



System for identifying individual stairways with wearable sensors

Description:

With age, the physical limitation of movement increases, leading to reduced mobility and functional decline. Tracking activities such as walking, jogging and stair climbing can provide valuable data about the user's health status. In fact, when climbing stairs, wearable sensors can also estimate the position and identify different stairways, which play an important role in indoor localisation and risk monitoring in old age [1][2].

Through the use of smartphones, smartwatches and comparable ubiquitous wearable sensors, corresponding data can now be collected unobtrusively and integrated into everyday life.

Gait parameters are analysed using Inertial Measurement Units (IMUs). Using the recorded data, steps can be captured and the position and individual characteristics of the stairs can be estimated.

This thesis can be designed with respect to the following topics:

- System for automating tests to determine performance when climbing stairs
- Implement novel approaches such as hybrid deep learning models and transformers [3] for a technical assessment tool for physical performance
- Classification of individual stairways

For the data analysis, different approaches will be applied, in particular, the suitability of established Deep Learning methods for time series such as RNNs, LSTMs, and hybrid models with attention to the above-mentioned tasks will be assessed.

In case of a student research project or similar, a connecting thesis is possible.

Keywords: Data processing system, AI in medicine, transformer, attention-based neural networks, gait analysis, Transformer, LSTM, Attention-based Neural Networks.

Start: Immediately or by arrangement.

[1] Jessilyn Dunn, Lukasz Kidzinski, et al., Wearable sensors enable personalized predictions of clinical laboratory measurements, 2021 (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8293303/>)

[2] Mohammad El-Musleh, Steps detection and position estimate from data collected using smartphone sensors, 2020

(https://www.academia.edu/44489313/Steps_detection_and_position_estimate_from_data_collected_using_smartphone_sensors)

[3] Ashish Vaswani, et al. Attention Is All You Need, 2017 (<https://arxiv.org/abs/1706.03762>)



UNIVERSITÄT ZU LÜBECK
INSTITUT FÜR MEDIZINISCHE INFORMATIK
NACHWUCHSGRUPPE MOVEGROUP

If you are interested and have any questions about this topic, please feel free to **book an appointment** via: <https://calendly.com/fudickar/>

Dr. Sebastian Fudickar

Medical Informatics Initiative Junior Research Group

Integration and Analysis of Multimodal Sensor Signals and Clinical Data for Diagnostics and
Investigation of Neurological Movement Disorders (MoveGroup)

Further thesis topics at: move.ulü.de