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TIC | Salut Social
Technology, innovation
and digital transformation.

Imagine 2029: Our data, our health, our care – 20th anniversary of EHTEL

EHTEL 2019 Symposium

16:30 – 17:45 [S5]



Aula 1
First Floor

AI as a Trustful Enabler for Better Health and Better Care - *concluded by a Debate*

More use cases and insights on betterment of health and care enabled by artificial intelligence.

Session Chair: Matteo Mellideo, Engineering, Rome, Italy

Use Cases enabled by High Performance Artificial Intelligence

Ulises Cortés, Barcelona Supercomputing Center, Barcelona, Spain

DMCoach+: A Digital Coach to Enhance the Self-Management of Diabetic Patients

Roberto Pratola, DMCoach and Engineering, Rome, Italy

AI-enabled Social Robots: Artificial Intelligence in Direct Interaction

Joao Quintas, Instituto Pedro Nunes and LifeBots Project, Coimbra, Portugal

Q&A - Panel Debate with the Audience

Moderator: Diane Whitehouse, EHTEL

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DM+
Coach

T...Systems
Let's power higher performance



#EHTEL_Symposium



#EHTEL_BCN



@ehtel_eHealth



DM+ Coach

A case study of telehealth applied on Type 2 Diabetes Management

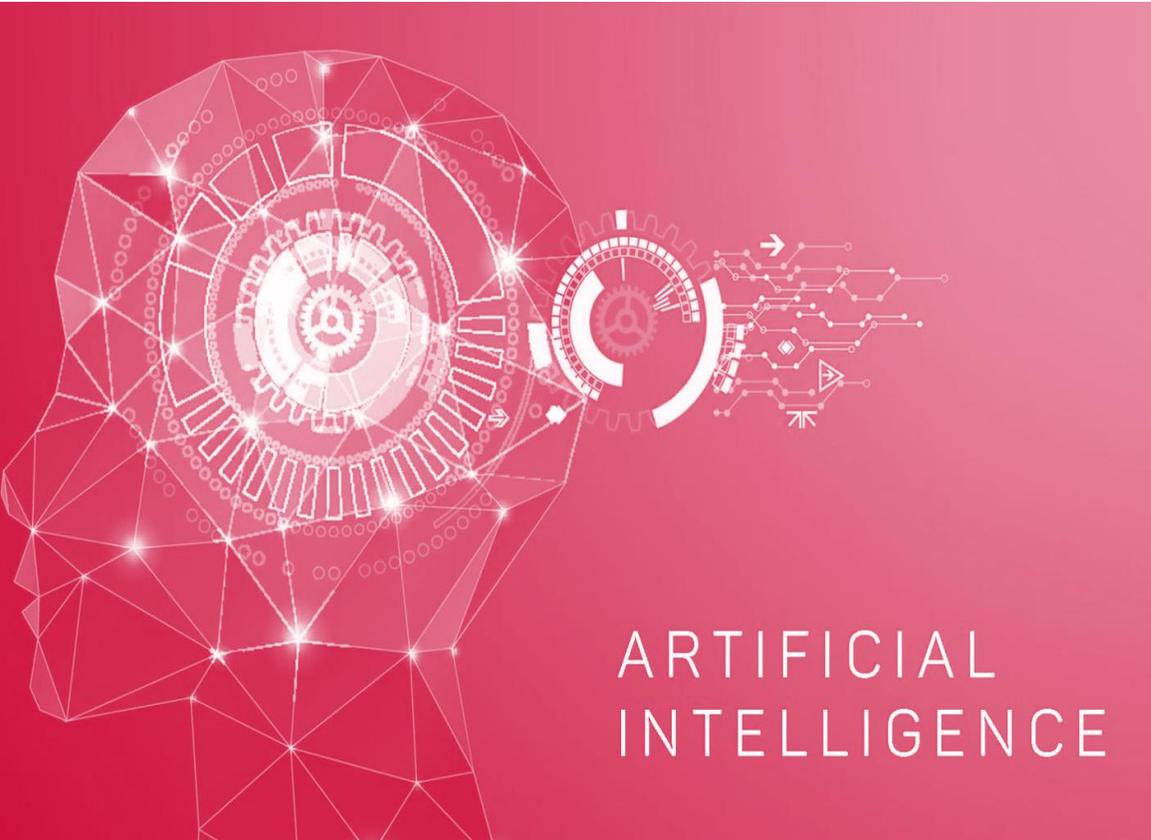
Fact and Figures



Our aims



Study Objective



Evaluate the **perception of** and the **engagement on**, of both patients with *Type 2 Diabetes Mellitus* and people at-risk-of, a **AI enriched digital coach** to prevent and manage the disease

Involved users

Doctors have been involved to ***tailor*** the solution

Patients and People at risk have been involved

The process

Phase 1

- Context: **Healthcare**
- elderly (60+) patients with T2DM
- diabetologists

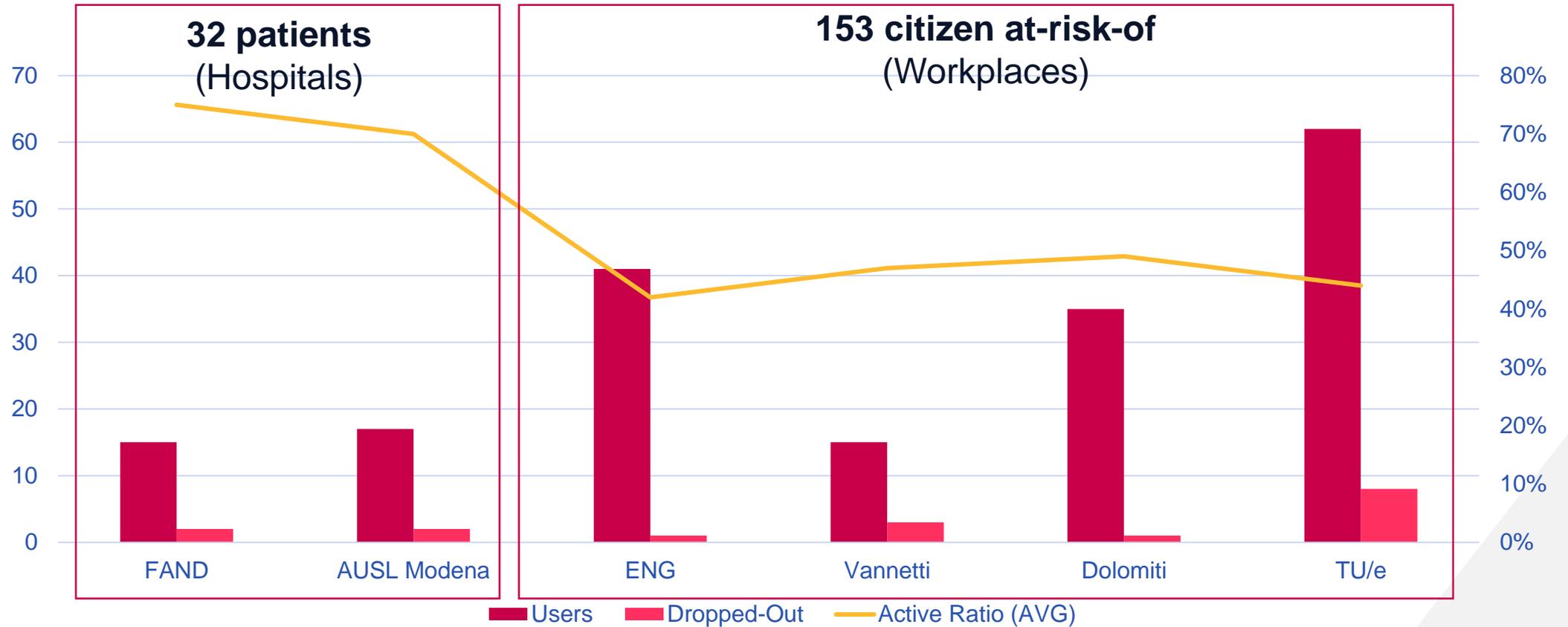
Phase 2

- Context: **Workplace Health Promotion**
- people at risk
- occupational doctors

Comparison

(ongoing)

Active ratio of users (tot: 185)



Overall Results

- In the first phase (with patients) the doctors' interventions have been more than the latter (with people at risk) thus a reduction of the adherence has been observed.
 - The involvement of the practitioners (when low interactions have been observed) has been *partially* compensated by the **social challenges**
- The more users felt involved in the solution, the more they **adhered** to doctors' directions

What the final users liked

- the tool itself increases the positive perception **on** the healthcare institution/company (perceived as innovative and “near” to them)
- the **nutrition diary** support their everyday life
- educational seen as practical pills
- **data** was shared only with doctors through a **secure** platform
- personalized coaching messages (automatic based on AI) was **considered reliable** (as the doctors enabled the app)

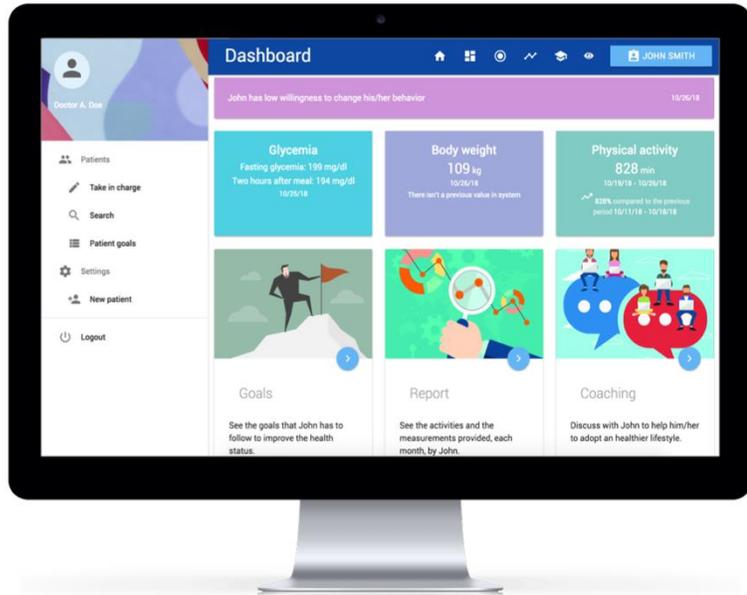
How it works?

DMCoach+

A solution managing Type 2 Diabetes Mellitus and preventing chronic diseases.

- provides **coaching** and **advices** towards healthy lifestyles
- enabled by doctors (*human touch*) who tailor the solution **on the specific needs of the users** and coach them keeping them **engaged** and **motivated**
- implements **Trans-Theoretical Model*** (*AI-based approach*)
- includes **gamification techniques** to create **social challenges** on health

DMCoach+



doctors easily **tailor** the app defining goals (and challenges)



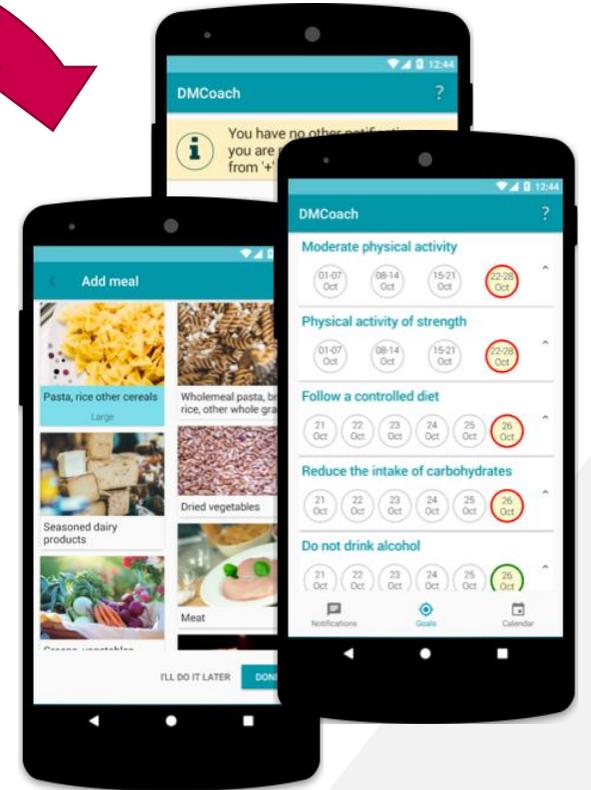
patients/users **comply** with the goals and get **automatic feedback**



adaptive feedback on users' behaviours



doctors **monitor** performance and send **personalized feedback (Human touch)**



What can be expected?

when interacting with digital coaches

... from doctors?

- Willingness to **support** patients
 - as to reduce the frequency of encounters
- **Remote coaching** of patients
 - often enabled by specialized nurses
- Interaction with (selected) patients to **motivate** them or **improve** their behaviours



... and from patients?

- Willingness to change behaviours
- Perseverance and engagement
 - as long as the human touch is perceived
- No propensity to lie (while tracking habits)



THANK YOU



 www.dmcoach.eu

 [@DMCoachTeam](https://twitter.com/DMCoachTeam)

 [Roberto Pratola](https://www.linkedin.com/in/RobertoPratola)



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LIFEBOTS
EXCHANGE

João Quintas

Intelligent Artificial Social Companions: European case studies and future directions

The annual EHTEL Symposium
Collaborating for Digital Health and Care in Europe

Barcelona, 3 December 2019

Artificial Social Companions in AAL



COGNIVITRA

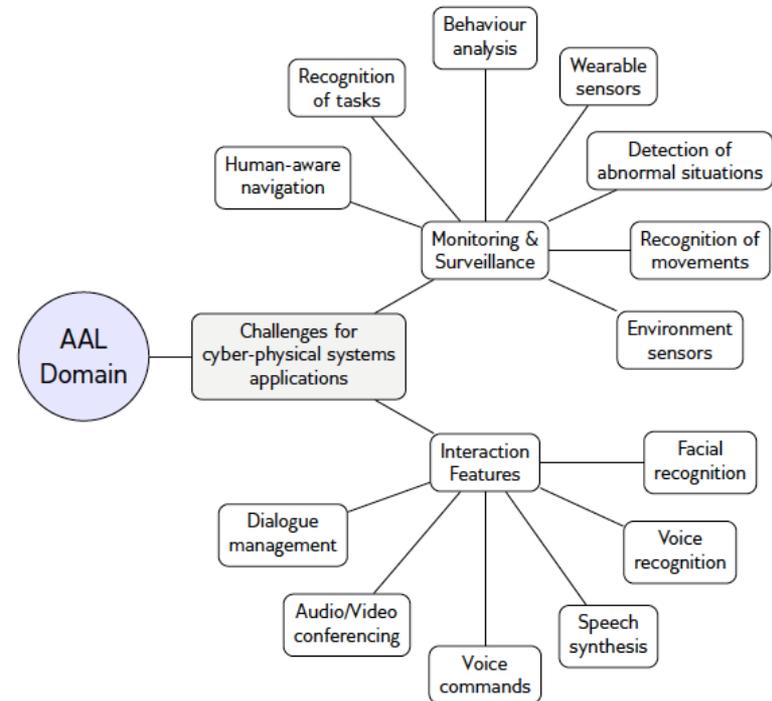


Problem



Variety of open scientific and technological challenges related with HMI/HCI/HRI but ...

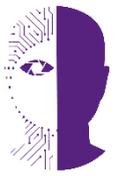
... There is still a lack of standardization in Robotics and Automation (R&A) field in terms of the way some core components are implemented



Based on needs and requirements of:



Problem



CaMeLi

“... after sometime interacting with the system, passed the novelty effect, we observed, [...] a **decrease in acceptance**. The most reported reason was that **the agent did not fully reach users’ original expectations**.“

“Participants easily got **frustrated after a few unexpected verbal behaviour by the agent**.“

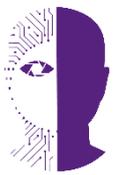


Artificial Social Companions in AAL CaMeLi and CogniViTra (AAL projects)



Artificial Social Companions in AAL

CogniViTra AAL project



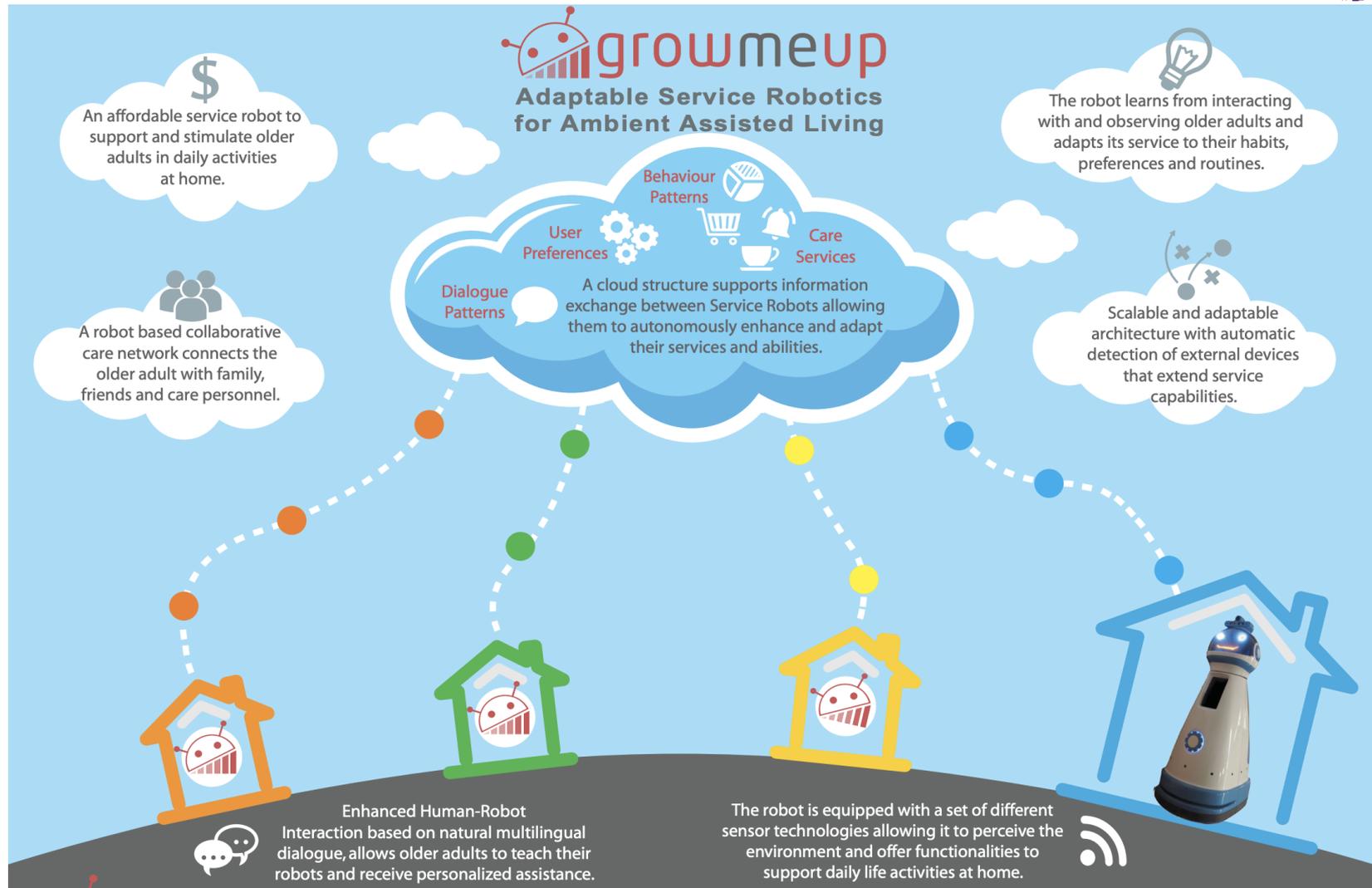
COGNIVITRA



<https://cognivitra.las.ipn.pt/>

Artificial Social Companions in AAL

GrowMeUp H2020 project



Contact :
growmeup@uc.pt
www.growmeup.eu

Funding :



Project Duration :
01/02/2015
-
31/01/2018

Project Partners :



Artificial Social Companions in AAL

Application scenario



Based on needs and requirements of:



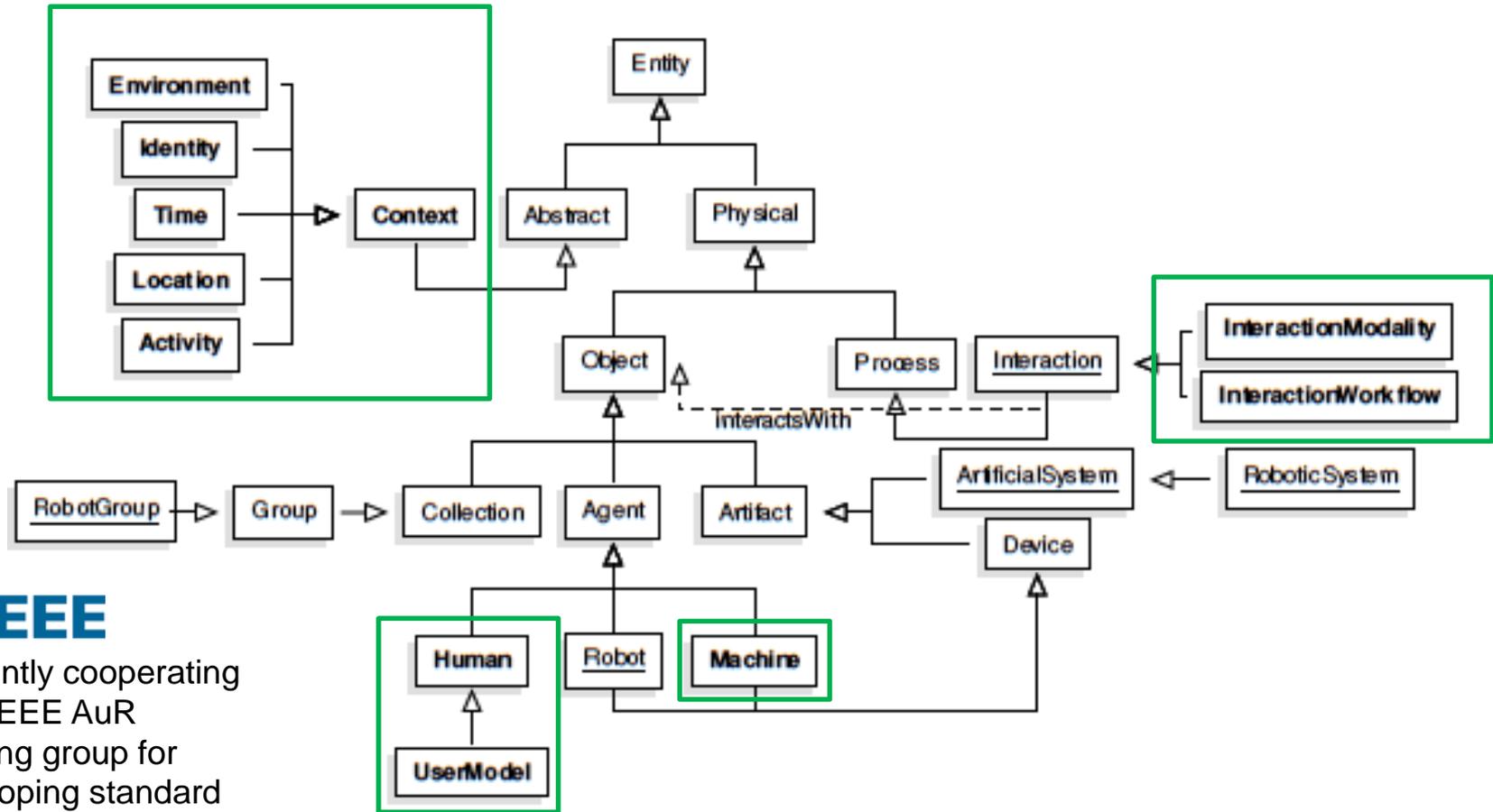
Context-Aware Human-Robot Interaction Framework

Knowledge representation



J. Quintas, G. S. Martins, L. Santos, P. Menezes, J. Dias, "Toward a Context-Aware Human-Robot Interaction Framework Based on Cognitive Development", in IEEE Transactions on Systems, Man and Cybernetics, May 2018. DOI: 10.1109/TSMC.2018.2833384.

J. Quintas, P. Menezes, J. Dias, "Information Model and Architecture Specification for Context Awareness Interaction Decision Support in Cyber-Physical Human-Machine Systems", in IEEE Transactions on Human-Machine Systems, 47 (3), 323-331, December 2016, DOI: 10.1109/THMS.2016.2634923.



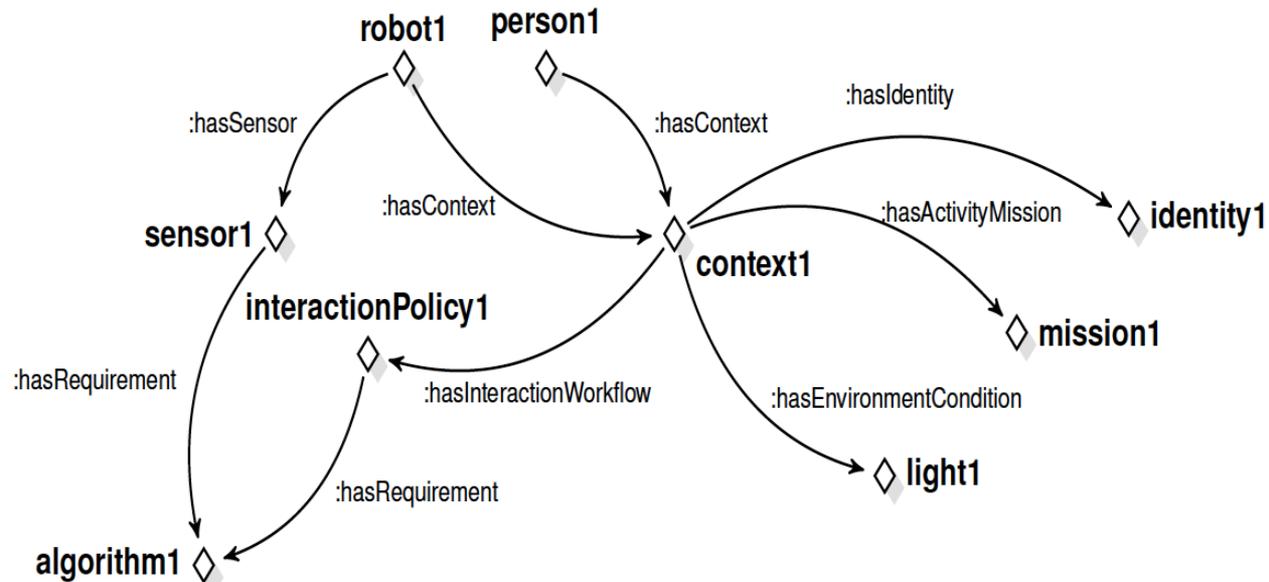
Currently cooperating
with IEEE AuR
working group for
developing standard
IEEE 1872.2

CAHRI Framework

Application scenario – Describing scenario ontology



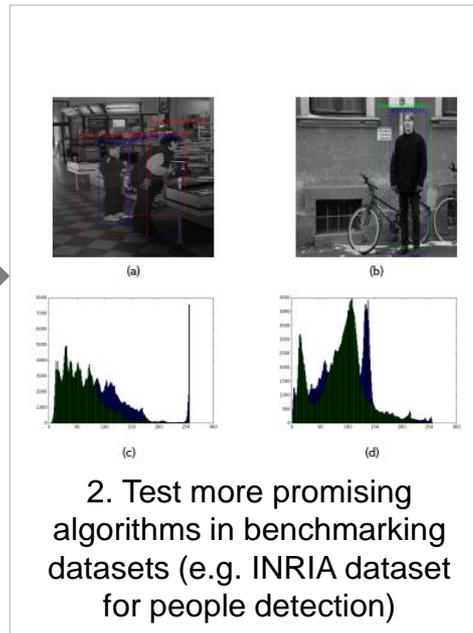
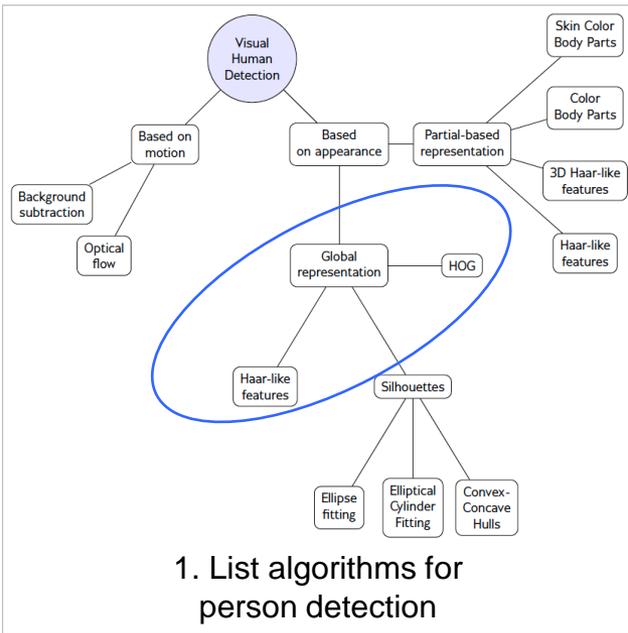
J. Quintas, G. S. Martins, L. Santos, P. Menezes, J. Dias, "Toward a Context-Aware Human-Robot Interaction Framework Based on Cognitive Development", in IEEE Transactions on Systems, Man and Cybernetics, May 2018. DOI: 10.1109/TSMC.2018.2833384.



<http://www.contextawarerobotics.org/cahri/kr/im-cahri.owl>

CAHRI Framework

Application scenario – Feature description & implementation



$$\{S, \mathcal{A}, \mathcal{O}, \Omega, T, R\}$$

$S = \{s_0 = \text{person detected}, s_1 = \text{person not detected}\}$
 $\mathcal{A} = \{a_0 = \text{haar detection}, a_1 = \text{hog detection}, a_2 = \text{check light}\}$
 $\mathcal{O} = \{o_0 = \text{dark light}, o_1 = \text{good light}, o_2 = \text{bright light}\}$

$$T_{a_0} = \begin{bmatrix} s_0, s_0 & s_0, s_1 \\ s_1, s_0 & s_1, s_1 \end{bmatrix} = \begin{bmatrix} 0.9 & 0.1 \\ 0.9 & 0.1 \end{bmatrix}$$

$$T_{a_1} = \begin{bmatrix} s_0, s_0 & s_0, s_1 \\ s_1, s_0 & s_1, s_1 \end{bmatrix} = \begin{bmatrix} 0.9 & 0.1 \\ 0.9 & 0.1 \end{bmatrix}$$

$$T_{a_2} = \begin{bmatrix} s_0, s_0 & s_0, s_1 \\ s_1, s_0 & s_1, s_1 \end{bmatrix} = \begin{bmatrix} 1.0 & 0.0 \\ 0.0 & 1.0 \end{bmatrix}$$

$$O_{a_0} = \begin{bmatrix} s_0, o_0 & s_0, o_1 & s_0, o_2 \\ s_1, o_0 & s_1, o_1 & s_1, o_2 \end{bmatrix} = \begin{bmatrix} 0.494 & 0.402 & 0.104 \\ 0.388 & 0.418 & 0.194 \end{bmatrix}$$

$$O_{a_1} = \begin{bmatrix} s_0, o_0 & s_0, o_1 & s_0, o_2 \\ s_1, o_0 & s_1, o_1 & s_1, o_2 \end{bmatrix} = \begin{bmatrix} 0.450 & 0.435 & 0.115 \\ 0.395 & 0.395 & 0.210 \end{bmatrix}$$

$$O_{a_2} = \begin{bmatrix} s_0, o_0 & s_0, o_1 & s_0, o_2 \\ s_1, o_0 & s_1, o_1 & s_1, o_2 \end{bmatrix} = \begin{bmatrix} 0.000 & 0.500 & 0.500 \\ 0.000 & 0.500 & 0.500 \end{bmatrix}$$

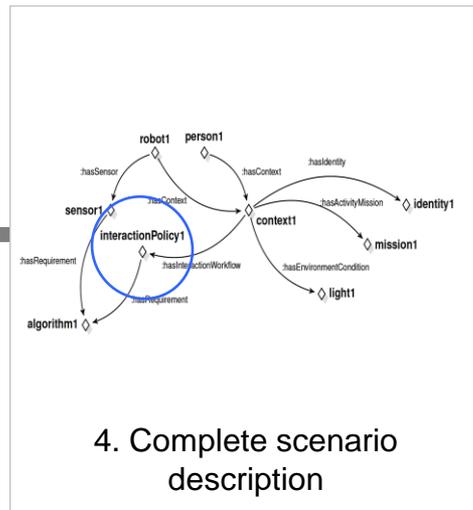
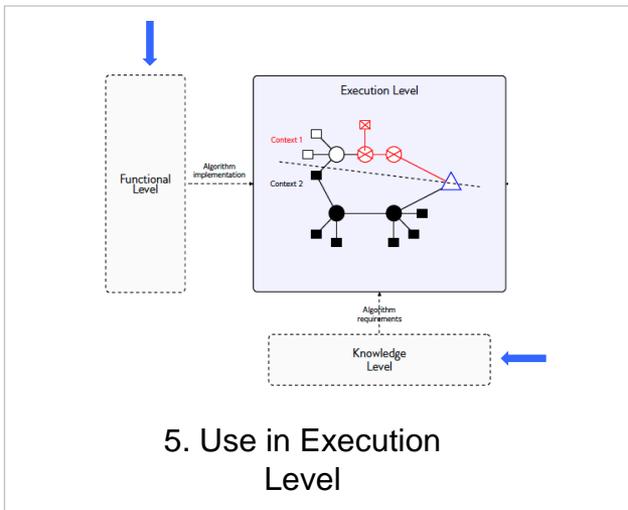
$$R(s_0, a_0, s', o) = 20 \quad R(s_1, a_0, s', o) = -100$$

$$R(s_0, a_1, s', o) = 20 \quad R(s_1, a_1, s', o) = -100$$

$$R(s, a_2, s', o) = -5$$

$$\pi^*(b) = \arg \max_{a \in \mathcal{A}} \left[r(b, a) + \sum_{o \in \mathcal{O}} P(o|b, a) V^*(b') \right]$$

3. Define decision process model to obtain interaction policies
(POMDP tool by Anthony R. Cassandra's in pomdp.org)



CAHRI Framework

Application scenario – Results

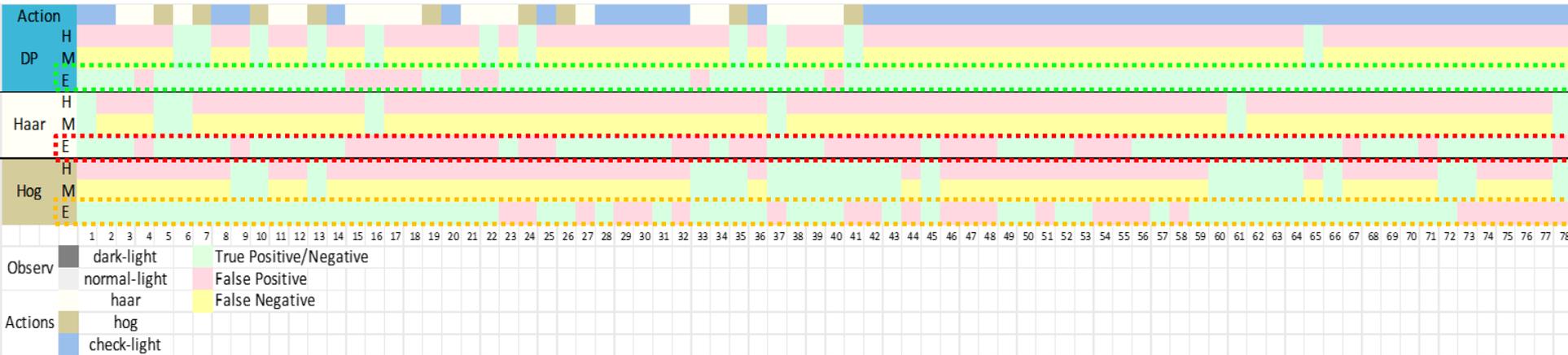


J. Quintas, G. S. Martins, L. Santos, P. Menezes, J. Dias, "Toward a Context-Aware Human-Robot Interaction Framework Based on Cognitive Development", in IEEE Transactions on Systems, Man and Cybernetics, May 2018. DOI: 10.1109/TSMC.2018.2833384.



CAHRI Framework

Application scenario – Results





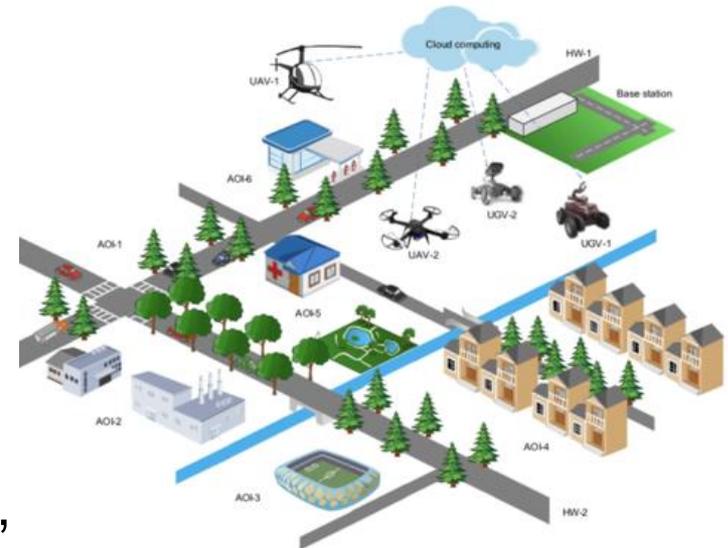
- Sponsored by IEEE Robotics and Automation Society/Standing Committee for Standards (RAS/SC)
- IEEE1872.2 Working Group to develop standards for autonomous robotics
- General **concepts and domain-specific axioms** for autonomous robotics; and
- Using developed vocabularies and ontology for conceptual design of autonomous robotic **applications** and general **use cases and/or case studies** for autonomous robotics.

Toward standardization of Knowledge Representation in Robots

Autonomous Robotics Ontology Group



- Knowledge needed to build autonomous systems comprised of robots that can operate in all classes of **unstructured environments**.
- Allows for **unambiguous identification** of the basic hardware and software components necessary to provide a robot, or a group of robots, with **autonomy**.



Law Enforcement Scenario in "Requirements for building an ontology for autonomous robots," *Industrial Robot: An International Journal*, vol. 43, no. 5, pp. 469–480, 2016.

"... an ontology is a description [...] of the concepts and relationships that can exist for an agent or a community of agents."

Tom Gruber

Toward standardization European supporting activities



Supporting European Experts Presence in International Standardisation Activities in ICT

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A GLANCE OF SOME OF OUR
SUCCESSFUL APPLICANTS
& THE SDO GROUPS
THEY ARE CONTRIBUTING TO



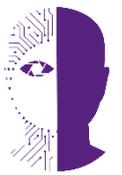
Supporting European Experts Contribution To International ICT Standardisation Activities

StandICT.eu is a new initiative funded by the European Commission focused on supporting the participation and contribution of EU Specialists to SDO and SSO activities covering the 5 essential building blocks of the digital Single Market: 5G, Cloud Computing, Cybersecurity, Big Data and IoT.

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Toward standardization

European supporting activities



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Supporting European Experts Presence in
International Standardisation Activities in ICT

8 OPEN CALLS

RESULTS & POPULAR TOPICS



25

EUROPEAN COUNTRIES

95 → ONE SHOT
130 → SHORT TERM
275 → LONG TERM



258

FUNDED APPLICATIONS

500 ELIGIBLE APPLICATIONS RECEIVED



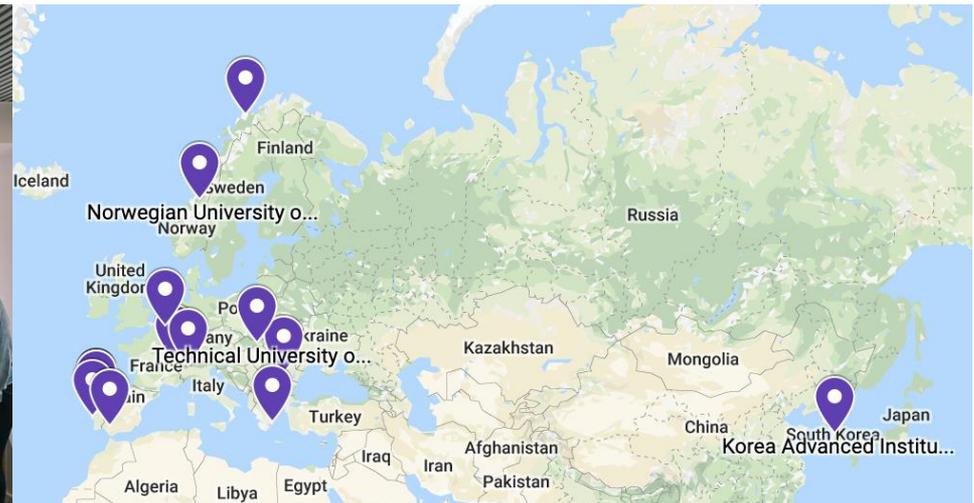
MOST TARGETED TOPICS

5% → AI
4% → BLOCKCHAIN
3% → CLOUD COMPUTING
30% → CYBERSECURITY
22% → BIG DATA
7% → 5G
11% → IoT
17% → Other

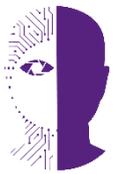
Undergoing work for strengthening the network of Social Robotics experts



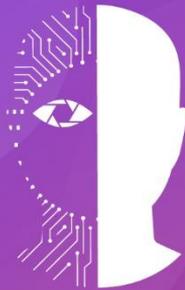
- **LIFEBOTS Exchange** seek to:
 - develop a holistic understanding of social robots in the intersection of care, user interaction, technology and society;
 - Researcher and staff exchange;
 - Increase knowledge on social robotics;
 - Increase cooperation between different disciplines, sectors and countries



Conclusion



- Developing solution for the **Intelligent Artificial Social Companions** involve a multidisciplinary approach and it entails a variety of open scientific and technological challenges but ... There is still a lack of standardization in Robotics and Automation (R&A) field in terms of the way some core components are implemented (including AI).
- The field needs more real application scenarios demonstrating the possibilities of such technologies but ... Still requires adaptation and improved robustness to provide services specifically designed for the user in order to enhance their everyday life and be provided with high-quality healthcare services.
- In the future, great developments adoption and promotion of a more standardized development and multidisciplinary collaboration with relevant European research and innovation networks (e.g. LIFEBOOTS Exchange, Digital Innovation Hubs for Robotics).



LIFEBOTS

EXCHANGE



Thank you!

jquintas@ipn.pt



The LIFEBOTS Exchange project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement No. 824047.

