Doktorandenvortrag
von Sebastian Wilhelm
am Mittwoch, 22.1.2025 ab 14:25 im Raum VR 147b
im Juridicum der Universität Passau
und per Zoom (diese Daten werden intern gemailt)
mit dem Titel
Emergency Detection
In Private Households Utilizing Existing
Data Sources for Human Activity Event Recognition

Emergency detection in private households is becoming increasingly crucial in aging societies, where the risk of falls and prolonged lie times poses significant challenges. Approximately 30% of individuals aged 65+ experience at least one fall annually, with many unable to rise without assistance. Current detection systems rely predominantly on wearables or installed sensors, often perceived as intrusive or complex, limiting user acceptance. This thesis introduces a novel approach that leverages existing household data sources for human activity recognition and emergency detection, providing a cost-effective and unobtrusive solution.

A survey of commonly used home automation platforms identified 44 potential data sources within households. However, many sources require intricate processing to extract meaningful activity information. This thesis analyzed three sources - smart power meters, smart water meters, and indoor weather stations - in depth, demonstrating the feasibility of human activity detection in real-world scenarios. Among these, smart water meters showed superior reliability, achieving a precision of 0.86 and a recall of 1.00.

Unlike traditional methods, which often depend on deterministic activity data, the thesis introduces the “Inactivity Score,” a novel framework that integrates probabilistic and noisy signals into the detection process. By evaluating historical inactivity patterns, this score facilitates anomaly detection that may indicate emergencies, such as prolonged inactivity following a fall. The approach, validated on seven open datasets, achieved an average emergency detection time of 5 hours and 23 minutes with a false alarm rate of only 0.09 per day, maintaining robustness even under high noise conditions.

This dissertation highlights the untapped potential of existing household infrastructures for emergency detection, enabling a scalable, privacy-preserving, and widely applicable solution. By addressing current systems' limitations and enhancing activity recognition's reliability, the thesis contributes to improving the safety and autonomy of older adults in their homes. Future research can build upon this foundation by incorporating additional data sources and exploring adaptive algorithms for further optimization.

Die Leitung der Doktorandenvorträge am 22.1.2025 übernimmt Prof. Dr. Michael Granitzer.
Der Doktorandenbetreuer von Herrn Wilhelm ist Prof. Dr. Harald Kosch.
Die Vortragsdauer beträgt ca. 20 Minuten plus 5 Minuten Zusatzzeit.