September 16th 2013, LIRMM-GALERA (room 127)

DEMAR team is welcoming Paulo Gonçalves (INRIA, ENS-Lyon). He will give a presentation at 14:30.

Allocation probabiliste de ressources basée sur un principe de grandes déviations

De plus en plus de systèmes sont soumis à une grande volatilité de leur demande. C'est par exemple le cas des services de vidéo à la demande où les périodes de buzz (flash crowd) provoquent des surcharges ponctuelles que les niveaux de ressources allouées ne peuvent pas toujours absorber. Le problème qui se pose est donc de trouver un bon compromis entre sur-dimensionnement (coûteux) des ressources et incapacité à satisfaire la demande (entrainant un mécontentement des utilisateurs). Nous présentons une approche originale qui intègre à la caractérisation probabiliste des niveaux de charges, la notion importante d'échelle de temps. Ce résultat peut participer à la définition d'un Service Level Agreement entre opérateurs et utilisateurs de clouds.

DEMAR team is welcoming Franck Multon (MimeTIC team - University Rennes2, INRIA, ENS
Reconnaissance et analyse du mouvement humain à partir de systèmes bas coût

Le mouvement humain intéresse de nombreuses disciplines, ce qui en fait un sujet d'étude très complexe et inter-disciplinaire. La démocratisation de capteurs de mouvements a permis le développement d'un très grand nombre d'applications, et la baisse des coûts de ces systèmes. Dans le flux issu de ces capteurs, l'un des premiers problèmes est de reconnaître l'action effectuée par l'utilisateur avant de l'analyser plus finement. Cependant, une action est sujette à une très grande variabilité, liée à la morphologie du sujet, à son style, à son niveau de fatigue, le type d'information délivré par le capteur... Une première partie de l'exposé propose d'utiliser des paramètres indépendants de la morphologie pour gérer le problème de variabilité morphologique. Ces paramètres sont testés dans le cadre de mouvements bimanuels ayant des propriétés cinématiques proches. Les résultats montrent que ce type de paramètre permet de conserver un haut taux de reconnaissance pour des utilisateurs dont la morphologie n'a jamais été vue pendant la phase d'apprentissage (comparativement aux paramètres Cartésiens ou aux angles d'Euler couramment utilisés).

Si on s'abstrait du problème de reconnaissance, dans un cadre d'analyse quantifiée de la marche par exemple, une autre problématique importante consiste à extraire de l'information pertinente des capteurs. La plupart des approches consistent à plaquer un squelette dans les données pour ensuite appliquer des tests validés au niveau biomédical. Cependant, le modèle de squelette utilisé est sujet à de nombreuses approximations qui peuvent conduire à des résultats erronés. Dans le cas de l'utilisation d'une Kinect, nous montrons qu'il est plus intéressant d'adapter les indicateurs biomédicaux au capteur. Par exemple, nous utilisons directement les volumes des jambes pour identifier les paramètres spatio-temporels de la marche. Nous définissons aussi un nouvel index d'asymétrie qui repose directement sur les cartes de profondeurs fournies par la Kinect.

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**September 6th 2013, LIRMM-GALERA (room 127)**

DEMAR team is welcoming Jose Luis Pons (Spanish National Research Council (CSIC)). He will give a presentation at 14:30.

Jose Luis Pons is Researcher at CSIC in Spain in Madrid and in particular was working on the
TREMOR European project... He develops FES and robotic systems that interact with patients.

Hybrid Exoskeletal Robotics and Neuroprosthetics for motor restoration: research at GBio-CSIC

Wearable exoskeletal robotics can play a role in rehabilitation and functional compensation in a number of neurological conditions, e.g. hemiplegia post stroke, paraplegia or quadriplegia post SCI, which lead to sever motor impairments. However, in general, the musculoskeletal system after the insult is preserved and Motor Neuroprostheses (MNPs) can also be considered as valid technologies for rehabilitation and functional compensation. In view of the pros and cons of both technologies, our current approach at the Bioengineering Group of CSIC is to study the combination of neurorobots (NRs) and motor neuroprostheses for rehabilitation and functional compensation of motor disorders of neurological origin. In this concept, three players are to be combined for an optimal intervention, i.e. the patients with their latent motor capabilities, and the two technologies NRs and MNPs. The evaluation of latent capabilities of the patients becomes a crucial aspect for the orchestration of all three actors in promoting functional recovery or substitution. This seminar will address on-going work at CSIC towards the combined use of NRs and MNPs for motor restoration.

October 25th 2012, LIRMM (seminar room)

DEMAR team is honored to welcome two prestigious colleagues, Dejan B. Popović and Agnès Roby-Brami.

At 10:30 - Dejan B. Popović, University of Belgrade, Serbia and Aalborg University, Denmark

Neuroprosthesis: A tool for neurorehabilitation or functional compensation?

Techniques to treat central nervous disorders are based on: (1) replacement of lost neural activity; (2) retraining of the central nervous system by repetitive practice; (3) neuromodulation, i.e., artificial restoration of the balance of activities in affected regions of the central nervous system. We define neurorehabilitation as the integration of the three above listed techniques, that is, as the augmentation of diminished or generation of absent function by use of electrical,
magnetic, and mechanical assistance of the neuromuscular system in parallel with the task oriented intensive voluntary exercise. The base for this approach are results from several studies where excitability of the human brain and spinal cord was documented when exposed to stimulation. Recent experiments at our and other laboratories suggest that patterned nerve stimulation of specific anatomical sites results in desired sensory-motor pathways activation, which elicits functional motor responses in patients with senory-motor disability. An important element when considering which method would be the most beneficial are the type and level of impairment, but also the time of the application of the treatment after the onset of disability.

At 14:30 - Agnès Roby-Brami, University Pierre & Marie Curie Institute of Robotics and Intelligent Systems (ISIR) CNRS UMR 7222

Orthoses: A perspective for the rehabilitation of upperlimb synergies at joint level.
Roby-Brami Agnès, Crocher Vincent, Jarrasse Nathanael, Robertson Johanna, Sahbani Anis, Morel Guillaume

Rehabilitation robots with an orthosis structure offer the opportunity to interact at the joint level with human individuals. This property is appealing accounting for the impairment of inter-joint coordination in hemiparetic patients but has been little explored. In stroke patients, normal flexible synergies are disrupted and replaced by global and fixed pattern of movements. The concept of joint rotation synergy has been used to develop an innovative robotic mode of control at joint level. Experiments with the ABLE orthosis demonstrate that such viscous force fields applied at joint level can be used to alter inter-joint coordination. These observations may open a new direction for research in the domain of robotic rehabilitation.

October 17th 2012, LIRMM-GALERA (room 127)

DEMAR team is welcoming Jessica Rose. She will give a presentation at 10:00.

Gait Analysis in Cerebral Palsy: Applications for Artificial Walking Technologies
Jessica Rose, PhD, Associate Professor, Department of Orthopedic Surgery, Stanford University. Director, Motion & Gait Analysis Lab, Lucile Packard Children’s Hospital
Cerebral palsy is the most common childhood disability, affecting approximately 3/1000 children in the general population and 15% of very low birth weight preterm children. Resulting in limited mobility throughout life, cerebral palsy (CP) is defined as “a group of disorders affecting the development of movement and posture, attributed to non-progressive disturbances to the developing fetal or infant brain” (Bax 2005). Although the initial brain injury is non-progressive, musculoskeletal impairments and functional limitations associated with CP are progressive. Flexed-knee gait, one of the most common walking disorders in children with CP (Wren, 2005), causes fatigue, limits mobility, and typically worsens over time, with many children losing independence in functional mobility as teenagers and adults (Bell 2002, Hanna 2009, Kerr 2011, Rosenbaum 2002). Spastic CP is characterized by four interrelated neuromuscular deficits including muscle weakness, spasticity, short muscle-tendon length, and loss of selective motor control (Rose 2010). Flexed-knee gait in CP can arise from short and spastic hip and knee flexors as well as from weak hip extensors and ankle plantarflexors. Affected muscles in CP have reduced neuromuscular activation (Rose 2005) and inability to sufficiently recruit and drive motor-units at higher firing rates, resulting in weakness and reduced muscle growth relative to skeletal growth. These deficits are associated with muscle spasticity and loss of selective motor control. Musculoskeletal manifestations of spastic CP typically progress as skeletal growth exceeds muscle growth and musculoskeletal deformities develop. Flexed-knee gait in young children causes abnormal mechanical loads and muscle forces across the hip and knee, which can result in bone deformities and a permanently flexed and rotated gait (Steele 2011). To date, surgical and pharmaceutical treatment of gait deficits offer only partial improvement, thus, most ambulatory children with CP have difficulty walking. More effective treatments for gait deficits in CP are needed at an early age, when there is optimal neuronal plasticity, rapid musculoskeletal growth and a greater likelihood of preventing musculoskeletal deformities.

Artificial walking technologies with potential applications for gait deficits in CP are emerging. Neuromuscular electrical stimulation (NMES) is a developing assistive technology that can generate purposeful movements through activation of weak or paralyzed muscles in adults and children with spinal cord injury, stroke, and CP. Previous research suggests that NMES-assisted gait may normalize walking patterns and has potential to improve muscle physiology, strength, and therefore potentially may improve muscle growth in children with CP (Wright et al, 2012). An initial study of multichannel NMES-assisted gait in children with CP suggested that NMES-assisted gait may reduce the need for orthopaedic surgery (Johnston et al, 2004). However, NMES-assisted systems designed to improve walking require further development in order to deliver patient-specific, optimal activation patterns as well as variable-frequency trains (Binder-Macleod, 2005, Lee, 2000), and feedback control for step initiated activation.

A systematic approach to NMES-assisted gait for children with CP can utilize gait analysis and musculoskeletal modeling (OpenSim) to identify NMES patterns for optimal neuroprosthetic affects that promote hip and knee extension during stance phase. A protocol that incorporates self-selected overground walking as well as faster velocity treadmill walking with alternating on-off NMES, applies a distributive learning model to enhance muscle memory and longer-term neurotherapeutic affects. Outcome can be assessed using the Gait Deviation Index (Schwartz & Rozulmalski, 2008), a comprehensive index of gait pathology validated for children with CP and normalized to 100. Treatment with NMES may improve both gait patterns and muscle physiology, reducing growth-related deformities and the need for surgery in children with CP.
October 25th 2012 - LIRMM seminar room

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Pr Dario Farina will probably give a talk on advanced EMG processing.