Title: Can sensors sense emotions?

Motivation

Approximately 280 million people in the world have depression[1]. Depression can be caused by stress and lack of motivation. Simon Sinek says "Working hard for something we don't care about is called **stress**: Working hard for something we love is called **passion**." A same event, can be interpreted in two different ways by humans. Humans are feeling emotions every day, but they can still encounter difficulties understanding them. To better understand emotions, there is a need to integrate interdisciplinary knowledge about emotions from various domains such as neurosciences, physiology, and psychology (affective sciences, etc.). To organize the knowledge, we can employ technologies such as Artificial Intelligence with Knowledge Graphs that are modeling the World and Semantic Reasoning to infer meaningful facts and provide recommendations. Furthermore, **Internet of Things (IoT)** technologies can help to acquire physiological data knowledge to understand the mood, in real-time, etc. IoT technologies could help to monitor better emotion in real-time.

Current Status

ACCRA (H2020, 2016-2020, https://www.accra-project.org/**)** was a joint H2020-Japan project which built a methodology for the agile co-creation of robotics applications for ageing. Trialog was the coordinator of this project. Three robots were involved including the French Buddy **Emotional Robot**. Well-being and emotions are modeled using AI, more precisely, knowledge representation techniques (e.g., knowledge graphs using ontologies) and are based on standards such as ETSI SAREF for Health and Ageing Well, etc.

There are a lot of available information available on the Web, representing the World, and machine-processable, that can be exploited such as ontology catalogs (LOV4IoT ontology catalog references more than 800 ontology-based IoT projects, and BioPortal for Biomedical ontologies, etc.). LOV4IoT demonstrates its usefulness, as AIOTI (Alliance for IoT) ontology catalog is being designed.

Research Challenges

We defined a set of research Challenges (RC):

- **RC1: Knowledge Extraction using NLP techniques:** The knowledge of the world is already partially designed and represented using data models/ontologies which are processable by machines. There is a need to reuse, extract, and
- interconnect the knowledge with Natural Language Processing (NLP) techniques and Knowledge Representation techniques such as Knowledge Graphs.
- **RC2: Synergies among standardization:** Being aware of existing standards related to the topics is challenging, from various SDOs (W3C, ISO, IEC, ETSI, OnM2M, etc.), with different way of collaborating, being a member, etc. For instance, there is the IEEE Std 1872.2-2021 Autonomous Robotics (AuR) Ontology, and an ongoing extension which is starting in 2023 called *IEEE P1872.3 Standard for Ontology Reasoning for Multiple Autonomous Robots* and will be under development and the standard/guideline completion date is December 2026. Other standards to considered are ETSI SAREF for eHealth and Ageing Well ontology, W3C Semantic Sensor

[1] https://www.who.int/news-room/fact-sheets/detail/depression

Networks (SSN/SOSA) ontology. W3C provides international standards for the Web which cannot be ignored. StandICT.eu 2023 can help us in being involved more and more within standards from various SDOs. Fortunately, there is StandICT.eu 2026.

- **RC3: Synergies among data space**: Data Space Support Center (DSCC), BDVA, Gaia-X, ISDA. What are the complementary activities? What are the overlapping activities? **Linked (Open) Data** from the Semantic Web community community need to be taken into consideration.
- **RC4: IoT Semantic interoperability** (e.g., via AIOTI IoT Semantic Interoperability Group which includes activities such as IoT Ontology catalog). Future steps are to reuse, extract, and interconnect the knowledge.

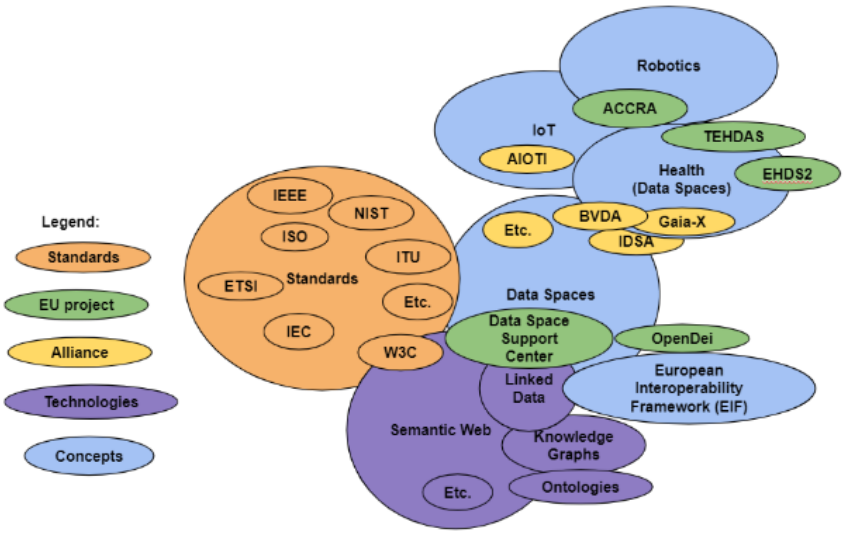

Figure: Required synergy among standards, alliances, technologies, EU Projects and concepts (Semantic Web, IoT, and Data Spaces)

Linked Open Data principles (Source: https://www.w3.org/DesignIssues/LinkedData.html from Tim Berners Lee the creator of the Web, and pioneer for Semantic Web, and Linked Open Data 5 stars.

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- http://wiki.aiisc.ai/index.php/AmelieGyrard#Publications