

## Description of data to Posture detection inference system.

Data were gathered by an inertial motion sensor and Kinect cameras that were allocated at the center of the ceiling or in front of the room. Since data in video format would violate privacy, only depth maps were interpreted. Data gathered from IMU sensors were prepared with the usage of source code contributed by the manufacturer, whereas depth maps data were collected with the OpenNI library. Two Microsoft Kinect cameras provided 5990 depth images, which were collected and stored in the UR Fall Detection Dataset (available on <http://fenix.ur.edu.pl/~mkepski/> and described in [Kwo14]). Every fall consists of approximately 150 frames that were saved in PNG16 format with the 640x480 dimensions.

In [Mro24], we concentrate on studying a single depth map in order to detect a lying pose, despite the fact that UR Fall Detection Dataset provides also character movement analysis.

Parameters describing character posture were specified as a consequence of clustering 600 images showing form in different situations: depicting daily life activity, during fall, and laying. Finally, descriptors were chosen from the following features:

- $H/W$  - a ratio of width to height of characters box frame
- $H/H_{\max}$  - a ratio of the height of the character surrounding the box to the character's physical height
- $\max(\delta x, \delta z)$  - the maximum chosen between the standard deviation of points included to the person form, from its center of gravity along X and Z axes, based on camera coordinate system
- $P_{40}$  - a number of points included to the person lying in a cuboid 40 cm high, located above the floor, divided by a number of all points belonging to the person.

All of the above parameters were parsed to interval values after fuzzification, using the rule:

*If fuzzy value is None, then fuzzy value = Method to imputation fuzzy interval values;  
Else fuzzy value = [fuzzy value, fuzzy value].*

Fuzzy values/labels (low, medium, high) are built by using the function presented in [Pek22].

- [Kwo14] B. Kwolek, M. Kepski, Human fall detection on embedded platform using depth maps and wireless accelerometer, Computer Methods and Programs in Biomedicine, Volume 117, Issue 3, December 2014, Pages 489-501, ISSN 0169-2607.
- [Pek22] B. Pękala, T. Mroczek, D. Gil, M. Kepski, Application of fuzzy and rough logic to posture recognition in fall detection system, Sensors 22 (4), 2022, 1602.
- [Mro24] T. Mroczek, D. Gil, B. Pękala, Fuzzy and rough approach to the problem of missing data in fall detection system, Fuzzy Sets and Systems, Vol. 480, 2024, 108868.