S.L.Dr.Ing. Sorici Alexandru | Contact: alexandru.sorici@upb.ro

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

Coordinator/Contact:

Sl. dr. ing. Alexandru Sorici (alexandru.sorici@upb.ro)

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-enabled context management system that enables the context aware search/discovery and status 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.

Keywords:

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

Tema poate fi folosita ca stagiu de practica.

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 (AMbIent 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:

IoT/WoT, Context-Awareness, RESTful API design, Digital Assistant.

Tema poate fi folosită ca stagiu de practica.

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

Coordinator/Contact:

Sl. dr. ing. Alexandru Sorici (alexandru.sorici@upb.ro)

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), 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).

Analiza imaginilor de microscopie electronică pentru studiul celulelor supuse electroforezei

Coordinator/Contact:

sl. dr. ing. Alexandru Sorici (alexandru.sorici@upb.ro)
sl. dr. ing. Mihai Trascau (mihai.trascau@upb.ro)
sl. dr. ing. Irina Andra Tache (irina.tache@upb.ro)

Description:

Tema propune analiza unor imagini obtinute prin microscopie electronica a unor tipuri de celule supuse unei proceduri de electroporare.

Folosind proceduri clasice de Computer Vision sau abordari de Deep Learning, obiectivul este de a extrage diferite proprietati ale unei singure celule sau a unui ansamblu al acestora. Printre obiectivele specifice se numara:

- Crearea unui profil 3D al celulelor; calcul al valorilor fizice de inaltime (h) si al indicelui de refractie (n - obtinut prin procedura de microscopie electronica) in fiecare pixel al imaginii de celula
- Segmentare la nivel de instanta a celulelor si clasificarea lor in functie de o gradare de risc tumoral
- Analiza variatiei indicelui de schimbare a fazei (phase-shift) in zona membranei unei celule supuse electroporarii.

Tema in colaborare cu departamentul de Biofizica al Universitatii de Medicina si Farmacie "Carol Davila"

Poate fi folosită ca stagiu de practica.

Prelucrarea si recunoasterea formelor semnalelor electroencefalografice (EEG)

Coordinator/Contact:
sl. dr. ing. Alexandru Sorici (alexandru.sorici@upb.ro)
sl. dr. ing. Irina Andra Tache (irina.tache@upb.ro)
sl. dr. ing. Mihai Trascau (mihai.trascau@upb.ro)
Description:
Tema propune analiza unor secvente temporale EEG (din seturi de date existente care) plecand de la instrumente clasice de prelucrare, ex. filtrari de semnale, care actioneaza ca modele de referinta (baseline).
Modele antrenabile (machine learning based) sunt folosite pentru a îmbunătăți capacitatea de clasificare/regresie a modelelor de referinta.
Setul de date de la care se pleaca este legat de analiza secventelor EEG inregistrate in timpul somnului (https://www.physionet.org/content/sleep-edf/1.0.0/), dar domeniul poate fi extins pe parcursul temei.

Exploring and navigating a maze-like course using a Vector Robot

Coordinators/Contacts:
sl. dr. ing. Alexandru Sorici (alexandru.sorici@upb.ro),
sl. dr. ing. Dan Novischi (dan_marius.novischi@upb.ro),
Drd. ing. Alexandru Gavril (alexandru.gavril@cti.pub.ro)

Description:
Vector is a small social robot capable of vision and infrared based sensing, as well as voice interactions. The objective is to increase Vector's navigation and exploration capabilities in a controlled environment (e.g. grid-based environment, a 3D maze, a small-scale lane circuit), primarily based on single camera RGB input.Possible approaches range from classic trajectory planning algorithms, to visual SLAM, to Reinforcement Learning based exploration and trajectory generation that transfers from a simulator to a real course.

Dialogue Management Service supporting the Romanian language in assistive robotics scenarios

Coordinators/Contacts:
dr. ing. Alex Awada (alex.awada@upb.ro),
sl. dr. ing. Alexandru Sorici (alexandru.sorici@upb.ro)
Description:
A dialogue management system, in the context of assistive robotics, is an application that models and guides a conversation carried out between a human user and a robot, by means of multiple modalities (e.g. written text, voice interaction), taking into account external cues (e.g. environment state, user fatigue or emotional state).

The purpose of this project is to develop a dialogue management service that works across different platforms and supports the Romanian language.
The service will be built in a modular, micro-service oriented architectural style, making use of existing web APIs that facilitate text-to-speech and speech-to-text processing for the Romanian language. The dialogue management service is expected to enable scriptable interaction scenarios, whereby the answers given by the robot are informed by both conversational context, as well as emotional state of the user (i.e. the response in the dialogue depends on what the user has said previously and on how he is feeling).
At the same time, the start of a dialogue can be triggered by contextual cues (e.g. the light is turned on in a room, a motion sensor is triggered), apart from direct voice interaction.

Enhancing the functionality of the AMIRO User Interface

Coordinators/Contacts:
dr. ing. Alex Awada (alex.awada@upb.ro),
sl. dr. ing. Alexandru Sorici (alexandru.sorici@upb.ro),
dr. Ing. Alexandru Gavril (alexandru.gavril@cti.pub.ro)

Description:

AMIRO (AMbIent RObotics) is a 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 the smart lights on/off or change their color) of an indoor lab environment, as well as access to external context information (e.g. health parameters of lab personnel) by a socially assistive robot.
The service also defines basic robot behaviors (e.g. navigating to a given position, identifying a person, searching for an object, speaking or listening for a voice command) that can be composed in a hierarchical manner to create more elaborate human-robot interaction scenarios (e.g. guiding a user to a location, finding a person in the lab to inform them of a notification).
The purpose of this project is to enhance the current UI (user interface) for the AMIRO system by creating a back-end tool (robot behavior management) that allows the creation of different robot behaviors by dragging, dropping and linking different elements (such as: predefined behaviors, predefined or new animations and dialogs, custom Python codes, etc.) into a scene. The tool output must support the export of constructed behavior compositions into tasks executable through the AMIRO system.