Supplementary Material

Performance of Multiple Neural Network in Predicting Lower Limb Joint Moments using Wearable Sensors

Zainab Altai1\*, Issam Boukhennoufa2, Xiaojun Zhai2, Andrew Phillips3, Jason Moran1, Bernard X.W. Liew1

1School of Sport, Rehabilitation and Exercise Sciences, University of Essex, Colchester, Essex, United Kingdom

2School of Computer Science and Electrical Engineering, University of Essex, Colchester, Essex, United Kingdom

3Department of Civil and Environmental Engineering, Imperial College London, London, UK

**\* Correspondence:**Zainab Altai  
[za21920@essex.ac.uk](mailto:za21920@essex.ac.uk); zainabaltai0@gmail.com

# Data

Data used for machine learning includes accelerations (Figure 1) and gyroscopes (Figure 2) measured by four Inertial Measurement Units (IMUs) located at the foot, shank, thigh, and trunk, and joint moments (Figure 3) of the hip, knee, ankle, and subtalar joints calculated by musculoskeletal models.

|  |
| --- |
| Diagram  Description automatically generated |
| **Supplementary Figure 1.** Accelerations of the foot, shank, thigh, and trunk measured by the IMUs |

|  |
| --- |
| Diagram  Description automatically generated |
| **Supplementary Figure 2.** Gyroscopes of the foot, shank, thigh, and trunk measured by the IMUs |

|  |
| --- |
| Diagram  Description automatically generated |
| **Supplementary Figure 3.** Hip, knee, ankle, and subtalar joint moments calculated by the musculoskeletal models. |

# Performance of the machine learning models

The predicted standard deviation (SD) waveform for each of the five predicted joint moments using Typical-split (Figure 4) and Leave-subjects-out methods (Figure 5).

|  |  |
| --- | --- |
| Chart  Description automatically generated | Chart  Description automatically generated |
| Histogram  Description automatically generated with low confidence | Chart, histogram  Description automatically generated |
| Chart  Description automatically generated |  |
| **Supplementary Figure 4.** Standard deviation of the joint moment waveforms for the hip, knee, ankle, and subtalar joints predicted by the six machine-learning methods using Typical-split method. | |
| Histogram  Description automatically generated with medium confidence | Chart, histogram  Description automatically generated |
| Histogram  Description automatically generated | Chart, histogram  Description automatically generated |
|  |  |
| **Supplementary Figure 5.** Standard deviation of the joint moment waveforms for the hip, knee, ankle, and subtalar joints predicted by the six machine-learning methods using Leave-subjects-out method. | |