ABSTRACTS

Antonis Argyros (University of Crete)
Computer Vision for Supporting Human-Robot Interaction and Collaboration
Monday, February 4, 2019 – 10.10-10.40, NYUAD Conference center

In this talk, we provide an overview of our work on computational methods for tracking human motion and semantic interpretation of human activities, based on unobtrusive computer vision techniques that rely on the processing and analysis of markerless visual data. We focus on tracking the 3D position, orientation and full articulation of the human body and human body parts and we show how this is employed to solve problems of varying complexity, ranging from 3D tracking of a hand (possibly in interaction with objects) up to action recognition, gesture interpretation and intention prediction. Finally, we show how our work can support intuitive human-robot interaction and human-robot collaboration as well as the development of interactive exhibits in the context of smart environments.

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Tonio Ball (University Clinic Freiburg)
How is robot action reflected in the (neuro)-physiological responses of a human observer?
Monday February 4, 2019 – 13.50-14.20, NYUAD Conference center

Cooperative scenarios involving both robots and humans require safe human-robot interaction. Important aspects here are the management of robot errors, and the human-compliantness of robot behavior in general. Analysis of (neuro)physiological signals from a human interacting with a robot may help identifying robot errors, but accuracies of such analyses have still substantial space for improvement. Here, based on imaging literature showing human mirror neuron system activation during robot observation, as well as based on a general outline how error-related information is processed in extended human brain networks, we show how a novel framework based on deep convolutional neural networks (deep ConvNets) can be used for decoding robot errors from the EEG of a human observer during naturalistic conditions. We also show how Deep Transfer Learning can be applied to error decoding from non-invasive EEG and evaluate the role of robot design in shaping robot-related error responses in the human brain. Finally, we address how Deep Regression can be used to infer information about the human compliantness of robot action during a direct interaction task. Together, these findings provide a basic understanding about how is robot action is reflected in the (neuro)-physiological responses of a human observer, and how these signals may be utilized for emerging neuro-technological applications.

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Abdelkader Nasreddine Belkacem (UAEU)
Real-time MEG-based Brain-Geminoid Interface

Tuesday February 5, 2019 – 11.00-11.25, UAEU Science & Innovation Park

A brain machine interface (BMI) provides the possibility of controlling artificial arms for patients with severe motor dysfunction by only using their thoughts. However, most of researchers have been using only unilateral hand movements for decoding motor execution and imagery which are not enough for multidimensional control. In addition, bilateral movement requires multitask processing whose neural correlates remains unclear. In order to study the multitasking neural process and control human-like robot, we analyzed and decoded the brain activity for four types of bilateral hand movements using noninvasive MEG measurement.

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Somaya Ben Allouch (Hogeschool van Amsterdam)
KEYNOTE *The Appropriation of Social Robotics*
Wednesday, February 6, 2019 – 13.20-14.00, UAEU Science & Innovation Park

The relationship between human behaviour and technology can be studied from different perspectives and with a broad range of methodologies. In this paper the approach is taken to focus on the long-term use and acceptance process of new technologies, specifically social robotics and show that focusing on people's long-term behavior towards technologies can improve our current understanding of how people use, accept and appropriate social robotics. The appropriation process of technology which encompasses the phases of adoption, implementation, use, acceptance and re-design of technologies is not a static one but rather a very dynamic one in which the user defines the meaning of technology in a specific context. A better understanding of people's long-term behavior towards new technologies can not only be used to inform the design of new technologies in an early development stage but also inform us about the different modes of how the long-term acceptance process of technology unfolds in different social contexts.

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Mohamad Bdiwi (UAEU)
Intelligent Industrial Robots for Smart Factories
Tuesday, February 5, 2019 – 9.50-10.15, UAEU Science & Innovation Park

The fourth industrial revolution "Industry 4.0" and its smart factories require completely a new generation of robot systems which should be equipped with smart sensors and intelligent algorithms. This kind of robots should be able to perceive, understand and take autonomous decision based on the surrounding circumstances and situations. This talk will focus on human-robot-cooperation as core theme in Industry 4.0. Furthermore, different visionary projects will be presented in the field of industrial robotics in order to upgrade them to collaborate with human safely and efficiently. The challenges of interaction between human and industrial robot will be also presented in comparison to social and service fields.

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Eduardo Benítez Sandoval (UNSW Sydney)
Addiction to Robots: From Science-Fiction Representation to Real Addiction
Wednesday, February 6, 2019 – 15.20-15.50, UAEU Science & Innovation Park

This work raises current concerns about the possible development of robot addiction, both physical and emotional, as we witness cognitive overload produced by multiple gadgets, social media and other technologies. Certain sectors of the population excessively use computers, internet, mobiles, tables, apps, videogames, VR viewers and other screen-based technologies . This "addiction" to technology is creating physical, psychological and emotional issues in users due to sedentarism, cognitive overload and lack of socialisation . Rapid advances in robotics foreshadow a daily life of service/social robots performing tasks on our behalf and interacting with humans in daily scenarios, generating the possibility of future physical and emotional dependency in the near future. An over-use of robots for physical and cognitive activities could result in modification of multiple behaviours affecting the way that humans experience daily life. Hence, some adjustments should be done in order to raise a healthy global population using robots and avoiding future negative consequences for users and society in general. Furthermore, addiction towards robots should be defined. Questions requiring further research are raised: to what extent a service/social robot should be used? To what extent should we encourage social, and emotional engagement with robots? How can we avoid negative interactions with robots as is suggested in much of science fiction? Media amplifies the possible interactive and emotional scenarios involving humans and robot relationships. People fall in love with robots, and being friends and enemies with robots are fictional topics depicted in movies, books, and tv series. Under this representation is possible to imagine different future scenarios with "toxic relationships", "emotional dependency" and "addiction to robots". However, technology hasn't yet achieved the level of sophistication required for natural human-robot interaction. At the moment, there is limited progress in the development of social robots capable of minimal and limited social interaction involving emotional, and psychological engagement with users under controlled conditions. Nevertheless, future short-term applications of social robots aim to use this technology in education, psychotherapy, caregiving and several other human interactive purposes. Considering the importance of those areas for human development, this proposal aims reflect over the adjustments required to use safely social robots in emotional, social and psychological terms avoiding future addition towards them. Similarly, ethical implications in robot-behavioural design must be considered in order to provide moral guidance to future robot designers.

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Robert Cheek (Hyundai Motor Securities)
Society and Social Robotics. A Market-Driven View
Wednesday, February 6, 2019 – 10.10-10:40, UAEU Science & Innovation Park

The presence of robotics and artificial intelligence in our lives grows at an exponential rate with every passing day. And with such rapid growth there is a need to influence it in way to ensure that it grows in a manner that shapes the technologies, products, and services that are created in a way that advance and promote the general welfare of human society as a whole. This ensures that precious resources of capital, time, and labor are utilized in the most efficient way possible for the greatest return for all. The impact of social robotics on society is an issue that continues to gain traction in several circles, which include but are not limited to academia, business, and the general public. While individuals and organizations continue to debate the definitions of precisely what a social robot (and the definition of the broader robot is still argued within the robotics community) is be it a humanoid robot, or an assistant robot like the now-defunct Jibo, or even a disembodied intelligent agent such as Apple's Siri, what is patently clear is that to advance the field in a manner to guarantee the greatest benefit to society there needs to be a set of internationally agreed-upon definitions of and standards for social robotics. And if possible, the goals as to how to steer social robotics so that the technology is used to advance the state of humanity. We are now at the point in the evolution of the human race in which the urgency of steering the technology is of utmost importance for the technology is evolving at an exponential rate, far beyond what is publicly disclosed to the public through mainstream or social media outlets or through corporate communications channels. If we fail to resolve certain key issues regarding social robotics at a global level within the next five years, then we run the risk of stratifying society to a degree which can only be imagined by peering through the looking glass of the most dystopian of science fiction. We have seen the missteps of misguided engineering labs which failed to develop robots or AI for the people, i.e. with a market view. The end results were mostly the massive losses of time, money, and effort. Furthermore, the harried design of social robot businesses without a clear market-driven view which has caused the collapse of more than a few companies and has resulted in the tapering off of funding for social robotics research and companies by investors due to the torrent of overpromising and underdelivering by so many companies and individuals. The purpose of my research and presentation is to demonstrate why a market-driven view of the field should come first and foremost for the purpose of the efficient use of the scarce resources of human labor, time, and capital, and to ensure that efforts in the wider robotics community are focused on achieving realistic results for the greatest benefit for society as a whole.

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Ron Chrisley (University of Sussex)
Applying the Deflationary View of Robot Ethics to Reactive Agents

Sunday, February 3, 2019 – 14.00-14.30, NYUAD Conference center

In previous talks I have argued for a deflationary view of robot ethics, according to which it is a mistake to try to make robots that decide what to do on the basis of what their moral obligations are. Rather, I have argued, one should strive to make robots that make decisions that allow us, as designers, users, etc., to meet our ethical obligations. In this talk, I extend the deflationary view to the case of non-deliberative, reactive ethical robots, such as those discussed and implemented by Alan Winfield and his team.

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Abdulmotaleb El Saddik (University of Ottawa)
KEYNOTE *Digital Twin: The convergence of Multimedia Technologies*
Monday, February 4, 2019 – 9.00-9.40, NYUAD Conference center

A digital twin is a digital replication of a living or non-living physical entity. By bridging the physical and the virtual worlds, data is transmitted seamlessly allowing the virtual entity to exist simultaneously with the physical entity. A digital twin facilitates the means to monitor, understand, and optimize the functions of the physical entity and provides continuous feedback to improve quality of life and wellbeing. In this talk, we will discuss the convergence of multimedia technologies (AR/VR, AI, IoT, Wearables, BigMM Data and 5G-Tactile Internet) towards the digital twin. We will conclude by describing the challenges and the open research questions.

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Francesco Ferro (PAL Robotics)
Human-Robot Interaction and AI, the key for service robotics
Wednesday, February 6, 2019 – 9.40-10.10, UAEU Science & Innovation Park

The potential of service robots to transform our lives is gaining importance, and at the same time the sectors of application are multiplying. Great efforts are being put to push robots to become humans' helpers in many ways, some of which are already contributing to making our lives easier. Some of the fields where robots can make a difference are Industry 4.0, Assisted Living, Smart Cities, Retail, IoT or Warehousing. In all them, there is a common element: robots must cooperate with people. Therefore, robots have to be easy to use, people expect a natural interaction with such interactive platforms. This keynote will reflect what is the state of the art in robotics, which are the latest developments achieved by PAL Robotics, and why Artificial Intelligence and Human-Robot Interaction are key to push the field of service robotics. In order to push service robots to help more in this wide scope of areas, an effort is needed to ensure the interaction between robots and people is effective. For that, the fields of Artificial Intelligence and Human-Robot Interaction are two of the most relevant areas in which the focus has to be set. Robots need to cooperate with people to pursue the goal of enhancing their quality of life. The roles of service robots in areas like Assisted

Living or Industry 4.0 are two examples of that. Research in Ambient Assisted Living with robots like TIAGo shows the high benefits that it has for old people to have a robot accompanying them in their daily routine. Gaining independence in their own life or feeling more optimistic when facing the challenges related to elderly are some of the conclusions we reached in successful pilots of some research projects. Artificial Intelligence needs to enhance even more the interaction. In Industry 4.0 robots like TIAGo Base, TALOS or TIAGo should undertake tasks that are risky or dangerous for people, so humans are prevented from suffering any health injury that conditions their life from that moment on. The idea of human-machine collaboration pursues the goal of having the fullest efficiency while adding value to the worker's role. As humans, we have extraordinary capabilities that enable us to do higher valued work that is more dynamic and even enjoyable than a repetitive movement for many hours a day. These two examples illustrate how collaborative robots can become a key element for facing relevant challenges in society, from industrial jobs that put health at risk, to the ageing population effects in society.

Jai Galliot (UNSW Canberra)
KEYNOTE *The soldier's Tolerance for Autonomous Systems*
Wednesday, February 6, 2019 – 9.00-9.40, UAEU Science & Innovation Park

Autonomous military robots are here, but they cannot yet do everything in the soldiering profession. Difficult decisions will therefore need to be made in which the gain to be derived from adopting autonomous systems is weighed against the implications for human workforces. While there is a dearth of relevant data, anecdotal evidence from the limited experience society has had in dealing with automation in the civilian realm suggests that the introduction of robotics and autonomous systems is highly disruptive and there exists a pattern whereby unskilled and semi-skilled labor is, eventually, partially or completely replaced by technology. Of course, the prospect of losing so many jobs to automation and robotisation is likely to generate serious political repercussions in a military context. Decision makers will, to some extent, need to accommodate the needs and demands of those in unskilled and semi-skilled labor positions until such time as the transition to a modernised military workforce is complete. Until this occurs, the implication of the revolution for the average soldier in any given developed military force remains that the increasingly roboticised and automated world is simultaneously becoming an easier and more difficult place in which to live, work and fight. Establishing and maintaining effective human machine interaction is tricky business and investigated by the military – and ordinarily expressed in strategy documents – in terms of trust. In the future, soldiers will almost certainly find themselves putting their lives or the lives of others in the hands of highly autonomous walking military robots, armed aerial robots or perhaps flying drone ambulances and their decision on whether or not to trust the judgment of a machine during the heat of battle may have life or death consequences. Armed forces have, therefore, already invested in much human-robot interaction research. Research has found that soldiers who place too little trust in automated systems may disuse those systems, with implications for safety and mission outcomes, as the automation may be better equipped to handle some scenarios better than human soldiers. In fact, evidence suggests that certain groups who do not trust a robot have a tendency to disengage its autonomous capabilities, often leading to damage of both the robot and its environment, particularly when the avoidance of automation involves reversion to direct control. Problems can also arise when too much trust is placed in an autonomous system, such as when users internalise a certain level of trust only to find that it puts themselves or others in harm's way. As in the civilian realm, there are also concerns about the potential displacement of military personnel, despite reassurances from senior military leaders and practical imperatives which dictate that soldiers will remain the core fighting force of any military force. Military forces have typically sought to understand trust and the broader relationship between humans and machines as an engineering challenge that begins as early as interacting with a robot's interface, but this paper argues that engineering is merely one part of the challenge and that trust in robotics and automation ought to be understood in a much broader social context. It is suggested that the problem for military robotics and automation is less a matter of trust than it is tolerance, defined by the soldier's tolerance for autonomous systems capacity of soldiers to endure subjection to technology and the extent to which automation impinges upon one's autonomy or otherwise impacts the soldier's wellbeing. Through a unique application of the work of philosopher of technology, Theodore Kaczynski, it is argued that soldiers will tolerate robots for so long as, and up to such point that, they remain engaged in the power process that governs their influence on the operating environment and hence the soldier's social and psychological welfare. It is contended that what constitutes being involved in this power process is likely to vary from soldier to soldier. Many factors will impact one's level of tolerance. For example: age and gender. Older soldiers further along in their careers might be less tolerant of new technologies that promise to change the way things have been done, whereas younger soldiers who have grown up with smart phones might be apt to trust the next generation of technology more easily. The gender of soldiers might also make a difference in that women, often ostracised in the armed forces, might tolerate a non-biased technological system more so than a sexist make solider. The impact of these factors will be important to a practical understanding of tolerance, but as the first step toward this and the implementation of change, this paper examines the overarching potential for disruption of this power process, how soldiers are generally likely to adjust beyond simply disengaging from technology and what strategies can be implemented to limit disruption of the power process and enhance soldiers' wellbeing, thus building tolerance and trust in automated robotic systems.

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Shuzi Sam Ge
Historical and futuristic perspectives of Robotics
Tuesday, February 5, 2019 – 10.15-10.40, UAEU Science & Innovation Park

Robotics and Artificial Intelligence (AI) are the buzzwords of today in research, industry and funding agencies as they are revolutionizing our works and daily lives. In this lecture, I will first give a brief introduction of industrial robots which has reduced the need for manual labour, then go through the works of mobile robots which have much wider outreach and larger operating space in comparison with industrial robots, and welcome the era of social robots which are becoming parts of the daily lives in education, healthcare, finance, entertainment, etc. I would like to conclude my lecture by the discussion on the fusion of AI and Robotics. For each of the sub topics, I will begin with an overview for a broader perspective, before delving into certain fundamental technical details and actual development examples. After a brief history of industrial and mobile robotics, I will focus more on the recent research works of social robotics which call for much higher demands in robot designs with artistic appeal, intelligent control with safety, scene understanding for better interaction and companionship, and among others. At this point of the time, the fusion of AI and robotics is apparent, and open for us to work together to make social robots as an integral part of our social fabric.

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Malte Jung (Cornell University)
Robots and the Dynamics of Emotions in Teams
Sunday, February 3, 2019 – 9.50-10.20, NYUAD Conference center

Over the last decade the idea that robots could become an integralpart of teamwork developed from a promising vision into a reality. Robots support teamwork across a wide range of settings covering search and rescue missions, minimally invasive surgeries, space exploration missions, and manufacturing. Scholars have increasingly explored the ways in which robots influence how work in teams is performed, but that work has primarily focused on task specific aspects of team functioning such as the development of situational awareness, common ground, and task coordination. Robots, however, can affect teamwork not only through the task-specific functions they have been developed to serve but also by affecting a team's regulation of emotion. In this talk I present empirical findings from several studies that show how theory and methods that were originally developed to understand the role of emotions in marital interactions can help us to not only further our understanding of teamwork but also to inform how we design robots to improve teamwork through their emotion regulatory behavior.

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Aila Khan (Western Sydney University)
Image Transfer with Social Robots
Wednesday, February 6, 2019 – 14.50-15.20, UAEU Science & Innovation Park

By referring to the model of communication process, our paper argues how social robots are a type of a media, used by businesses to communicate company-generated/advocated messages. In comparison to other types of media, humanoid robots possess certain 'rich' attributes (Daft and Hengel 1984) which result in audiences forming unique perceptions (or images) about this medium. Communication researchers acknowledge the significant role of media in shaping the frame of reference by which audiences interpret messages. According to previous research, different media can generate a range of communication effects on the same audiences with the same messages. We explain this by using the 'media vehicle effect' concept, through which we propose a conceptual model in which it is hypothesised that when a specific humanoid robot is employed by an organisation to communicate with its stakeholders, there is an 'image transfer' (McCracken 1989) of the robot's attributes or values to the associated organisation. With an increased focus on using social robots in public spaces such as retail outlets, it is useful for organisations to see what kind of robot-related perceptions are held by the public. Moreover, results from this study will assist top management to view the extent to which social robots' usage can bring value to the corporate brand. Our project has the following research objectives: a) to examine audience's perception of the robot generally; b) to compare audiences' perceptions about a robot and perceptions for a computer-mediated media in a marketing/retail context; c) to examine the extent of image transferred from involvement with two different types of media (robot vs computer-mediated media). In this presentation we will present a theoretical framework for our proposed research questions. We will also discuss some preliminary results which we have analysed from focus group discussions. Much of the research in Human-Robot Interaction has focused on users' perceptions of robots. Results from our study will contribute to the Human-Robot Interaction literature by providing evidence on the extent of image-transfer which takes place from the robot to the organisation. This has practical implications for organisations planning to use social robots for interacting with their stakeholders.

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Chu Kiong Loo (University of Malaysia)
Trusting Humanoid Robots to Undertake Social Tasks
Sunday, February 3, 2019 – 14.30-15.00, UAEU Science & Innovation Park

Human communication between different cultures often leads to misunderstanding. The research "Trusting Humanoid Robot Undertake Social Tasks" introduces an intermediary robot or avatar which can undertake negotiations in social interactions using different languages. The goal of this research is to provide an integrated system which can reduce cross-culture conflicts among people from different cultures and language backgrounds during social activities. From a research perspective, this project is seeking to build an adaptive and trustworthy system, which is capable of understanding dialog and adapt to various situational contexts, besides imitating human behaviour based on the current trust level.

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Peer Mohamad (Al Ain Hospital)
Social robotics for human performance improvement
Tuesday, February 5, 2019 – 11.50-12.05, UAEU Science & Innovation Park

Human being has his physiologic limitations that limit his performance. Disability caused by old age, trauma or disease process can cause further increase functional limitations. Robotic human augmentation can enhance the existing capabilities or compensate for disabled capabilities. The presentation discusses how the invention and use of mobile robots to assist people in their homes, socially interactive robots for childhood education, intelligent prostheses for enhanced community integration, soft robotic systems, haptics, and robotic exoskeletons that interpret a user's intent have paved the way for technology that can be used to extend human sensory experience, facilitate physical motor performance, enhance mental cognition and as therapeutic or compensatory strategies to overcome disability. The presentation also explores the biomechanical impact of physical augmentation on muscle activity, perceived musculoskeletal effort and contact pressure.

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Mohammad Obaid (UNSW Sydney)
Designing Assistant Classroom Robots. A User-Centered Approach
Sunday, February 3, 2019 – 10.40-11.10, NYUAD Conference center

Including children in the design of educational technologies that they use daily is essential and their involvement is important. However, it is unclear how this involvement should take place when designing a robotic assistant in a classroom environment. In this talk, I will present our approach to involving children in the development of a robotic assistant in a classroom environment. I will first describe the development of a robot design toolkit (Robo2Box) aimed at involving children in the design of classroom robots. Then, I will report on some of the studies we conducted to understand and evaluate our approach using the toolkit. Thereafter, I will outline some of the challenges and lessons learned from our approach to eliciting children's requirements using the Robo2Box toolkit. Finally, I will conclude with possible design implications and future directions.

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Riccardo Manzotti (IULM Milan)
Enworlded Social Robots: Beyond Embodied and Enactive Cognition
Sunday, February 3, 2019 – 15.20-15.50, NYUAD Conference center

To solve the limitations of traditional computational approaches, the last three decades have seen the rise of various stripes of embodied and enacted cognition. The core idea is that mental activity is constituted not only by internal computational processes but also by body-word interactions. There are two possible interpretation of this notion: a weak and a strong one. The weakest form (loosely represented by the extended mind's parity principle) is a form of functionalism that gives credit to the body and the environment. The strongest form suggest that mental states are indeed constituted by the interactions between one's body and the external world (as suggested in the seminal paper by O'Regan and Noe). These views have failed to address the issue of consciousness both conceptually and empirically. On the conceptual side, it is worth to mention that embodied and enacted cognition are covert form of dualism. They still place the center of cognition in one's body and this is conceptually unjustified. Why should the mind be embodied? Is not the body another form of privileged shell? Why should considering the body be any better than considering the brain? On the empirical side, enaction has fallen short its expectations and is plagued by many unresolved questions. For one, why should it be easier for consciousness to arise out of body-world interactions than from neural processes? Body-world interactions are not closer to consciousness than neural signals. Second, enactivism fails to explain misperception unless it appeals to internal representations of body-world interactions (be them sensory motor contingencies, affordances, or knowledge of one's body-word interactions). Finally, there is no convincing not-circular ontology of the notion of action (an action is a cause-effect processes caused by an agent!). Yet, enactivism and embodied cognition have gone in the right direction. They have tried, albeit without success, to get out of the trap of the homunculus. Only they swapped the traditional homunculus with a bigger one (the body). Is it possible to do better? Yes. By considering a completely different ontological basis: namely the world itself rather than the body-world nexus. By doing so it is possible to consider an enworlded view of cognition that is neutral with respect to the biological basis of an organism. This view, which is not yet another version of functionalism (since it does not allow multiple realizability), is suitable for social robots because it locates consciousness in the external world rather than in the interaction with one's body. The proposal is simple and based on two key steps. First, objects have a relative existence dependent on other objects (in this case, the bodies of agents). According to such a hypothesis, one's consciousness is physically external to one's body. The body is necessary for the object that is one with one's mind to exist, but it is not the container nor a constitutive element of one's mind. The mind is one with the collection of objects that exist relative to one's body and that are one's relative world; a notion not far from von Uexkull's Umwelt. Second, mental states are identical with such relative objects. They are neither constituted by interactions nor caused by them. The proposed relation is that of an identity between mind and objects. This version of mind-object identity is called the spread mind.

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Juan C. Moreno (Cajal Institute Madrid)
Designing Technologies for Gait After Stroke
Monday, February 4, 2019 – 14.20-14.50, NYUAD Conference center

Pathologies such as stroke and spinal cord injury affect motor neuronal pathways altering the gait and they have a significant incidence around the world. Orthoses, wearable robots combined with Functional Electrical Simulation technologies have a high potential to facilitate human after these neurological conditions. Research related to neuroprosthetics for walking has focused on the design and development of portable systems capable of stimulating muscle groups of the leg to achieve physiological movements of a most effective way. Control techniques have also been implemented whose objectives are to adapt assistance with FES to solve problems, such as muscle fatigue, and provide assistance as needed. These strategies of stimulation not only seek to solve the given abnormal pattern in an appropriate way during the assisted gait with FES, but try to produce a therapeutic effect that facilitates walking without assistance at long-term. This talk will revise which are, in our view, the main ideas behind

FES with orthotic/robotic assistance after stroke, from the engineering point of view, and in particular when targeting recovery of locomotion.

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Yukie Nagai (Osaka University)
KEYNOTE *Computational Models of Predictive Coding for Robot Cognitive Development*
Sunday, February 3, 2019 – 9.10-9.50, NYUAD Conference center

My talk will present computational models that account for human cognitive development. Although behavioral studies have revealed developmental trajectories in infants, their underlying mechanisms remain poorly understood. We have been suggesting that predictive coding of human brain provides a unified account for cognitive development and have been proposing computational neural network models to demonstrate infant-like development in robots. Our experiments showed that a robot acquired the abilities of mirror neuron systems and mental simulation through multimodal predictive learning of sensorimotor signals. Temporal and spatial properties of predictive coding enabled the robot to associate multimodal signals and thus recall imaginary signals from actual ones. Potentials of the proposed models to account for developmental disorders as well as typical development will be discussed to show our future research direction.

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Lakmal Seneviratne (Khalifa University)
Challenges in Designing Robotic Systems for Safe Autonomous Human Interactions
Wednesday, February 6, 2019 – 14.00-14.30, UAEU Science & Innovation Park

Robots are poised to have a revolutionary social and economic impact. However, many open research challenges remain to be solved before the mass deployment of robots into our daily lives. Biological systems are typically autonomous, and have soft and compliant bodies and joints. This is in sharp contrast to the vast majority of the present generation of robot systems; autonomy in the real world and safe physical interactions are still far beyond the current state of the art. This talk will focus on the development of autonomous soft and compliant robot systems. We will review the current state of the art and present some preliminary results. We will also discuss the challenges and opportunities in deploying autonomous robotic systems in close proximity with humans.

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Jeff S. Shamma (KAUST)
Game-Theoretic Methods for Robotics
Monday, February 4, 2019 – 9:40-10.10, NYUAD Conference center

In cooperative multi-robot systems, there is a group of autonomous robots that seek to achieve a collective task as a team. Each individual robot makes decisions based on available local information as well as limited communications with neighboring robots. In such systems, one of the robots may be controlled by a human operator, in which case the autonomous robots must adapt to the decisions of the human. In either case, the challenge is to design local protocols that result in desired global outcomes. In contrast to a traditional centralized control paradigm, both measurements and decisions are distributed among multiple actors. Such a distributed decision architecture motivates an approach from the perspective of game theory, which is the study of interacting decision makers. Traditionally, game theory has been used as a descriptive modeling formalism in mathematical social sciences. By contrast in robotics applications, game theory is used as a prescriptive approach to design interaction protocols. This talk surveys game theoretic concepts for multi-robot systems addressing issues of cooperation, competition, and trust.

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Shingo Shimoda (RIKEN)
Biological Methods Applied to Robot Control
Tuesday, February 4, 2019 – 11.25-11.50, UAEU Science & Innovation Park

How do living organisms adapt to the environmental situations? Is it possible to apply the biological method to robot control? The amazing ability of living organisms to adapt to unknown situations is so unique that we cannot understand it through the conventional model-based control strategy. Our approach is to find the design principle of biological computational systems and apply it to artificial controllers. Using bio-mimetic controllers, we will work towards developing controllers that can learn autonomous behavior through the interaction of robot bodies and unknown environments.

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Agnieszka Wykowska (IIT, Luleå University of Technology)
KEYNOTE *Social Cognition in Human-Robot Interaction*
Tuesday, February 4, 2019 – 13.20-14.00, UAEU CIT Building

In daily life, we need to predict and understand others' behaviour in order to efficiently navigate through our social environment. When making predictions about what others are going to do next, we refer to their mental states, such as beliefs or intentions. That is, we adopt the intentional stance towards others. At the dawn of a new era, in which robots might soon be among us at homes and offices, one needs to ask whether (or when) we adopt the intentional stance also towards robots. In our research, we examine what behavioral characteristics of an agent induce adopting the intentional stance and whether adopting the intentional stance facilitates engagement of mechanisms of social cognition in interaction. We use methods of cognitive neuroscience and experimental psychology in naturalistic protocols in which humans interact with the humanoid robot iCub. Here, I will present results of several experiments in which we examined the impact of various parameters of robot social behavior on the mechanisms of social cognition and the likelihood of adopting the intentional stance. We examined whether mutual gaze, gaze-contingent robot behavior, or human-likeness of movements influence engagement of mechanisms of social cognition. Our results show an interesting interaction between more “social” aspects of robot behavior and fundamental processes of human cognition. The results will be discussed in the context of several general questions that need to be addressed, such as, the societal impact of robots towards whom we attune socially or clinical applications of social robots.

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Tom Ziemke (University of Linköping)
KEYNOTE *Intentions & Intentionality: Challenges for Social Robotics*
Sunday, February 3, 2019 – 13.20 – 14.00, NYUAD Conference center

Research in the cognitive sciences, not least social neuroscience, has in recent years made substantial progress in elucidating the mechanisms underlying the recognition of actions and intentions in human social interactions - and in developing computational models of these mechanisms. However, there is much less research on the mechanisms underlying the human interpretation of the behavior of artifacts, such as robots or automated vehicles, and the attribution of intentions to such systems. Given the state of the art in the cognitive sciences, there are at least two very different intuitions that one might have: On the one hand, ever since Heider and Simmel’s seminal psychological research on attribution 70 years ago, it is well known that people tend to interpret the movement of even very simple geometric shapes in terms of more or less human-like actions and intentions. This could be taken to point to the existence of universal schemata and mechanisms that are applied to any type of system that can be interpreted as an intentional 'agent', relatively independent of what that agent might look like. On the other hand, much social neuroscience research in recent decades, in particular the discovery of the mirror neuron system, seems to indicate that similarities and differences in embodiment/morphology might play a crucial role in the understanding of others’ actions and intentions. This could be taken to indicate that humans might be able to understand the behavior of human-like robots more easily than, for example, the behavior of autonomous lawnmowers or automated vehicles. The talk focuses on the role of intentions in human social interactions with different types of autonomous technologies, ranging from social robots to driverless cars.