

Diploma Topics 2021-2022, AI-MAS Laboratory

Context Management

Title: Context-Aware Discovery and Search for Web-Enabled Smart Things

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Description:

In the domain of Ambient Intelligence and the Web-of-Things, an important research direction is the creation of scalable, long-lived information management infrastructures to facilitate **search/discovery** and **querying** of context information retrieved from physical or virtual sensors deployed in smart environments (e.g. smart homes/offices, smart cities). The objective of this work is the development of a **web-driven context management system** that enables the **context aware search/discovery** and **query** of actuators and sensors (e.g. automated blinds in lab 308 of PRECIS, Philips Hue smart lamp, luminosity sensors) installed in the AI-MAS lab.

The research topic is based on existing work.

Keywords: Semantic Web, RDF Streams, Linked Data, W3C standards in sensor and actuator descriptions, RESTful web-services

Title: Context-Aware Laboratory using the Google Assistant API

Coordinator/Contact: Sl. dr. ing. Alexandru Sorici (alexandru.sorici@upb.ro)

Description:

In the AI-MAS Laboratory of PRECIS we have developed the AMIRO (AMblent RObotics) framework. It is ROS-based system enabling monitoring (e.g. detecting when the door of the lab is opened or closed) and actuation (e.g. raise or lower the blinds in the lab, turn a Philips Hue smart light on/off or change its color) of the indoor lab environment, as well as access to external context information (e.g. health parameters of lab personnel).

The topic entails creating a [Google Assistant](#) based *context-aware interface* to the AMIRO system. We want the assistant to enable custom voice based interaction with AMIRO, as well as become proactive (e.g. if the light sensor detects low luminosity during daytime, the blinds are closed and there is someone in the lab, the Google Assistant asks lab personnel if wishes blinds to be raised or lights to be turned on).

Keywords: Digital Assistants, Conversational Agents, IoT/WoT, Context-Awareness, RESTful API design

Title: Classifying Activities of Daily Living from ambient and wearable sensor triggers by combining Complex Event Processing and Machine Learning methods

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Description:

In the domain of Ambient Intelligence, one of the often-encountered subjects of project and development is that of recognizing activities of daily living (ADL - e.g. sleeping, toileting, preparing food, eating, watching TV). Recognizing and monitoring these activities is especially useful in extending the care for elderly people at their own home. In order to support privacy, activity detection is performed on hand of ambient sensors installed in the user homes (e.g. motion sensors, cupboard/door/window opening sensors, item removal/return sensors), as well as body-worn sensors, primarily accelerometer based (e.g. from a mobile phone, a smart watch or a dedicated bracelet). Using existing datasets (e.g. [CASAS](#), [OPPORTUNITY](#)), the aim of this project proposal is to incorporate data-driven (Machine Learning based) inference capabilities into the context inference process. The purpose is to develop online-learning based algorithms that can in time learn the pattern of sensor activations for individual activities and individual users. These must then be coupled with knowledge-driven approaches that can, for example, precisely cue when a shift in context (i.e. possible person activity/interest) has happened (e.g. by change of position from one room to another).

Titlu: Intelegerea mediului inconjurator

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Descriere:

Scopul proiectului consta in crearea unui sistem capabil sa inteleaga mediul inconjurator (mediul interior unei case). In acest scop se vor dezvolta urmatoarele componente:

- Recunoasterea obiectelor aflate in mediu
- Identificarea obiectelor aflate pe podea si clasificarea acestora in functie de dimensiuni
- Recunoasterea activitatilor realizate de persoanele existente in mediu; se va pune accentul pe existenta mai multor persoane in scena care desfasoara activitati individuale.

Analizele se vor realiza folosind imagini achizitionate de la o camera RGB-D (imagini RGB si depth).

Examples:

1. <https://arxiv.org/pdf/1807.05511.pdf>
2. Kong, Y., & Fu, Y. (2018). Human action recognition and prediction: A survey. arXiv preprint arXiv:1806.11230.
3. <https://arxiv.org/pdf/2104.13586v1.pdf>

Number of students: 3