Dem@Care: Multi-Sensing Monitoring for Intelligent Remote Management and Decision Support

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Abstract. This paper presents an overview of the Dem@Care project, which delivers a multi-parametric monitoring framework that sustains semantic, context-aware, personalized and adaptive feedback mechanisms for the remote management of people with dementia.

1   Introduction

The increase of the average lifespan across the world has been accompanied by an unprecedented upsurge in the occurrence of dementia with high socio-economic costs. The development of personal health systems provides the necessary medium to deal with such problems in a meaningful and sustainable manner, enabling individuals with dementia to maintain independence and societal inclusion, while improving their quality of life and the effectiveness of their caregivers.

Dem@Care provides an integrated solution for personal health services to individuals with dementia, as well as medical professionals and caregivers, by using a multitude of sensors, context-aware, multi-parametric monitoring of lifestyle, ambient environment, and health parameters. Multi-sensor data analysis combined with intelligent decision making mechanisms facilitates an accurate representation of the individual's current status and provides the appropriate feedback so as to enhance the standard clinical workflow. The aggregation of information from complementary sources, which is a critical aspect in multi-sensor processing, is addressed by Dem@Care with advanced knowledge representation and ontology-based semantic interpretation methodologies. The system has already been deployed in home and nursing home settings in Ireland, France, Sweden and Greece, providing clinicians with a comprehensive tool for the remote monitoring of the individuals' condition and its progression.

2   R&D Activities and Goals

Dem@Care proposes a multidisciplinary approach that brings into effect the synergy of the latest advances in sensor technologies addressing a multitude of complementary modalities (including activity recognition, affective state, speech deficits, vital signs,

lifestyle, etc.), large-scale fusion and mining, knowledge representation and intelligent decision-making support. The core of Dem@Care lies in the multi-parametric monitoring and ontology-based analysis and interpretation of the recorded sensor data. This is achieved through reasoning techniques and decision making procedures that effectively integrate, link and correlate the information to support the monitoring of discern traits that have been identified by the clinicians as relevant for assessment and diagnosis, aiding them to design and adjust intervention. Through a hybrid combination of SPARQL queries and OWL 2 reasoning, as well as the incorporation of context-aware semantic similarity measures, Dem@Care provides a multi-parametric monitoring of daily activities, lifestyle and behavior, supporting clinicians to obtain a comprehensive image of the person's condition and its progression, without being physically present.
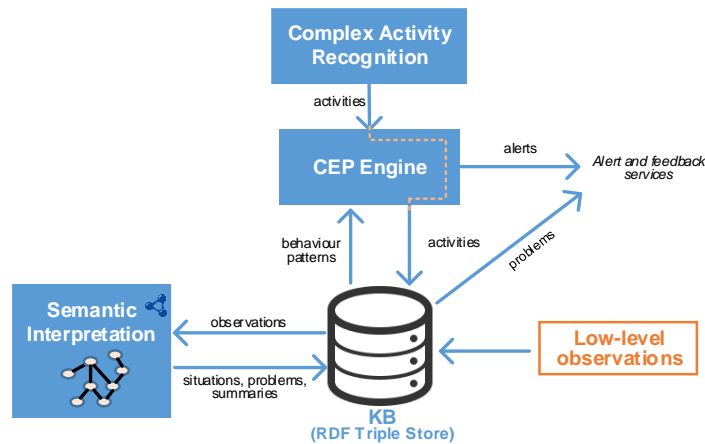
3   Relevance to the Session

Knowledge representation and semantic reasoning are key features of Dem@Care. Through the use of background knowledge and contextual dependencies, the observations from the multiple sensors are analyzed, correlated and semantically integrated at several stages, in order to take full advantage of their information content. In ESWC 2015, Dem@Care aims to present the basic Semantic Web technologies underpinning the platform, in order to identify areas for collaboration with other organizations and existing European projects. More specifically, Dem@Care is interested in developing synergies and coordinating the developments between concurrent projects in the areas of ontology modeling, integration, reasoning and semantic interpretation of heterogeneous sensor data. These synergies will include knowledge, datasets and technology sharing, as well as identification of activities, which can form the basis for common research proposals and joint organization of events and participation in standards.