

Physical Therapy Dataset

Aras Yurtman

aras.yurtman@kuleuven.be

Department of Computer Science, KU Leuven, 3001 Leuven, Belgium.

Billur Barshan

billur@ee.bilkent.edu.tr

Department of Electrical and Electronics Engineering, Bilkent University,
Bilkent, Ankara TR-06800 Turkey

This dataset contains wearable inertial and magnetic sensor data during the execution of physical therapy exercises [1–4]. We consider eight types of physical therapy exercises, and three execution types (correct, fast, and low-amplitude) for each. Each execution type of each type of exercise was performed multiple times by five subjects. The subjects wore five MTx sensor units manufactured by XSens [5]. Each unit contains three tri-axial sensors: an accelerometer, a gyroscope, and a magnetometer, sampled at 25 Hz.

More information about the dataset and the experimental procedure can be found in [1]. Reference [1] also includes a study on automated detection and evaluation of physical therapy exercises. Refer to [2] and [3] for more brief versions of [1].

The data acquisition procedure was approved by Bilkent University Ethics Committee for Research Involving Human Participants. All participants gave informed consent and their identities are anonymous.

Folder Structure

The data are stored in .txt files that are organized in folders as follows:

- s1, ..., s5: subject 1–5
- e1, ..., e8: exercise type 1–8
- u1, ..., u5: sensor unit 1–5

Data Files

Each .txt file contains numerical values separated by semicolon (;) and a header row.

- **Template sessions:** For each subject, each exercise type, and each sensor unit, the file `template_session.txt` contains data acquired during a template recording session. Such a session contains three executions for each of the three execution types. For each execution type, a single template is selected in [1–4]. The time intervals of the selected templates are available in `template_times.txt` files (see below).
- **Time intervals of selected templates:** For each subject and exercise type, the file `template_times.txt` contains the start and end time indices of the templates for the three execution types. The time indices correspond to the `template_session.txt` files. As an example, Figure 6(a) in [1] highlights the three templates for exercise type 1 of subject 3.

- **Test sessions:** For each subject, each exercise type, and each sensor unit, there is a **test.txt** file that correspond to a test session that contains 10 repetitions for each execution type. See Figure 6(b) in [1] as an example.

Each row of the files named **template_session.txt** and **test.txt** contains the time index ($n = 1, 2, \dots, N$) as well as the measurements along the x, y, z axes of accelerometer (acc), gyroscope (gyr), and magnetometer (mag) sensors, where the order is provided in the header rows. The sampling rate is $f_s = 25$ Hz; hence, time can be calculated as $t = (n - 1)/f_s = 0.04 (n - 1)$ seconds.

References

- [1] A. Yurtman and B. Barshan, "Automated evaluation of physical therapy exercises using multi-template dynamic time warping on wearable sensor signals," *Computer Methods and Programs in Biomedicine*, 117(2):189–207, November 2014 (DOI: 10.1016/j.cmpb.2014.07.003).
- [2] A. Yurtman and B. Barshan, "Detection and evaluation of physical therapy exercises by dynamic time warping using wearable motion sensor units," *Information Sciences and Systems 2013 - Proceedings of the 28th International Symposium on Computer and Information Sciences*, 28-29 October 2013, Paris, France, Lecture Notes in Electrical Engineering, vol.264, E. Gelenbe and R. Lent (eds.), Springer International Publishing, Switzerland, pp. 305–314, 2013.
- [3] A. Yurtman and B. Barshan, "Detection and evaluation of physical therapy exercises from wearable motion sensor signals by dynamic time warping (Fizik tedavi egzersizlerinin giyilebilir hareket algılayıcıları işaretlerinden dinamik zaman bükmesiyle sezimi ve değerlendirilmesi)," *Proceedings of the IEEE 22nd Conference on Signal Processing, Communications, and Applications*, 23–25 April 2014, Trabzon, Turkey
- [4] A. Yurtman, "Recognition and classification of human activities using wearable sensors," M.S. Thesis, Department of Electrical and Electronics Engineering, Bilkent University, Ankara, Turkey, September 2012.
- [5] Xsens Technologies B.V., Enschede, The Netherlands, MTi and MTx User Manual and Technical Documentation, 2014, <http://www.xsens.com>.