Machine learning applications in movement biomechanics – Sina David & Marion Mundt

This tutorial will provide an overview of different applications of machine learning to support movement biomechanics analysis. You will learn the basics of machine learning and how it is used in biomechanics. We will touch the three main application areas of machine learning: regression, classification, clustering, and pattern recognition – utilising supervised and unsupervised approaches.

In a first hands-on part on the use of an off-the-shelf pose estimation model to determine anatomically related landmarks in 2D videos and how to process the results.

The second part of the workshop will provide an example on how to develop a simple artificial neural network to classify normal and abnormal gait from inertial sensor data.

The third part will demonstrate how to use unsupervised approaches to detect patterns in movement data and how to visualise them.

Finally, we will wrap up this workshop discussing the pros and cons of machine learning in biomechanics, opportunities, and challenges, based on the examples provided.

Biography

Marion is a Research Fellow in the UWA Tech & Policy Lab at The University of Western Australia, working with the Australian Institute of Sport to use machine learning techniques to estimate motion parameters from standard two-dimensional video. She received her PhD in Sport Science from the German Sport University Cologne for the application of artificial intelligence to motion analysis. Using inertial sensors, health-related information like joint loads can be collected for different movements during daily life situations, enabling the collection of big data in biomechanics on-the-fly.

Sina is currently an Assistant Professor at the Vrije Universiteit Amsterdam in the Department of Human Movement Science where she focuses on the use of Artificial Intelligence to research the underlying determinants of gait rehabilitation progress in neurological patients. Besides applying mainly unsupervised algorithms in the clinical setting, her research also covers sports biomechanical questions such as fatigue detection and prediction of joint loading in both team sports and running.