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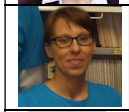

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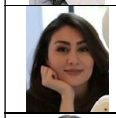

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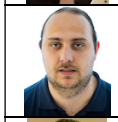

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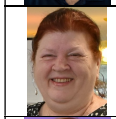

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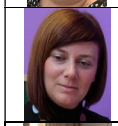

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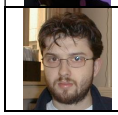

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The development of new technologies enables changes in all spheres of social activity. Particularly vulnerable social categories are people suffering from autistic spectrum disorders, as well as people with other forms of disability. The aim of the workshop is to share knowledge about the different technologies that should facilitate the easier inclusion of these people in society. Special attention is devoted to technologies that enable the diagnosis of autistic spectrum disorders and appropriate therapy from the earliest years of life. Particularly important roles are referred to robotics and information technology. Very common side effects of autistic spectrum disorders are motoric dysfunctions, where advanced robotic systems can play a very important role in successful rehabilitation. The half-day workshop will bring together top experts - trainers from the field of robotics, information technology, human-robot interaction, rehabilitation and other related areas.

Agenda of the Workshop:

09:00 – 09:05	Opening and welcome address *Maja Cepanec, Zdenko Kovačić*
9:05 – 9:40	Keynote talk: NAO and Autism: an update on SoftBank Robotics's projects *Alexandre Mazel*
9:40 -10:00	DE-ENIGMA – Robot-based emotion-recognition and emotion-expression teaching programme to school-aged autistic children *Vesna Petrović, Sunčica Petrović*
10:00-10:20	CareTOY - Rehabilitation at Home based on Mechatronic Toys *Marko Munih*
10:20 – 10:40	ADORE – Autism Diagnostic Observation with Robot Evaluator *Zdenko Kovačić*
10:45 – 11:00	Coffee break
11:00 – 11:20	QTrobot, programmable by everyone *Aida Nazarikhorram*
11:20 – 11:40	Digital stimulating environment for children with multiple impairments *Željka Car*
11:40 – 12:00	Assistive technology for environmental control, education, and communication *Miroslav Vrankić*
12:00 – 12:20	Voice Conversion and Expressive Speech as Assistive Technologies *Vlado Delić, Darko Pekar*
12:20:12:40	Children with ASD and Robots - What's the Connection? *Sanja Šimleša*
12:40 – 13:00	Robot-assisted Autism Spectrum Disorder Diagnostics using Partially Observable Markov Decision Processes *Frano Petric*
13:00 – 14:00	Lunch break

The 26th Mediterranean Conference on Control and Automation
Venue: Hotel Kolovare, Zadar, Croatia
Date: Tuesday June 19, 2018.
Meeting Room 1

HRZZ
Hrvatska zaklada za znanost

Workshop

Assistive Technologies for People with ASD and other Disabilities

Organized by:
Zdenko Kovačić (University of Zagreb Faculty of Electrical Engineering and Computing) and Maja Cepanec (University of Zagreb Faculty of Education and Rehabilitation Sciences)

Sponsored by Croatian Science Foundation through the project

ADORE
autism diagnostic observation with robot evaluator

http://www.med-control.org/med2018/

Abstracts:

NAO and Autism: an update on SoftBank Robotics's projects
In this talk, we'll give you an overview of our company's recent developments in the uses of our robot related to autism. Including the EC funded DREAM Project on Robot Enhanced Therapy for Autism; the new version of the AskNAO solution, and other related projects.

DE-ENIGMA – Robot-based emotion-recognition and emotion-expression teaching programme to school-aged autistic children
There are over 5 million people with autism in the European Union. If you include their families, autism touches the lives of over 20 million Europeans. It affects the way a person communicates, understands and relates to others. People with autism often have difficulty using and understanding verbal and non-verbal language. This often makes it difficult to understand others and interact with them. Getting the right support and therapies makes a substantial difference to people with autism. On the other hand, people with autism often have intact and sometimes even superior cognitive abilities to comprehend predictable systems, such as robots. Children with autism perceive a humanoid robot as being less complicated, less threatening, and more comfortable to communicate with than humans. Research has demonstrated that the best treatments are early and specialized behaviour-based therapies that helps people with autism to develop skills to cope with the individual challenges they face.
The DE-ENIGMA project is developing artificial intelligence for a commercial robot (Robokind's Zeno). The robot will be used for an emotion-recognition and emotion-expression teaching programme to school-aged autistic children. This approach combines the most common interests of children of school age: technology, cartoon characters (that Zeno resembles) and socializing with peers. During the project, Zeno will go through several design phases, getting 'smarter' every time. It will be able to process children's motions, vocalizations, and facial expressions in order to adaptively and autonomously present emotion activities, and engage in feedback, support, and play.
Preliminary results
In its first 18 months, DE-ENIGMA has seen numerous empirical evidences of impact that the teaching program had on children who participated in sessions with Zeno. Almost all of the children showed improvement of socio-emotional skills and their use in context. This includes:
- positive emotions caused by the pleasant environment and the type of program, improved the ability to learn academic skills
- improving social interaction, developing relationships with people through Zeno
- recognition of own emotions, use in the context, generalization of the learned content
- developing empathy, ability and desire to help others
- improving social interaction, skill of sharing with others
- improvement of social interaction, control and subtle display of emotions
- developing empathy and an adequate response to the emotions of other people
- improving social skills and rules by implicit learning
- alleviating of sensory issues by adjusting content to the child's interest
- understanding of own needs, desires and emotions
- understanding the needs, desires and emotions of other people
- improving communication and vocabulary (in verbal children)

CareTOY - Rehabilitation at Home based on Mechatronic Toys
The project CareToy promoted early intervention in the first year of life with a portable, low cost, smart system using telemonitored therapy. The CareToy system is composed of different modules: a) an instrumented baby gym with mechatronic hanging toys, so that the infants' actions on the gym can be measured and stimulated, b) a vision module, for measuring and promoting infants' attention and gaze movements and c) a sensorized mat and Inertial Measurement Units (IMU) for measuring and promoting postural control. A fourth telerehabilitation module allows for remote communication with the rehabilitation staff for monitoring and the rehabilitation task definition. CareToy was validated by a RCT on 60 preterm infants with different brain lesions.

ADORE – Autism Diagnostic Observation with Robot Evaluator
Notwithstanding intensive research and many advances, diagnosing autism spectrum disorders remains a slow and tedious process. Due to the absence of any physiological tests, the outcome depends solely on the expertise of the clinician, which takes years to acquire. The goal of our ADORE project funded by Croatian Science Foundation (HRZZ) is to develop a robotic assistant, which will facilitate the diagnostic process and make it more reliable. For this purpose, four tasks from the ADOS-2 protocol were selected.

QTrobot, programmable by everyone
Social robots are effective tools to make healthcare and education more accessible, affordable and effective through standardization and mass replication. Today, however, working with robots requires extensive IT knowledge. LuxAI, a spin-off of the University of Luxembourg has brought social robots for healthcare and education from research centres to the autism centres, by developing user-friendly robots which are accessible for everybody to script custom robot applications. QTrobot enables therapists and teachers to develop robot-enhanced therapeutic or educational curriculums and be an effective part of the new era of Artificial Intelligence and robotics. Dr. Aida Nazari is a research fellow at SNT department of the University of Luxembourg and the co-founder and Chief Communication Officer of LuxAI. In this talk, she will present the QT social robot platform and the findings from a research project at the University of Luxembourg on using QTrobot for emotional ability training of children with autism.

Digital stimulating environment for children with multiple impairments
Within ICT-AAC software application portfolio, there is a variety of mobile and web applications for communication and education that resulted from the multidisciplinary competence network. Focus in each phase of the application life cycle is on the continuous multidisciplinary cooperation with stakeholders from information and communication technology, education and rehabilitation, graphic design as well as a number of parental and professional associations, organizations and individuals who represent user needs. Their continuous involvement in the process of software solution development as well as participation in the evaluation process is required in order to make the applications accessible and highly usable. So far, more than 30 ICT solutions for education and communication, as well as for raising awareness in the field of assistive digital technology and Alternative and Augmentative Communication (AAC) were developed and published at digital application stores for most popular platforms, such as Android, iOS and Web. Also, several prototypes are developed for smart-watches and virtual reality applications, and they are currently in the evaluation process with users. The main research focus is on personalization and adaptation of both content and user interface in order to best accommodate user needs.
During UNICEF funded project recently, the research was directed toward the children with multiple and severe impairments. Not much literature from this field can be found as well as developed digital assistive solutions due to an inherent complexity and diversity of this user group and according lack of experience and systematic approach in the assessment and digital technology utilization. New technology comes with devices and features that can provide digital stimulating environment for children with multiple impairments. Working together with the professionals from Special hospital Gornja Bistra, two multiplatform software solutions are developed: one for teaching the cause-and-effect relationship and one for teaching colors. The lecture will provide experience and lessons learnt during the research and development process and try to motivate different stakeholders to get involved in investigating the possibilities offered by new technology in making the life of children and persons with severe and multiple impairments better.

Assistive technology for environmental control, education, and communication
E-Glas is a Croatian company which produces and distributes assistive technology solutions. It was founded in 2009. at the Science and Technology Park of the University of Rijeka. The first product of E-Glas was Servus, which was later named Serwantess. Serwantess is an electronic system which enables users to control their home through voice commands. Serwantess helps people with physical disability to be more independent and safe at their home. Another product of E-Glas is ABC Maestro, an educational rehabilitation software for learning how to write, type, and read. It is a didactic tool that can be a valuable equivalent to the pedagogical methods of active literacy learning for children with special educational needs. The lecture will be concluded with a presentation of an EEG-based communication system which was created in order to enable communication with patients suffering from the locked-in syndrome patients.

Voice Conversion and Expressive Speech as Assistive Technologies
Authors will present their experience in speech technology applications as aids for people with different forms of disabilities. They will also present the project „Design of Robots as Assistive Technology for the Treatment of Children with Developmental Disorders", particularly its dialogue system based on ASR and TTS in South Slavic Languages. A new generation of DNN-based TTS enables easier conversion of both voice and style of speech in human-robot interaction. Expressive humanoid robots are proven to be preferable over more efficient ones.

Children with ASD and Robots - What's the Connection?
Various technological devices have long been an essential part of diagnostics and rehabilitation of many disorders. In the field of autism spectrum disorder (ASD) research, enhancement of diagnostics process and therapy of individuals with ASD, scientists have become rather interested in potential of socially-assistive robotics. So far, in the field of human-robot interaction, research goals were mainly directed to measurement and analysis of children's reactions in relation to the robot partner. Future goals include detailed analysis of certain behaviours which are considered important in the process of diagnosis and intervention of individuals with ASD. One of those behaviours is an imitation. Individuals with ASD have considerable imitation deficit. Imitation is correlated with positive social behaviours and is considered predictive to social skills. Robots have so far been successful in eliciting desirable social behaviours in children with ASD, such as joint attention or sharing of the enjoyment. The purpose of the current study was to examine the differences in interactions of children with ASD in relation to the demonstrator of the task (robot-human) and to give a detailed description of the imitation skills. The results will be elaborated in the presentation.

Robot-assisted Autism Spectrum Disorder Diagnostics using Partially Observable Markov Decision Processes (POMDP)
In this talk the focus is on robot reasoning for ASD diagnostics. The method being presented is a hierarchical POMDP framework that enables a humanoid robot to process the observations of child's behavior, infer information about the unobservable state of the child and autonomously make decisions by selecting actions and tasks within the robot-assisted ASD diagnostic protocol. Each task of the protocol is modeled using a Mixed Observability Markov Decision Process model as a template. In order to formulate observation probabilities of task models, ASD experts are surveyed and their knowledge is encoded in the observation probabilities of task models. Expert knowledge also allowed for implementation of child behavioral models which are used to validate developed models. The model of the protocol is defined as a POMDP whose actions are tasks of the protocol. The interface between task and protocol models is formulated using regions of belief space of the task as observations for the protocol model. Following the successful validation through simulations with child behavioral models, task and protocol models are validated through experimental sessions with seven typically developing children and eight children with ASD. Results obtained through experiments show that the robot can recognize the behavior of the child and capable of differentiating different types of children, since the belief of the robot over the states of the child was comparable to assessment of autism experts.