Clinical Applications of Computational Medicine

Baretalk - summer workshop on student projects

WHEN Thursday, September 17th, 2020
18.00 – 20.00

WHERE Online-Meeting, link provided after registration

FOR Physicians, physiotherapists, healthcare professionals/students/individuals with an interest in research concerning barefoot running, wearables and mobile clinical applications

ENTRANCE Free – join by using the following link:
https://tum-conf.zoom.us/j/96663214176
Meeting ID: 966 6321 4176
Passcode: 370011

18.00 **Welcome & Introduction**
Overview of the course and student projects

18.15 **On the effect of Runningpads on tactile sensitivity**
Prototyping a novel test setup for investigating the tactile sensitivity of the skin of the foot in the presence of calluses compared to Runningpads

18.30 **Towards verification of mobile fetal heartbeat monitoring**
Novel tools to assess the precision of mobile fetal heartbeat measurements

18.45 **Wear-time assessment algorithm for the wearable actibelt**
Data selection and filtering for efficient data collection and monitoring in clinical trials

19.00 **Stair step detection algorithm with actibelt**
Design and implementation of an algorithm to detect ascending and descending of slopes and stairs

19.15 **Conclusion**
Our story of learning in times of COVID-19

19.30 **Discussion & Get Together**
Online Meet and Greet with the groups and participants

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Lehrstuhl für Datenverarbeitung

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Project Descriptions

On the effect of Runningpads on tactile sensitivity
Biljana Gjeroska (MKD), Irem Öztürk (TUR), Dimitar Peychev (BGR), Nino Ponchev (BGR)

Foot calluses are nature's evolutionary solution to protect the skin on the lower part of a person's foot while walking barefoot. Cushioned footwear has taken over the protection part, but at the same time also reduced our skin's tactile sensitivity. Therefore, we speculate whether it is possible to maintain natural tactile sensitivity while still keeping protection at the same time. To explore the particular ramifications of this problem, we prototype a novel test setup. With it, we can easily carry out experiments with human subjects where minimalistic leather shoes with different thicknesses are investigated as a form of alternative footwear. We hypothesize that such bio-inspired footwear would be able to improve sensitivity in a manner similar to that of foot calluses while still providing adequate protection of the skin.

Towards verification of mobile fetal heartbeat monitoring
Paul Büschl (DEU), Özgün Keles (DEU), Doğa Korkmaz (TUR), Julian McGinnis (DEU)

Fetal heartbeat monitoring has become a vital instrument during various stages of pregnancy and is utilized to assess the development and health of the fetus. In the past, measurements have been conducted in clinics by specially trained doctors and assistants.
However, newly developed devices such as the "Herabeat" present new possibilities and enable mobile monitoring from home - facilitating the introduction of more flexible and secure patient treatments.
In order to simplify the integration of mobile measurements into clinical workflows and assess the risks of inexpert measurements, various heartbeat simulation devices and methods have been analyzed. To evaluate the accuracy and versatility of devices, we propose and implement a prototype based on a modular design architecture. Thus, we aim for easy adaptation to other devices and re-usability of components for similar applications. In conclusion, we highlight our findings and indicate improvements of our prototype.

Wear-time assessment algorithm for the wearable actibelt
Laura Pilger (DEU), Özgün Turgut (DEU)

Wearables are increasingly used in clinical studies to record physical activities in order to enhance the individual treatments and diagnoses. We conducted our research with the "wearable" actibelt RCT3, which incorporates multiple sensors such as a 3D accelerometer, barometer, gyroscope, hall sensor or magnetometer. This allows to extract robust, accurate and meaningful parameters like real-life walking speed and steps, in combination with a time stamp. However, since the device can record continuously over a period of weeks or months, it is crucial to select the time periods where the device was actually worn by the patient. In this project, we propose and evaluate an algorithm that analyses the entire dataset from the actibelt RCT3 and identifies the periods in time in which the belt was worn.

Stair step detection algorithm with actibelt
Thomas Glas (DEU), Seehyun Song (KOR)

Wearable technology in healthcare is designed to collect the data of users' personal health and exercise. This information can directly impact clinical decisions. Goals of the devices include improving the quality of patient care and decreasing cost of patient care. In our project, we worked with actibelt RCT3 which uses sensors such as gyroscopes, accelerometers and magnetometers to collect data on the wearer's physical activity. Algorithms can analyze the data to extract information on walking and running characteristics. We have designed and implemented an algorithm to detect ascending and descending of slopes and stairs. With our proof of concept, we demonstrate the simplicity yet effectiveness of the algorithm, while acknowledging the necessity of improvements for reliable real world use.

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