



Profiling Humans Using Pattern Recognition Algorithms for Personalised Healthcare

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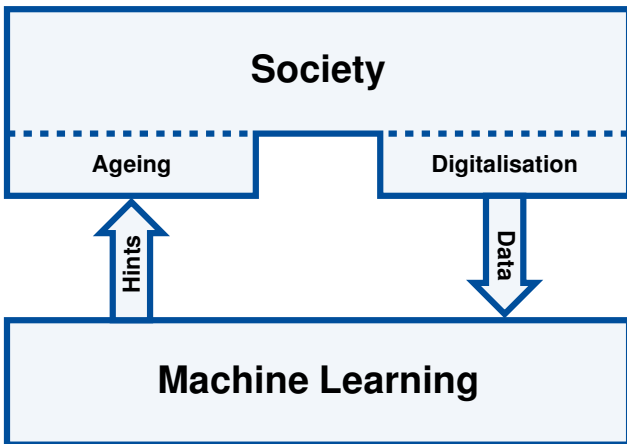


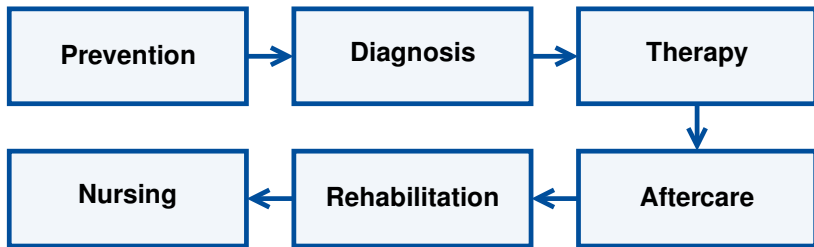


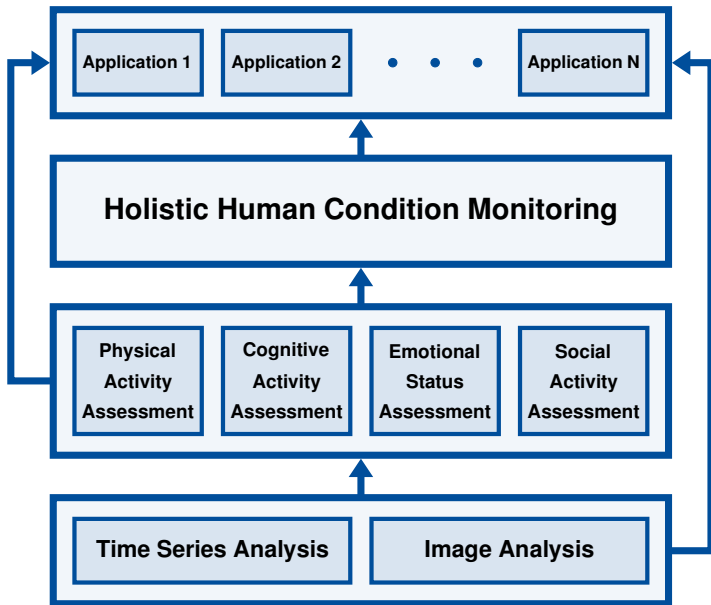
- 1 Introduction
- 2 Conscious Physical Activities
- 3 Unconscious Body Movements
- 4 Personalised Nutrition
- 5 Conclusion



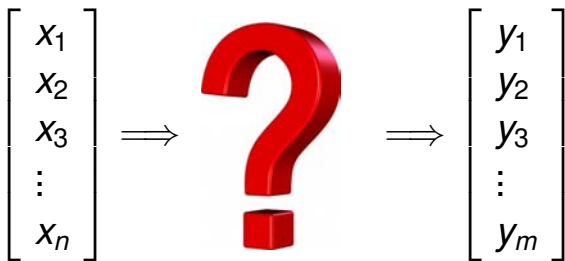
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$$\begin{bmatrix} X_1 \\ X_2 \\ X_3 \\ \vdots \\ X_n \end{bmatrix}$$



$$\begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

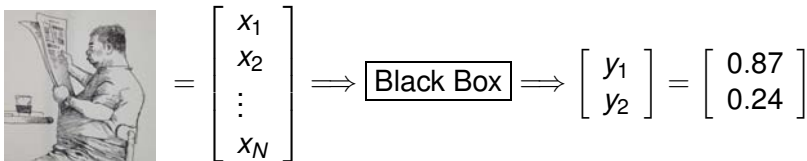


$$\begin{bmatrix} X_1 \\ X_2 \\ X_3 \\ \vdots \\ X_n \end{bmatrix}$$



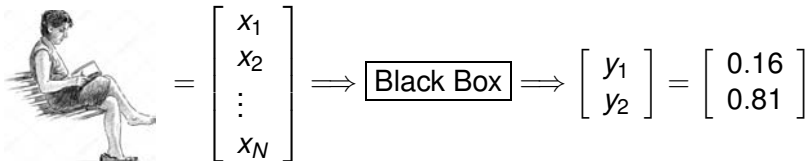
$$\begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

End-to-end insulin resistance recogniser:

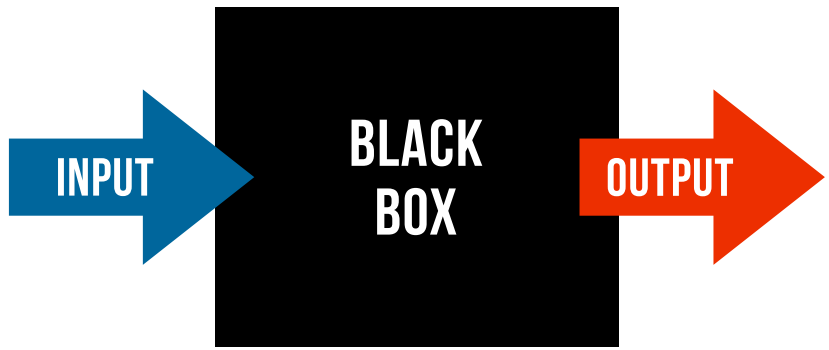


- y_1 : score for the class “insulin resistance”.
- y_2 : score for the class “no insulin resistance”.

End-to-end insulin resistance recogniser:



- y_1 : score for the class “insulin resistance”.
- y_2 : score for the class “no insulin resistance”.



INTERVIEW

mit Prof. Josef Hecken, unparteiischer Vorsitzender des Gemeinsamen Bundesausschusses (G-BA)

Wer den Algorithmus nicht offenlegt, kommt nicht in die Versorgung

Mit dem Digitale Versorgungs-Gesetz (DVG) bekommt der Gemeinsame Bundesausschuss neue Aufgaben. Die Prüfung von „Spaß-Apps“ lehnt der unparteiische Vorsitzende ab. Josef Hecken über das Fehlen der elektronischen Patientenakte, Berührungsängste der Ärzte mit digitalen Produkten und über eine künftige Datenspende.

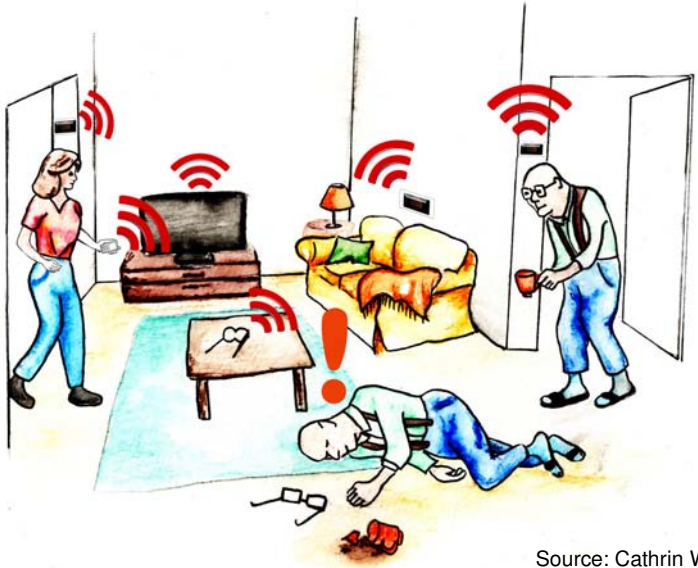




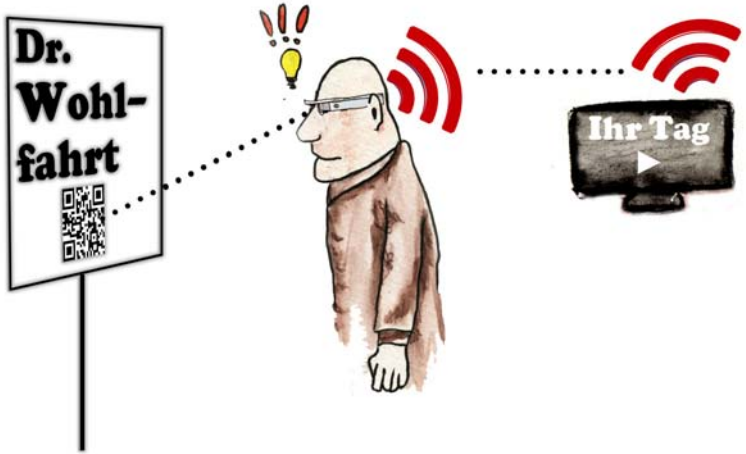
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Selected Projects	My Research Focus
CogAge (BMBF)	Physical Activity Assessment
PainMonit (BMBF)	Pain Monitoring in Physiotherapy
KIBA (EFRE – EC)	Movement Analysis and Therapy
My-AHA (EC)	Health Monitoring for Elderly



Source: Cathrin Warnke

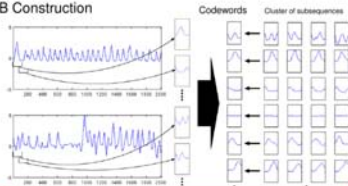


Source: Cathrin Warnke

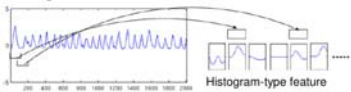
Atomic Activity Recognition

Codebook (CB) Approach^[1]

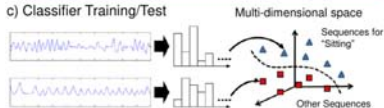
a) CB Construction



b) CB Assignment



c) Classifier Training/Test

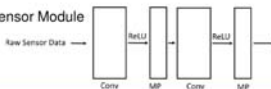


[1] K. Shirahama and M. Grzegorzek, On the Generality of Codebook Approach for Sensor-based Human Activity Recognition, Electronics (MDPI), 2017

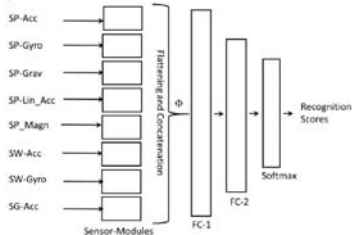
M-CNN Approach

F. Li, K. Shirahama, **M. A. Nisar**, X. Huang, M. Grzegorzek, *Deep Transfer Learning for Time-series Data Based on Sensor Modality Classification*, Sensors, MDPI, 2020

a) Sensor Module

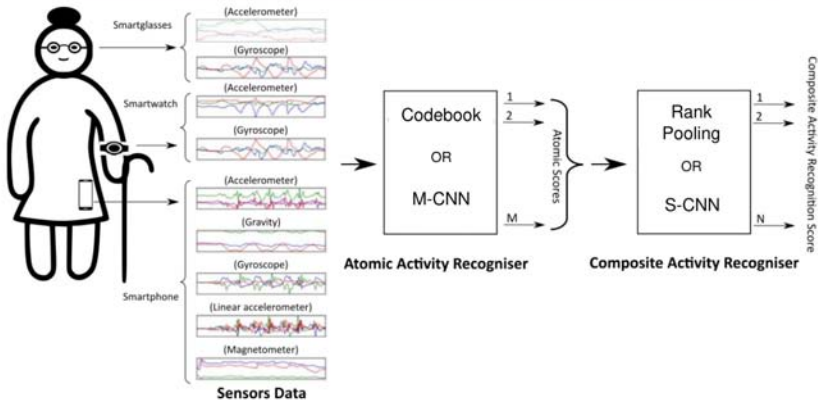


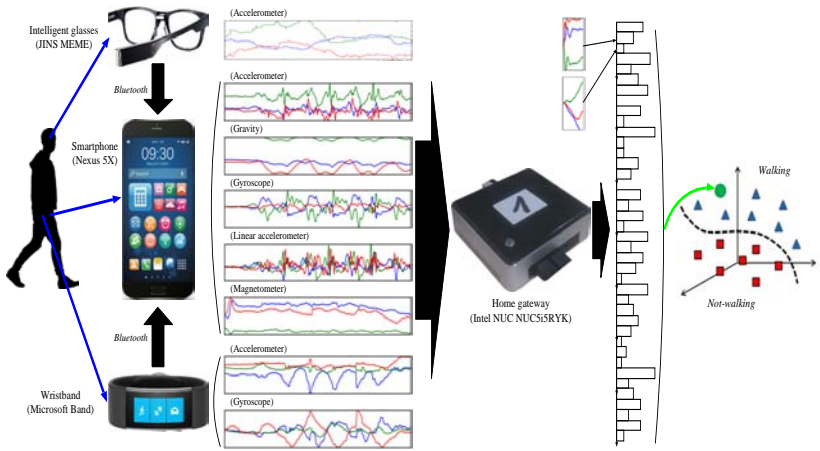
b) Multi-branch Architecture



Multilevel Activity Recognition Framework

M. A. Nisar, K. Shirahama, F. Li, X. Huang, M. Grzegorzek, *Rank Pooling Approach for Wearable Sensor-based ADLs Recognition*, Sensors (MDPI), 2020





Future-Shape GmbH

<https://future-shape.com>



Healthcare and Hospitals

SensFloor® Care 



Assisted Living

SensFloor® Life 



Gait Recording

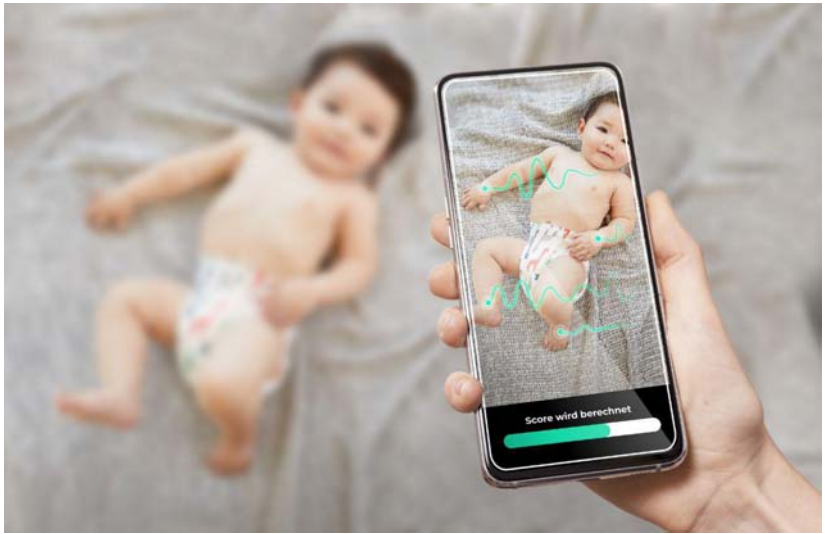
SensFloor® Gait 



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Selected Projects	My Research Focus
ScreenFM (BMBF)	Screening of Fidgety Movements
MoveGroup (BMBF)	Neurological Movement Disorders
SenseVojta (BMBF)	Vojta Therapy Assistance
My-AHA (EC)	Human Health Monitoring



ScreenFM data acquisition campaign

- Sensor devices:



RGBD Azure
Kinect camera



RGBD iPhone 12
Pro camera



4 MoveSense IMUs (3D
acceleration, 3D angular
velocity) placed at the
shoulders and hips

- Data acquisition:

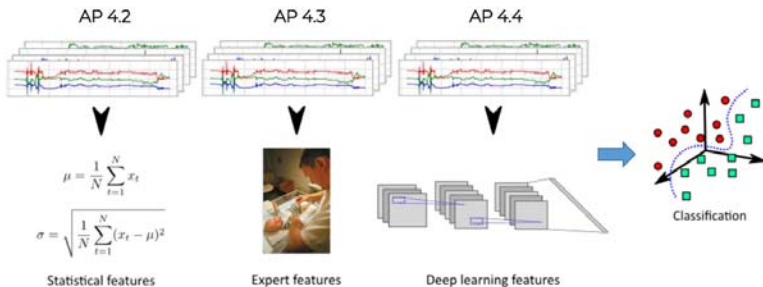
- Started January 2022
- 100 infants recruited from the UKSH Lübeck and Ratzeburg Kinderklinik
- Includes potential risk subjects (e.g. premature babies, new-borns with phototherapy, hypoglycaemia, severe respiratory adjustment disorders)



FM classification with machine learning

Three different approaches to be tested in the project:

- On RGBD video data: Motognosis GmbH
- On IMU data: UzL-IMI



Motognosis GmbH

www.motognosis.com

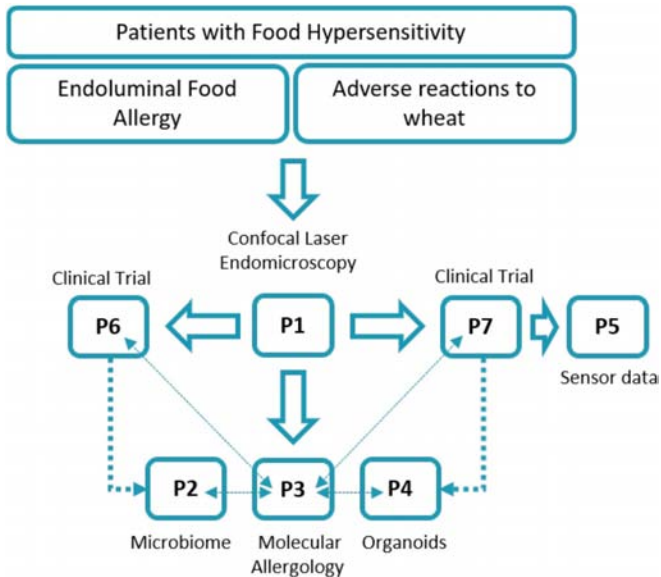


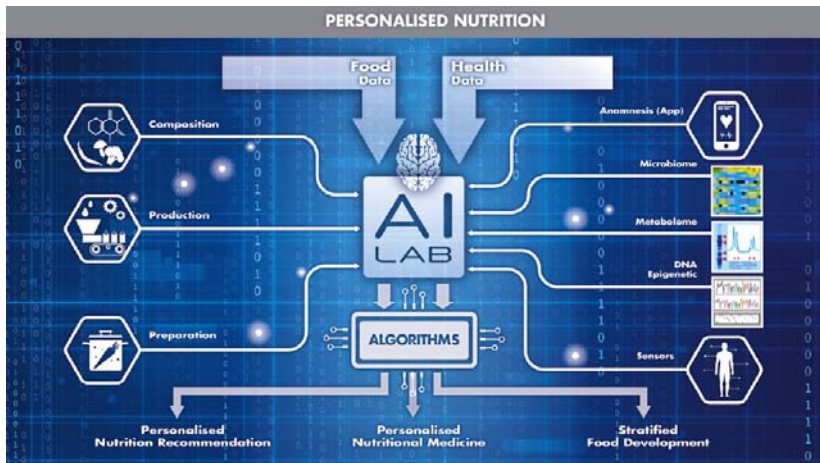


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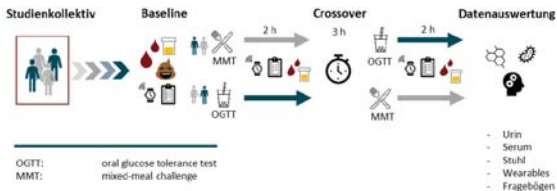


Selected Projects	My Research Focus
INDICATE-FH (BMBF)	Food Hypersensitivity Profiling
SENSE (BMBF)	Metabolic Reactions to Food
My-AHA (EC)	Human Health Monitoring





- **Study design:** 34 experimental participants in the pilot study (two days' nutritional intervention study for each participant)



OGTT

Work pipeline of the pilot study



Fresubin Mixed Meal

• **Sensor devices:**



Empatica E4 wristband

4 sensor modalities:

- **EDA:** skin conductance
- **TEMP:** skin temperature
- **BVP:** blood volume pulse
- **HR:** heart rate



BiosignalsPlus Explore Kit

4 sensor modalities:

- **EGG:** electrogastrogram
- **EOG:** electrooculogram
- **RES:** respiratory rate
- **B-TEMP:** body temperature

* **With different sampling frequencies**



Freestyle Libre 3

- **Blood glucose levels**

Perfood GmbH

<https://perfood.de>

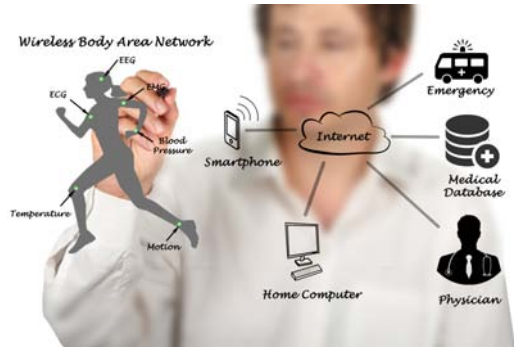
<https://millionfriends.de>





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(1) Hardware





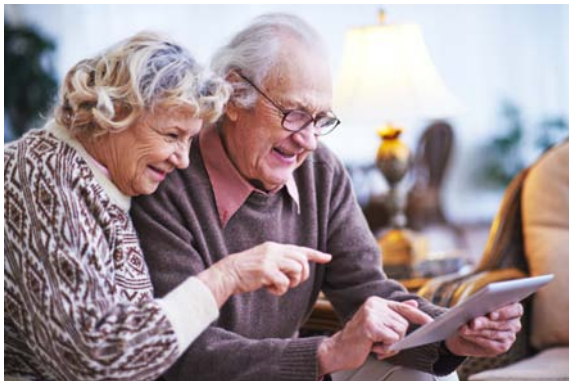
- (1) Hardware
- (2) Software



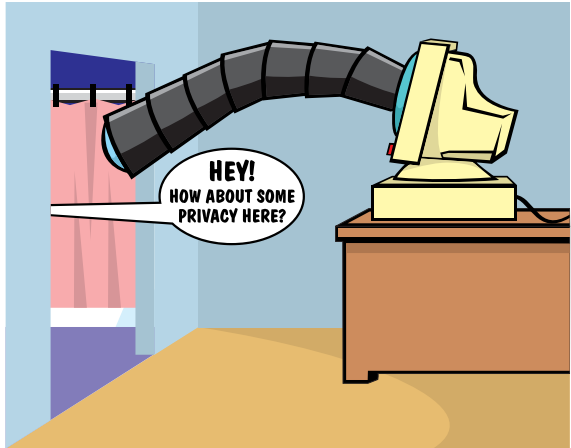
(1) Hardware

(2) Software

(3) Usability



- (1) Hardware
- (2) Software
- (3) Usability
- (4) ELSI





- (1) Hardware
- (2) Software
- (3) Usability
- (4) ELSI
- (5) Economy



