

OPP: APPLICATION FIELDS & INNOVATIVE TECHNOLOGIES

Self-learning AI method for anomaly detection in ambient assisted living environments

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Purpose The demographic shift in Germany, along with the resulting rise in the average age of the population and the growing shortage of skilled workers in geriatric care, present challenges that demand innovative solutions. The aging population is accompanied by a growing number of individuals requiring care (Statistisches Bundesamt, n.d.). Elderly people, who live alone, are at risk of all kinds of accidents going unnoticed, leaving them without help for hours or even days. This can result in a decline in health and, in severe cases, even death. Advancing digitalization offers opportunities to support older people in maintaining their independence and living at home, improving their quality of life and reducing the workload of family members and caregivers. By using a wide range of sensors, it is already possible to recognize gradual changes in a multisensory manner at an early stage. Time-based observations of the duration of activities or everyday routines over time can provide initial indications of decreasing or unusual activities. For example, increased activity at unusual times can be a sign of sundowning syndrome and therefore dementia (Rindlisbacher & Hopkins, 1992). To achieve this, a self-learning system is being researched that adapt to individual users and continuously learn their normal behavior. This will enable early detection of changes and enable preventative measures to avoid accidents and maintain health. Movement patterns and habits vary from person to person. Therefore, an approach is needed that goes beyond a pre-trained, generalized system and takes into account and continuously learns specific individual patterns. **Method** Suitable AI methods and sensors for the project are being investigated. The interoperability of various sensors and the fusion of their data are of central importance for the project. This technical interaction is intended to give the system a comprehensive overview of the situation. Data collection, processing and analysis are to take place exclusively locally to protect the user's privacy. External communication should only occur when anomalies are identified to inform caregivers or family members. Additionally, to increase accuracy and efficiency, the process should integrate rule-based models and context-related data such as weather and temperature. Public data sets from single people, such as those provided by the Center for Advanced Studies in Adaptive Systems (CASAS) at Washington State University, will be used to develop, test and review the model (Cook, 2012). **Results and Discussion** An autoencoder was chosen as the model for the neural network. Autoencoders are commonly used for anomaly detection (Bank et al., 2023). The motion sensor data used was pre-processed accordingly in order to obtain a complete daily routine with hourly residence times. The use of online learning enables continuous adaptation of the system if a new daily routine is classified as normal. Anomalies can be detected through reconstruction-based anomaly detection and a dynamically adapting threshold approach. The procedure is to be made scalable in the next steps so that changes and anomalies can also be reliably recognized and reported over a longer period of time. The research will also investigate how to best parameterize such a system to quickly adapt to the user.

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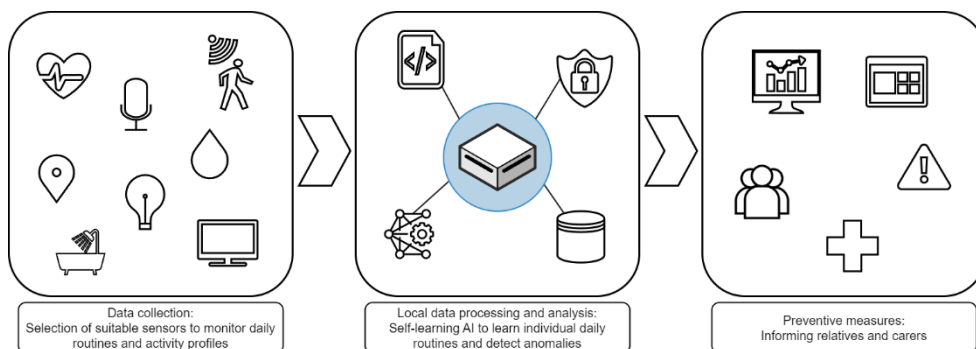


Figure 1. Overview of the proposal