPSRC-IAA project - An intelligent non-invasive real-time elderly activity recognition system for next generation healthcare – 314038. The grant reference number for this award is EP/R511705/1

SHARING/ACCESS INFORMATION

Licenses/restrictions placed on the data:

NA

Links to other publicly accessible locations of the data:

NA

Was data derived from another source?

No

Recommended citation for this dataset: Shleibta, A. M. A., Taha, A., Taylor, W., Imran, M. and Abbasi, Q. (2021), 5G-Enabled Contactless Multi-User Presence and Activity Detection for Independent Assisted Living, University of Glasgow <http://dx.doi.org/10.5525/gla.researchdata.1151>

DATA & FILE OVERVIEW

Details of Data Folders and Files

The dataset was divided into 16 classes, that is, a total of 1777 data samples/files, each represents a particular number of subjects and activities (see Table 1). The main data folder is subdivided into 16 folders corresponding to the 16 classes (see Figure 1 and Table 1).

Data Set for 5G-Enabled Contactless Multi-User Presence and Activity Detection for Independent Assisted Living

| Name | Status | Date modified | Type | Size |
|---------------------------------|--------|------------------|-------------|------|
| 0_Subjects_Empty Room | ✓ | 26/05/2021 11:55 | File folder | |
| 1_Subject_Sitting | ✓ | 26/05/2021 11:55 | File folder | |
| 1_Subject_Standing | ✓ | 26/05/2021 11:56 | File folder | |
| 1_Subject_Walking | ✓ | 26/05/2021 11:56 | File folder | |
| 2_Subjects_1_Sitting_1_Standing | ✓ | 26/05/2021 11:56 | File folder | |
| 2_Subjects_1_Walking_1_Sitting | ✓ | 26/05/2021 11:56 | File folder | |
| 2_Subjects_Sitting | ✓ | 26/05/2021 11:56 | File folder | |
| 2_Subjects_Standing | ✓ | 26/05/2021 11:56 | File folder | |
| 3_Subjects_2_Sitting_1_Standing | ✓ | 26/05/2021 11:56 | File folder | |
| 3_Subjects_2_Sitting_1_Walk | ✓ | 26/05/2021 11:56 | File folder | |
| 3_Subjects_2_Standing_1_Sitting | ✓ | 26/05/2021 11:56 | File folder | |
| 3_Subjects_Sitting | ✓ | 26/05/2021 11:57 | File folder | |
| 3_Subjects_Standing | ✓ | 26/05/2021 11:57 | File folder | |
| 4_Subjects_2_Sitting_2_Standing | ✓ | 26/05/2021 11:57 | File folder | |
| 4_Subjects_Sitting | ✓ | 26/05/2021 11:57 | File folder | |
| 4_Subjects_Standing | ✓ | 26/05/2021 11:57 | File folder | |

Figure 1 Data folder Structure

Table 1 Details of the Data Set (Folders, Files, Description, and Number of Samples)

| Number of Subjects | Folder Name | Class/File Name | Description | Number of Samples per Class |
|--------------------|-----------------------|-----------------|---|-----------------------------|
| 0 | 0_Subjects_Empty Room | Empty | Empty activity area without any test subjects | 117 |
| 1 | 1_Subject_Sitting | 1_Sitting | One subject performing the action of "Sitting" | 140 |
| | 1_Subject_Standing | 1_Standing | One subject performing the action of "Standing" | 140 |

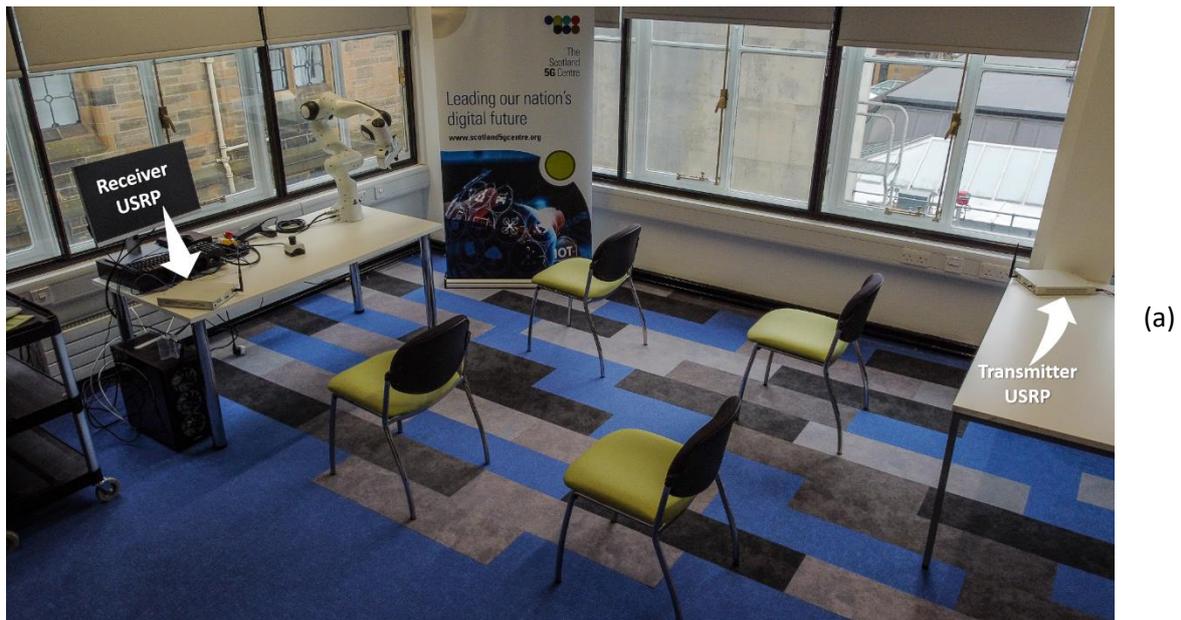
| | | | | |
|---|---------------------------------|-----------------|--|-----|
| | 1_Subject_Walking | 1_Walking | One subject performing the action of "Walking" | 140 |
| 2 | 2_Subjects_1_Sitting_1_Standing | 2_1_Sit_1_Stand | One subject performing the action of "Sitting" and one subject performing the action of "Standing", at the same time | 100 |
| | 2_Subjects_1_Walking_1_Sitting | 2_1_Walk_1_Sit | One subject performing the action of "Walking" and one subject performing the action of "Sitting", at the same time | 100 |
| | 2_Subjects_Sitting | 2_Sitting | Two subjects performing the action of "Sitting", at the same time | 100 |
| | 2_Subjects_Standing | 2_Standing | Two subjects performing the action of "Standing", at the same time | 100 |
| 3 | 3_Subjects_2_Sitting_1_Standing | 3_1_Stand_2_Sit | One subject performing the action of "Standing" and two subjects performing the action of "Sitting", at the same time | 100 |
| | 3_Subjects_2_Sitting_1_Walk | 3_2_Sit_1_Walk | Two subjects performing the action of "Sitting" and one subject performing the action of "Walking", at the same time | 120 |
| | 3_Subjects_2_Standing_1_Sitting | 3_2_Stand_1_Sit | Two subjects performing the action of "Standing" and one subject performing the action of "Sitting", at the same time | 120 |
| | 3_Subjects_Sitting | 3_Sitting | Three subjects performing the action of "Sitting", at the same time | 100 |
| | 3_Subjects_Standing | 3_Standing | Three subjects performing the action of "Standing", at the same time | 100 |
| 4 | 4_Subjects_2_Sitting_2_Standing | 4_2_Sit_2_Stand | Two subjects performing the action of "Sitting" and two subjects performing the action of "Standing", at the same time | 100 |

| | | | | |
|--|---------------------|------------|---|-----|
| | 4_Subjects_Sitting | 4_Sitting | Four subjects performing the action of "Sitting", at the same time | 100 |
| | 4_Subjects_Standing | 4_Standing | Four subjects performing the action of "Standing", at the same time | 100 |

METHODOLOGICAL INFORMATION

Description of methods used for collection/generation of data:

The dataset represents a combination of activities captured through wireless channel state information, using two USRP X300/X310 devices each equipped with the VERT2450 omnidirectional antenna. One USRP (X300) was used as the transmitter and the second USRP (X310) was used for the receiver. Each USRP was connected to an All-in-One PC that uses and Intel(R) Core (TM) i7-7700 3.60 GHz processors and 16 GB RAM. The system made use of virtual machines to provide the Ubuntu 16.04 operating system. On the Ubuntu virtual machines, Gnu Radio was used to communicate with the USRP devices and it also hosted the artificial intelligence engine. Figure 2 (a) and (b) shows the experimental setup which was used to collect the data.



(a)

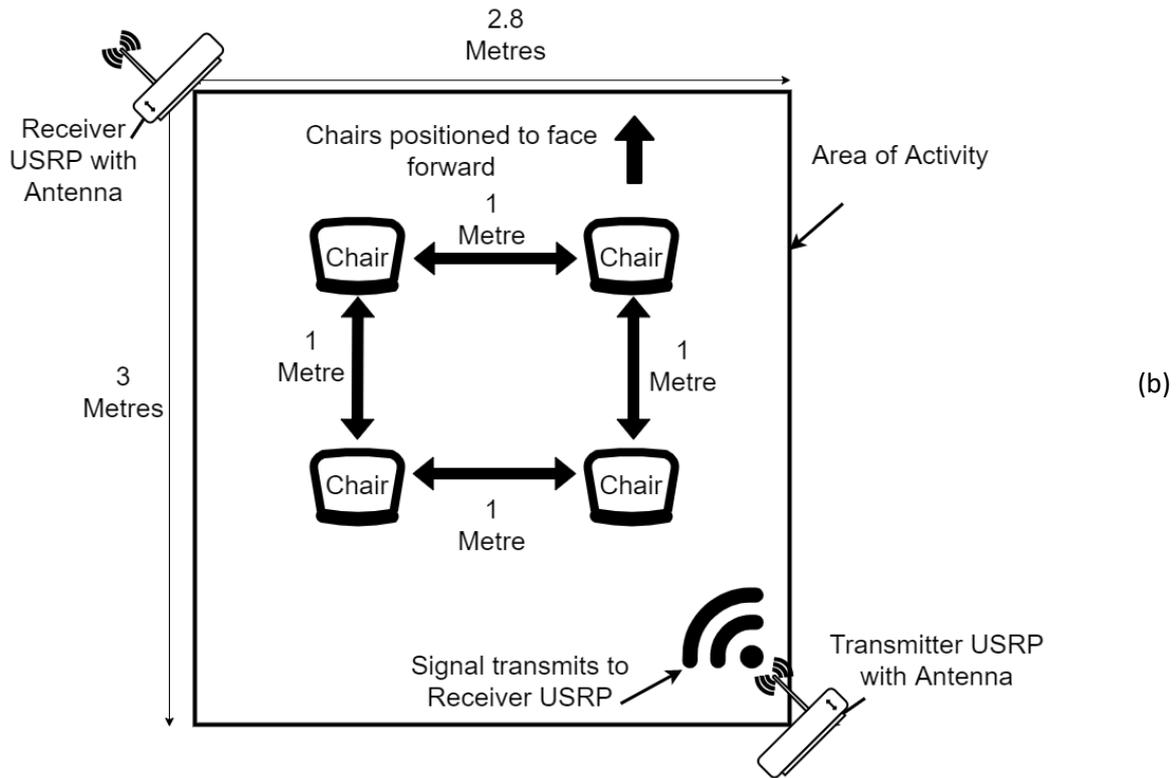


Figure 2 Experimental Setup

Methods for processing the data:

Firstly, the USRP transmitter and receiver devices were configured to communicate together using the GNU radio python package to set parameters such as central frequency, number of Orthogonal Frequency Division Multiplexing (OFDM) subcarriers, and power levels (see Table 2).

Table 2 System Parameters

| Parameter | Value |
|-----------------------|----------|
| Central Frequency | 3.75 GHz |
| OFDM subcarriers | 52 |
| Transmitter Gain (dB) | 70 |
| Receiver Gain (dB) | 50 |

GNU Radio is a free and open-source software which is used in research for software defined radios and signal processing. GNU Radio comes with examples of OFDM signal processing where the channel state information can be extracted. This example is modified to include the USRP as the transmitting and receiving devices. The GNU Radio software publishes the configuration in the format of a flow diagram which can be used to set up the blocks of the USRP and OFDM communication. Figure 3 shows the GNU Radio flow diagram that depicts the configurations of the USRP devices. The flow diagram can then be converted into a python script, which can be executed to begin OFDM communication. The raw form of the channel state information output is written to text files which are then converted to a processable format (see Figure 4).

carries out mathematical functions to calculate the amplitude of the RF signal from the channel state information complex numbers. The amplitude values are then saved to CSV format for ML and to visualise the signal propagation through line graphs, see an example in Figure 5. The above process was repeated for all the data files in this data set.

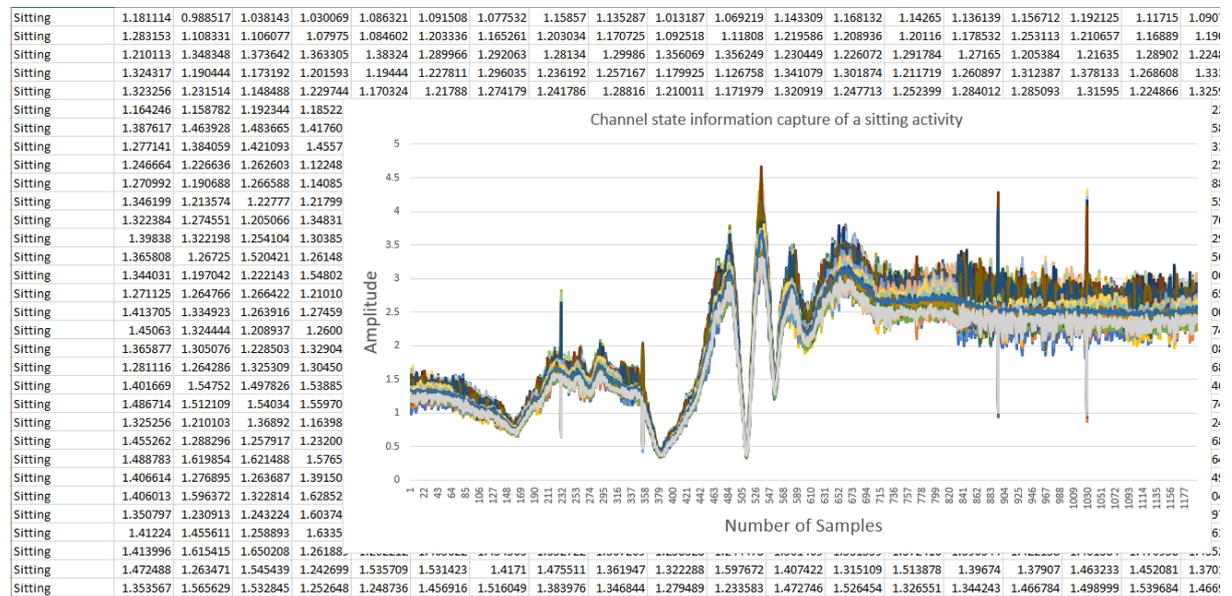


Figure 5 Channel state information capture of “Sitting” activity in “.csv” format and the corresponding plot

Instrument- or software-specific information needed to interpret the data:

Data files are all in “.csv” format which could be opened using Microsoft Excel and further processed using python.