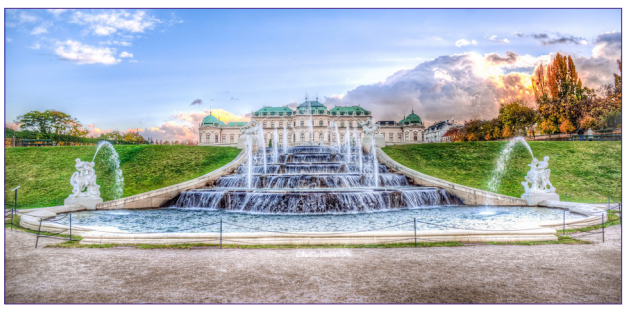
Accepted Abstracts

Robotics 2019



2nd International Conference on

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May 23-24, 2019 | Vienna, Austria

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Physiological signal-based detection of driver hypovigilance

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Driver hypovigilance which includes drowsiness, inattention and fatigue are the major reason for road accidents. To detect the driver hypovigilance, the physiological signals needs to be collected and analyzed. In case of hypovigilance, the driver has to be alerted on time so that loss can be avoided. The physiological signals are the graphical representation of human physical condition. Electrocardiogram (ECG), Electrooculogram (EOG) and Electromyogram (EMG) are some of the signals that are used here to provide the state of driver's abnormal behaviour. Ten subjects participated in the data collection experiment and were asked to drive for two hours at three different timings of the day (00:00 – 02:00 hrs, 03:00 – 05:00 hrs and 14:00 – 16:00 hrs) when their circadian rhythm was low. The five classes namely – normal, visual inattention, cognitive inattention, fatigue and drowsy were analyzed. The Butterworth 6th order filter is applied to remove the noise from the signals. The features that are extracted from the signals can be linear and non-linear. Sixteen Linear features such as mean, median, minimum, maximum, standard deviation, power, skewness, kurtosis, Energy, correlation coefficient, central frequency, peak frequency, first quartile frequency, third quartile frequency, Interquartile Range and Root Mean Square were extracted. Likewise, eight Non-linear features such as Spatial filling index (SFI), Central tendency measure (CTM), Correlation dimension, Approximate Entropy (ApEn), HURST exponent, Largest Lyapunov exponent, Non-linear Predication error (NLPE) and stoppage criteria were extracted. These extracted features were given as input to the different classifiers (Support Vector Machine (SVM), K-Nearest Neighbour (KNN), Convolutional Neural Networks (CNN)) to obtain the accuracy, sensitivity and scalability. The results show that the features from ECG can be embedded in a smart watch which can alert the driver during hypovigilance.

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Emotionally intelligent AI systems for children with autism spectrum disorder

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Emotion regulation in people with Autism Spectrum Disorder (ASD) is challenging for family, caretakers and people around them due to extreme behavior patterns such as aggression, self-injury, defiance and outbursts. Understanding the underlying emotional states of the children can help care takers, parents, teachers and other concerned persons to intervene and formulate personalized preventive and reactive strategies. A number of wearable devices like smart watches and smart belts are used for monitoring the health and related parameters. Researchers in Human Computer Interaction (HCI) have used these devices to identify the hidden emotional state of the user by acquiring physiological data (Electrocardiogram (ECG), Electromyogram (EMG) etc.,) as well as visible behavioral information (posture, gesture, activity levels etc.,) to predict the emotional state of the user. This research aims to develop an AI device that would predict the internal state of children suffering from Autism Spectrum Disorder (ASD) using the Heart Rate Variability (HRV) signals derived Electrocardiogram signals (ECG). Data is collected corresponding to the positive and negative valance of children with ASD and controls. Results indicate higher order statistical features to significantly demarcate the positive and negative states of children with ASD. Validating the results and embedding the algorithm into wearable AI devices can help in identifying the internal component of the child's behavior and provide personalized care.

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Human-robot collaboration in i4.0: Control methodologies exploiting machine learning techniques

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Advanced human-robot collaboration is at the basis of the I4.0 paradigm. New-generation manipulators have to be capable to adapt their behavior to the human intentions, in order to assist and relieve them during tasks execution. In the last years, control approaches are then exploiting machine learning techniques, in order to adapt the manipulator behavior to the interaction with the human, optimizing control parameters. The talk will, therefore, describe such a research scenario, introducing some practical examples.

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Agent-embedded robots with machine intelligence

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To develop agent-embedded robots with machine intelligence (MI), the design of intelligence operating architecture (iOA) is required for sensing, thinking and action. One of the key modules in iOA is the memory module for storing temporal event sequences of tasks, the mechanism of thought for reasoning, and motion planning for execution, among others. This talk introduces how to develop agent-embedded robots with MI based on iOA, focusing on long-term memory for active knowledge acquisition and adaptive knowledge application. The long-term memory is developed as an integrated multi-memory neural model, in which episodic memory is designed using a Deep DRN (Developmental Resonance Network) neural model and semantic memory is built using the DRN-tree. Procedural memory is also designed using the context-based RNN (recurrent neural network) to store the trajectories of the manipulators along with context information and then retrieve them according to the context without conscious thinking. Robots are taught either by human demonstration or symbolic description. A behavior appropriate to the current situation is selected by the mechanism of thought learned through machine intelligence learning, while a proper task is retrieved from the Deep DRN model. The behaviors are executed safely and quickly with the motion planning algorithm. The effectiveness of the agent-embedded robot development is verified through experiments with a humanoid robot, Mybot, developed in the Robot Intelligence Technology Lab. At KAIST, Agent-embedded Mybot is introduced mainly for natural interactions including VQA (Visual Question Answering) with humans. In the last part, AI World Cup shall be introduced, which has three categories, AI Soccer, AI Commentator, and AI Reporter.

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Using robotics programming in Primary Education

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Robots for educational purposes also come with a smaller size and in a low-cost market, such as the Wonder Workshop Dash Robot, Ozobot, SPHERO, BB-8, Wow Wee COJI The Coding Robot Toy, mBot, Transformable DIY Programmable Robot Kit, Clementoni My First Robot, LEGO, Bocco, Plen, Chip, Damian, Hicolor, Kamigami Robots Spot the Ladybug, DOBBY, Robi, Robohon, Roboactor, OHaNAS, Zoomer, Mip, KINGBOT, DIY Iron Bot Robot, Premaid, light sensor programing car, the exhilarated robot programming set, the Puchi little robot, block robot taste and Tama robot, etc. Why are there so many robots invented for programming education? They stimulate students through body sensation. In prior to the breakthrough learning point at 9 years old, touching various objects and observing in real objects are vitally important .So, our focus is on the planning of the implementation of robot programming as primary students in Japan, in where programming education is still in a very initial stage, students should also be more interested in programming through real and visible robotic movements than in computerized ones. Kanoh upholds the instruction proposal of nurturing "ways to learn and think about the information" defined by Kanoh and her group and the implementation of the programming education proposal in the concrete controlling period of Piaget, J's development theory is also suggested.

The project 'Challenge Robots Programming' was carried out on Wednesday, October 18, 2017 at Yamagata Municipal Elementary School5. 18 children participated. When checking the Pearson correlation coefficient on both sides, a highly positive correlation coefficient ($r=.78$, $p<.01$) was found about the degree of understanding to the programming itself. The linear approximation curve is $y = 0.48x + 3.02$, which proves that children are highly motivated to learn about and have a high degree of understanding towards programming. In addition, some children explored questions they found.

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Welfare robotics in elderly care homes

Norbert Krüger
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The pressure caused by the demographic development in Western European countries allows for easily creating very good business models for the application of so called "welfare robots" in care institutions for the elderly. In my talk, I will give an overview of current developments in welfare robotics in the elderly care sector, the technical problems that still need to be addressed and the applications to be expected within the next decade. In particular, I will talk about the SMOOTH project which stands for "Seamless human-robot interaction for THe support of elderly people". In the SMOOTH project, we focus on repetitive tasks that do not involved manipulation such as transport of laundry, offering beverages and guidance. To make such applications technically feasible, it was important that the design of the robot simplifies a lot of the technical problems involved. I will in particular talk about the process that led to the design of SMOOTH robot that is currently built by a Danish start-up company.

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Emotion aware robot based on emotion estimation by human's biological information

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Emotion aware technologies have been developed these days, to understand the internal state of the human through sensors. We use EEG, and heartbeat sensors to estimate emotion of human's and apply it for service and communication robots. It would be possible to decide the robot behavior responsively with analyzing changes in real-time emotion during human-robot interactions.

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MATE robots simplifying my work: The benefits and socioethical implications

Valeria Villani, Lorenzo Sabattini and **Cesare Fantuzzi**
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With the increasing complexity of modern industrial automatic and robotic systems, an increasing burden is put on the operators, who are requested to supervise and interact with such complex systems, typically under challenging and stressful conditions. To overcome this issue, it is necessary to adopt a responsible approach based on the anthropocentric design methodology, such that machines adapt to the humans capabilities. To this end, we have developed an integrated methodological design approach, which we call MATE, consisting in devising complex automatic or robotic solutions that measure current operator's status, adapt the interaction accordingly, and provide her/him proper training to improve the interaction and learn lacking skills and expertise. Accordingly, a MATE system is intended to be easily usable for all users, thus meeting the principle of inclusive design.

Using such a MATE system gives rise to several ethical and social implications, which are discussed in this talk.

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