SMART DIASPORA 2023

User Trust in Ambient Assisted Living Systems

Prof. Adina Magda Florea & AI-MAS members

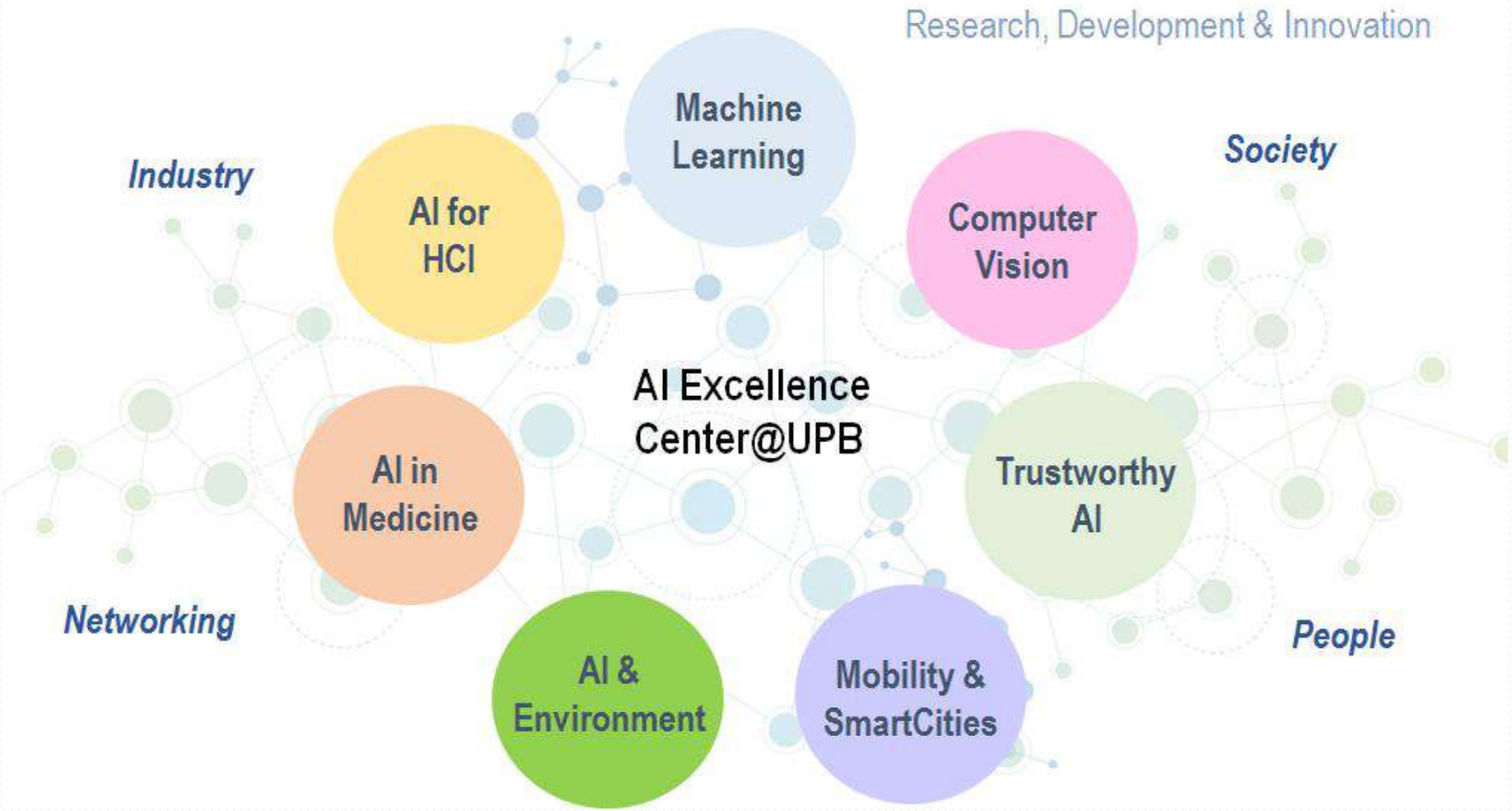
Department of Computer Science

Center of Excellence in Artificial Intelligence @ UPB

University POLITEHNICA of Bucharest

Workshop Trust-AI, 10-13 April 2023, Timișoara

Center of Excellence in Artificial Intelligence @ UPB



Center of Excellence in Artificial Intelligence @ UPB

AI-MAS Laboratory

AAL, eHealth, HAR, Autonmous Driving & Pedestrian tracking, Wellbeing, MAS , Context aware computing

https://aimas.cs.pub.ro/

AIMAS Team

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Shall we Trust AI?

About TRUST

Trust
Trust serves as a mechanism for reducing complexity. When we make a decision to trust, we are managing the uncertainty of an interaction partner's future actions by limiting the number of potential outcomes. *N. Luhmann, (1979) Defining the Problem: Social Complexity*
Trust is generally regarded as a psychological mechanism for reducing uncertainty and increasing the likelihood of a successful interaction (e.g., safe, pleasant, satisfactory) with entities in the environment. When we trust someone, we use less cognitive, physiological, and economic resources dealing with this entity *Yamagishi, T. (2011). Trust: The evolutionary game of mind and society*

About TRUST

Trust in AI

Tendency to take a meaningful risk while believing in a high chance of positive outcome

Glikson, E., & Woolley, A. W. (2020). Human trust in artificial intelligence: Review of empirical research

If H (human) perceives that M (AI model) is trustworthy to contract C, and accepts vulnerability to M's actions, then H trusts M contractually to C

Jacovi, A., Marasović, A., Miller, T., & Goldberg, Y. (2021). Formalizing trust in artificial intelligence: Prerequisites, causes and goals of human trust in AI

About TRUST

Trust in AI

→ Human agency and oversight
→ Technical robustness and safety
→ Privacy and data governance
→ Transparency
→ Diversity, non-discrimination and fairness
→ Societal and environmental well-being
→ Accountability

Ethics guidelines for trustworthy AI, (2019), European Comission

Ambient (Active) Assisted Living

- Development of innovative technology and the innovative use of existing technology towards a happier, more independent way of living for elderly people and people with special needs
- Innovative utilization of ICT, new ways of user interaction or new types of value chains for independent living services

Active and Assisted Living

- Health monitoring & support
- Daily activity support
- Activity recognition
- Companionship

- Sensors, wearable technology
- Social assistive robots
- AI

AI-MAS Laboratory
One of research directions - AAL

- Health monitoring
- Activity recognition and support
- Companionship

- Programming social assistive robots
- Integration of sensors and wearable technology

AMIRO System

AMIRO Platform (S. Ghita et.al., 2019,2021)

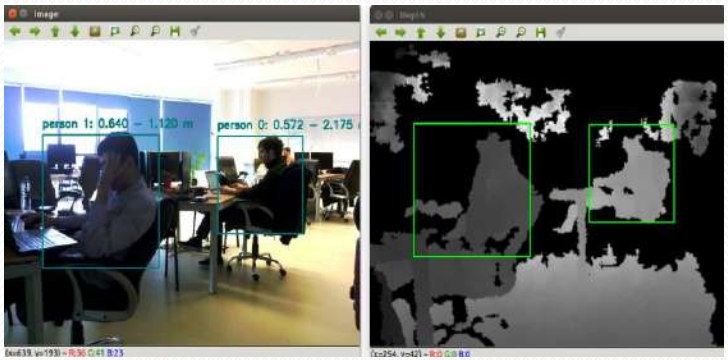
- Available integrated on Pepper robot
- Available on mobile devices, without robot facilities

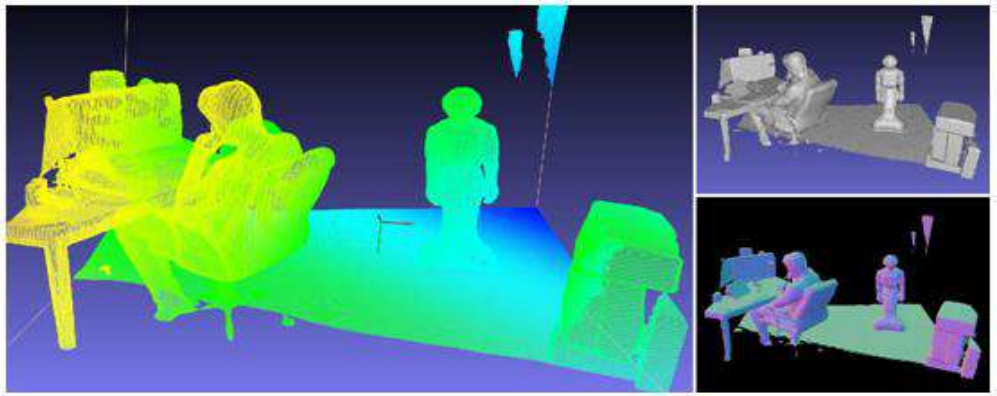
AMIRO

- **Robot navigation** in the environment
- **Visual interpretation** of people, objects in the environment
  - Recognize and track people
  - Recognize objects
- Interacts with people
  - Natural language **dialogs** between users and robot
  - Issuing alerts
- Support for user **physical exercises**
- Integration with **body sendsors** and **interpretation of data measurements**
- Integration with **environmental sensors** and **interpretation of data measurements**

AMIRO

- Pepper functionalities – several limitations identified
- **Developed our own solution** for
  - ***people detection*** - the robot needs to know where the person is in the room
  - ***people recognition*** - recognize the person so as to provide the information specific to the user, by accessing this information in the CAMI cloud
  - ***navigation in the environment*** - navigate to approach the person -> do a mapping of the environment





Pepper in AMIRO

Pepper acts as assistant for elderly people

- Efficiently **looks for and finds a particular person**
- **Notifies** the person **regarding personal health or well-being issues,** e.g., take medication, take blood pressure, perform physical exercises, call friend, etc.
- **Follows a person in the room**

Pepper in AMIRO

- Comunicates with the user with a **vocal/touch interface**
- **Collects data** regarding sensors
- Is able to **receieve and execute commands** for domotic devices
- Instructs users to **perform exercices** and **corrects him/her**

Body sensor measurements

- **Weight measurement analysis** - informs caregiver and user with different messages if there are any increase/decrease from the current weight by 2kg.
- **Steps data analysis-** Done once per day (based on the number of steps that user has taken) - informs caregiver or user with different messages
- **Analyzing health parameters (**like pulse) - generates a notification to user and caregiver if the pulse measurement is outside the normal range
- **Generation of various kind of reminders** for notifying user or caregiver - for example taking the blood pressure measurement or taking medicine at a given time

Multimodal interface (A. Awada et. al., 2019, 2020)

The interface adapts to the:

- preferences of the user
- status of the user (e.g. medical condition, emotional status)
- environment condition + user activity
- system configuration (e.g. presence/absence of modules)

Multimodal interface

- The interface is multilingual and supports multimodal interactions
  - voice interactions
  - touch-based gestures
  - touch-free gestures

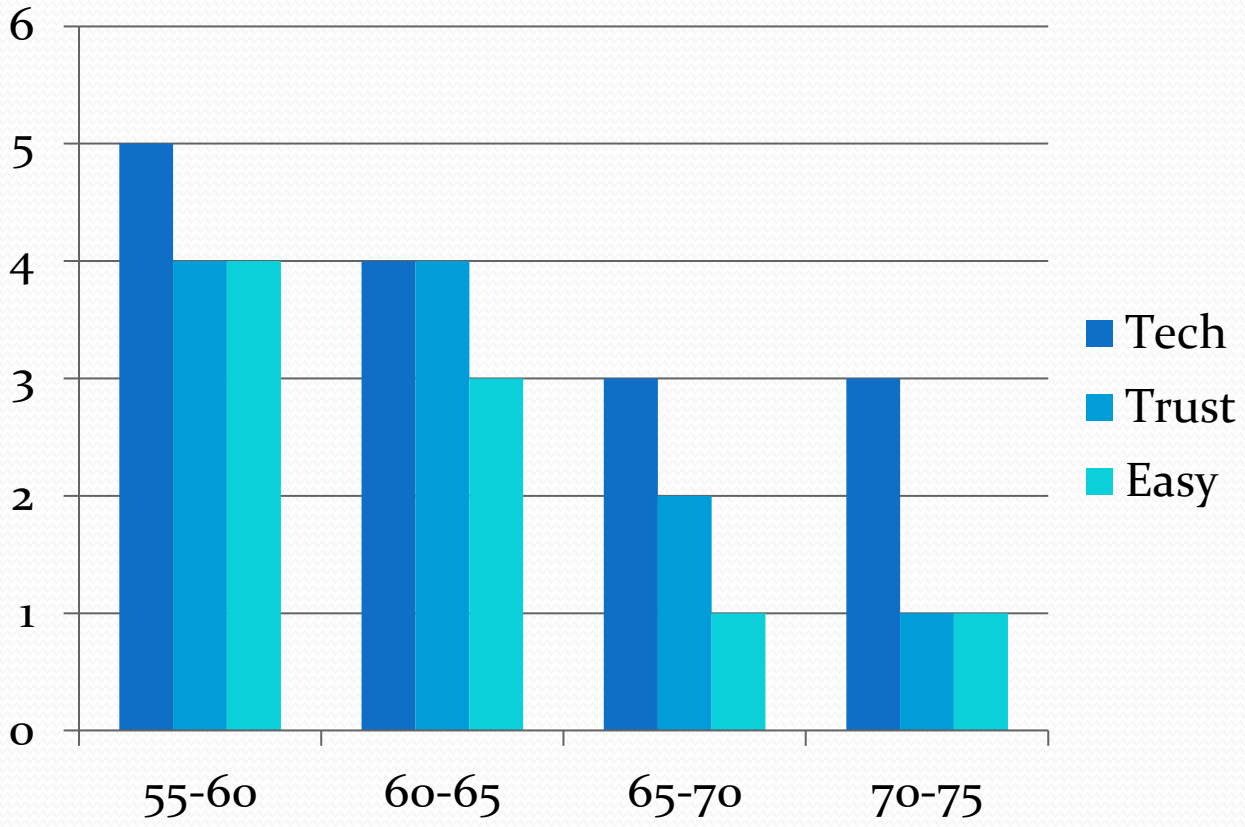
Field trials

- 105 primary end-users from Romania, Poland and Denmark
- 58 secondary end-users

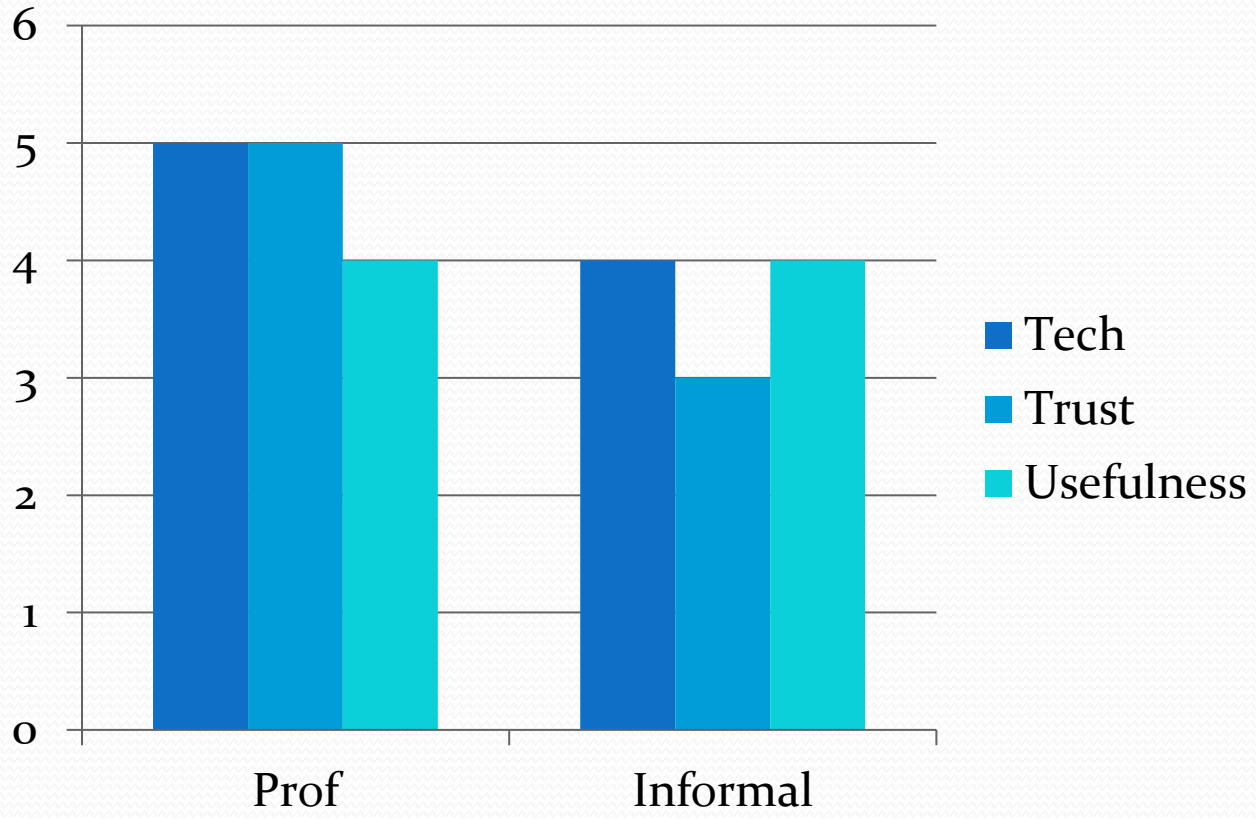
The primary users were between 55 and 75 years old, which was the only eligibility criterion applied in their selection
The second users consisted of 22 professional (37.9%) and 36 informal (62.1 %) caregivers

- Appreciate technologies
- Trust technology
- Easyness of use

Primary end-users

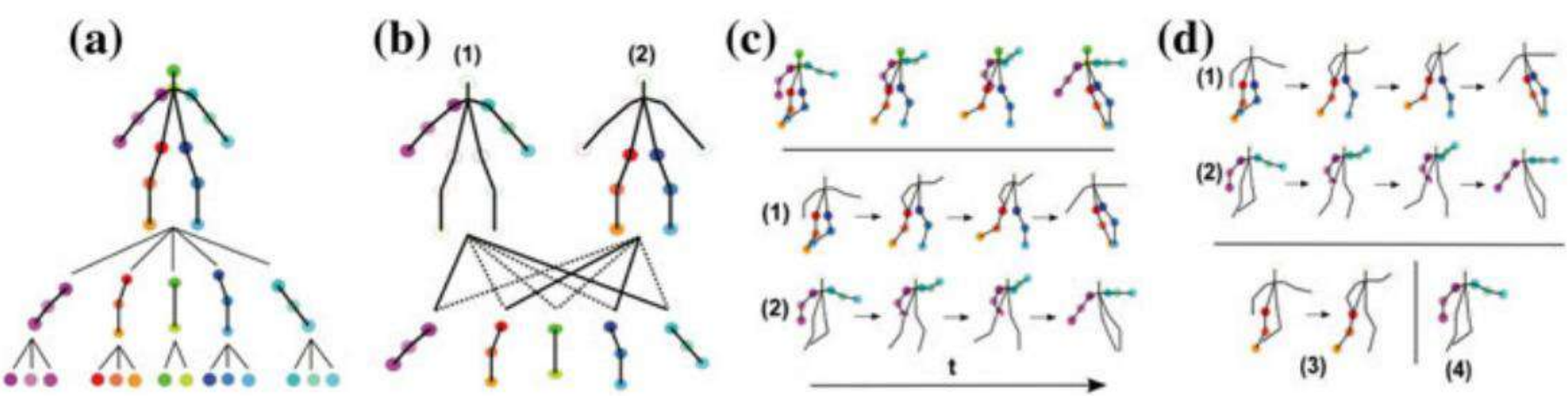


Secondary end-users



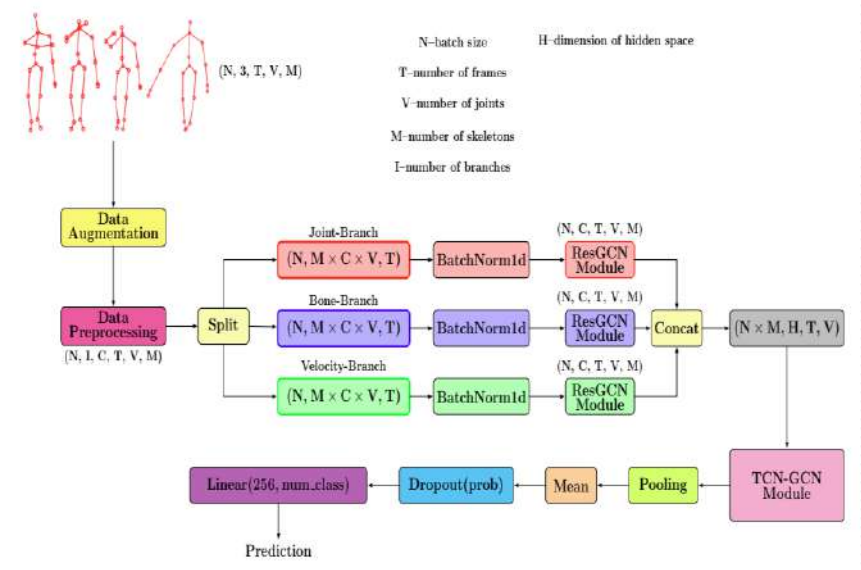
Understanding user actions (M. Trascau et.al., 2020)

- Basic human skeleton representation was first introduced by Johanson in 1973, demonstrating that a small number of points can effectively represent the behavior and characteristics of the human body
- The coordinates of the points that make up the skeleton can model relationships between joints and codify the whole body configuration using a very small amount of information



Human action recognition from video sequences

- Skeleton input data – Kinect & synthesied from RGB
- Use original TCN and GCN architectures - reduced number of parameters and increased speed
- Recognizes 120 different human actions
- Validated by integration into the AMIRO robotic platform (original)



- typing on a keyboard

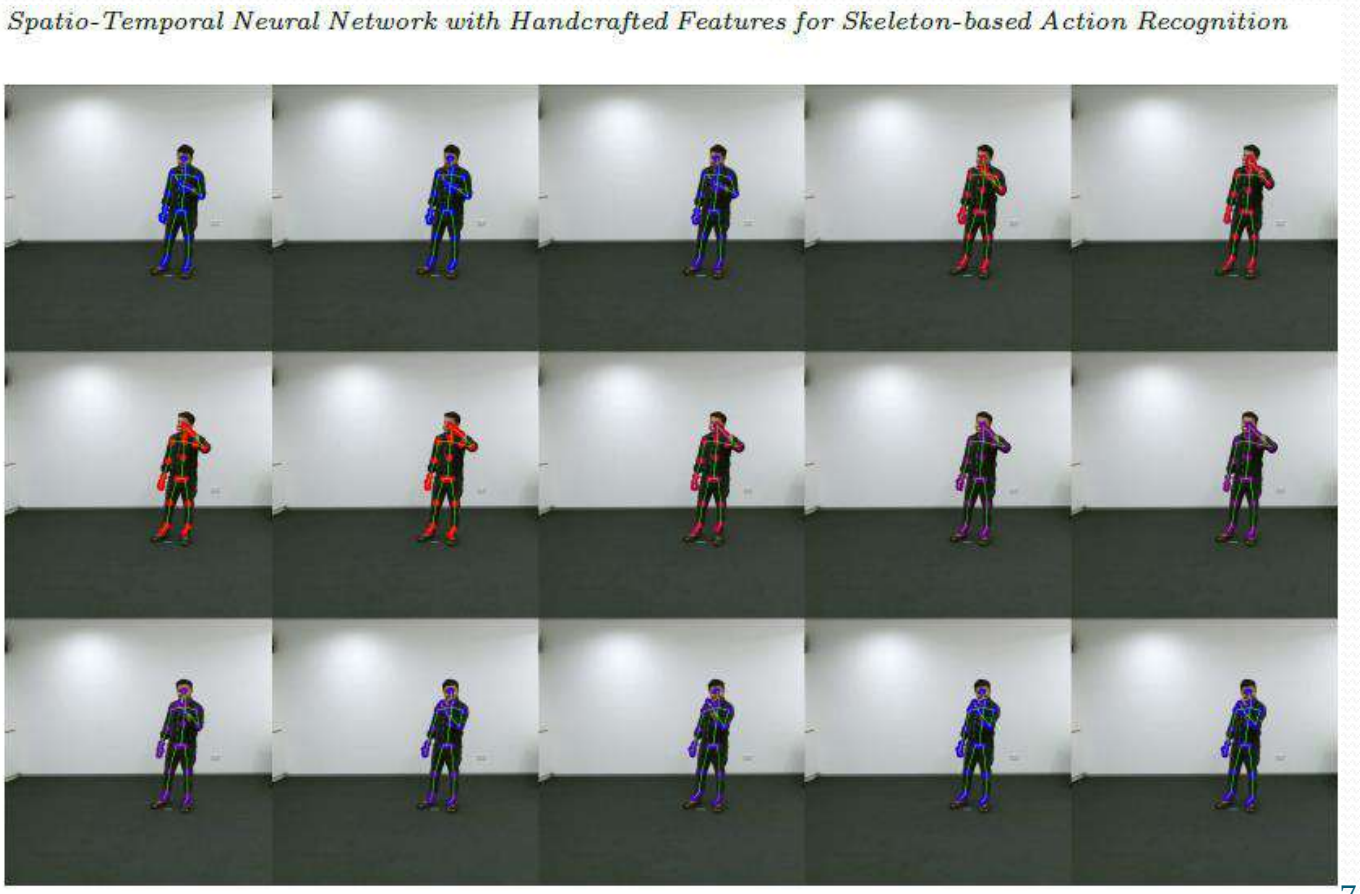
- pointing at something

- sneeze/cough

- touch chest (stomachache/heart pain)

Understanding user actions (M. Nan et.al., 2022)

- Explainability - explain why an action was recognized based on skeletons



INCARE (Irina Mocanu & team)

INCARE is a digital platform connected to sensors and devices that allow users to monitor different health, activity and cognitive parameters, keeping them physically active and engaged with their peers

INCARE (Irina Mocanu & team)

Health & activity monitoring

Indoor and outdoor localization and fall detection

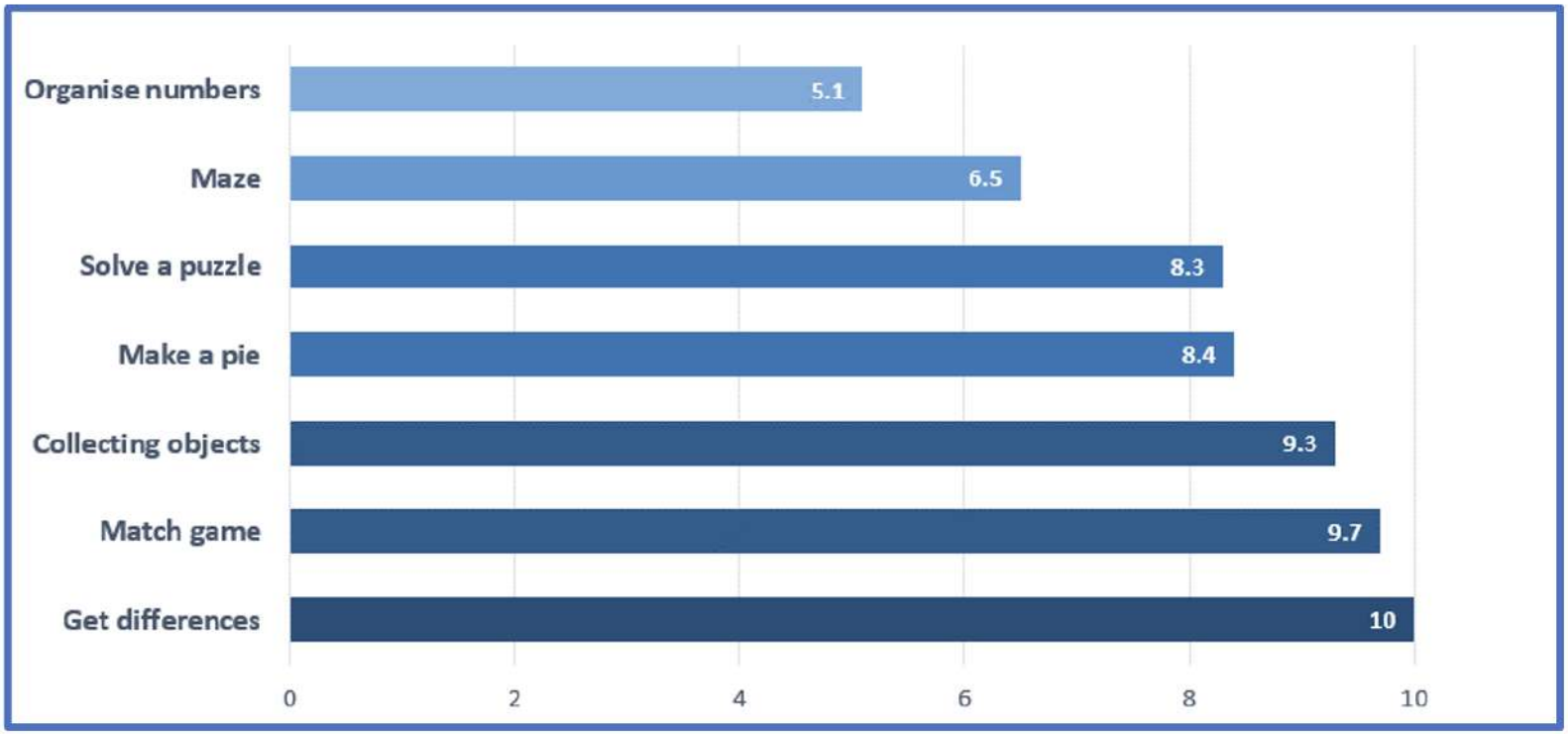
Cognitive games: to stimulate attention, memory, reaction speed, logical problem-solving

Object manipulation (TIAGo robot)

Multimodal interface (touch and voice-based commands)

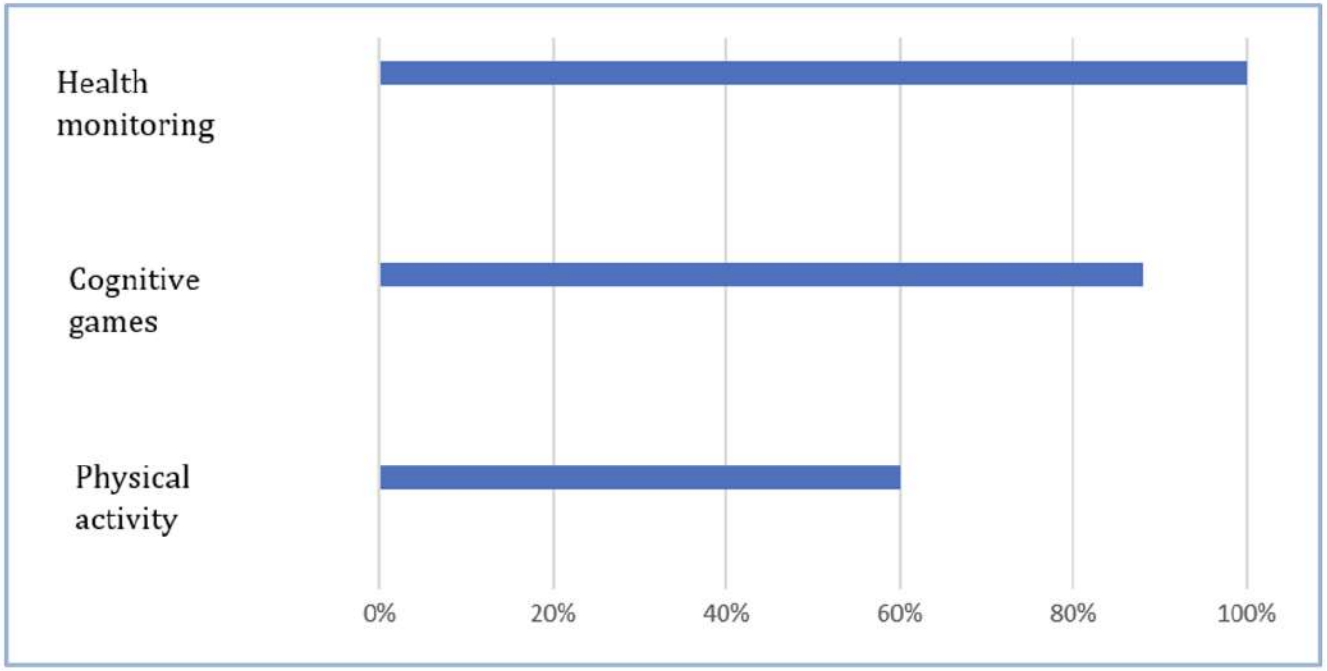
Home monitoring

Games evaluation: average level of satisfaction ranked on a 1-10 scale



100 elderly users participated in the test

Impact of INCARE solution on seniors' health practices/routines



AI-MAS - Projects to start

CNCC - Centrul Național de Competență în domeniul Cancerului

Kick-off meeting CNCC

31 ianuarie 2023, 13:00 - 15:00

Bulevardul Eroii Sanitari 8, București

UNIVERSITATEA DE MEDICINĂ ȘI FARMACIE GRIGORE T. POPA IAȘI

KOL Medical Media
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IOCN Institutul Oncologic "Prof. Dr. Ion Chiricuță" Cluj-Napoca

Victor Babeș National Institute of Pathology

NETVIBES

OncoHelp TM

OncoMed

SISTEMUL MEDICAL MedLife

Horizon Europe

ENFIELD: European Lighthouse to Manifest Trustworthy and Green AI

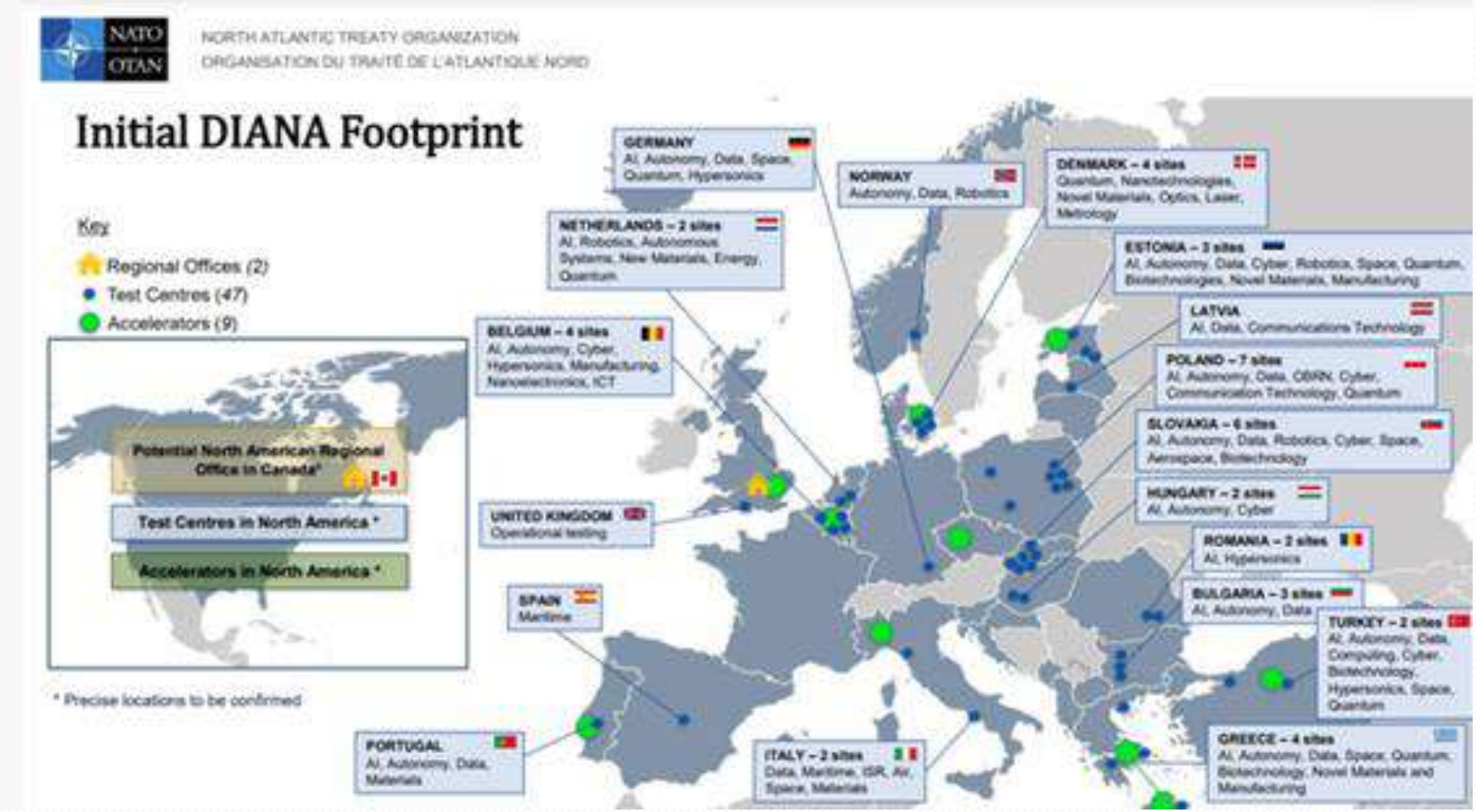
ENFIELD will create a unique European Centre of Excellence that excels the fundamental research in the scientific pillars of Adaptive, Green, Human-Centric and Trustworthy AI

Human-Centric AI pillar – TUE & UPB

ENFIELD aims at designing novel techniques aimed at enhancing the explainability of AI systems, providing a comprehensible description of the internal procedures used while the model is trained or makes decisions, providing context-aware explanations for different stakeholders with different user profiles.

AI-MAS - Projects to start

Member of the **Defence Innovation Accelerator for the North Atlantic – DIANA - Test Centres Network**



Testing Center facilities

- Ambient Assisted Living testing facilities
- Imitation learning simulator for autonomous driving, based on real data
- Own collected data sets to be used in testing and validation
- First set of tools for ExAI for object recognition and HAR