

Assistive and Rehabilitation Robotics

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Assistive robotics aims at developing solutions (mechatronic devices, systems and technologies) to assist and interact with individuals with reduced motor or cognitive abilities in order to increase their autonomy in a personal environment. Rehabilitation robotics proposes similar solutions for assisted therapy and objective functional assessment of these patients usually in a clinical context [1].

In one hand, assistive robotics solutions are designed to be used on a lifelong perspective in personal environment and promote independent living and autonomy of disabled and elderly individuals. On the other hand rehabilitation robotics intends to be complementary of existing therapeutic approaches in order to improve patient's functional recovery. As therapeutic tools the systems are used to optimize and maximize clinical effectiveness of therapy. The constraints associated to assistive and rehabilitation robotics are therefore different, especially in terms of acceptability. But even though the differences are important between the two fields, from a technical and scientific point of view there are important similarities. Advances in micro-electronics have lead to miniaturized sensors which make possible the embedment in portable and ambulatory devices.

This topical issue is dedicated to the new advances in robotics and related technologies for rehabilitation and assistance and is aimed at presenting an overview of the trends in this field.

Six papers have been selected after peer-review to be published in this special issue. One article is dedicated to background research, which can concern both assistive, and rehabilitation robotics. The aim of the presented work is to improve the estimation of joint torques based on EMG signals. Three papers are concerned with rehabilitation robotics, one of them presents a portable device for rehabilitation of the upper limb in post-stroke patient, and the second one investigates the influence of robot coaching styles in the motivation of stroke survivors during motor-task practice. The third article presents a portable device to correct gait asymmetries in post-stroke patients, it is intended to mimic the action of a treadmill in over-ground walking, which would allow for long term training in clinical and home environments. Assistive robotics

advances are illustrated through two papers. One of them presents a project of a mobile platform embedding a prehensile arm for grasping tasks in the context of the assistance of wheel chair users with upper limb deficiencies. The second article presents an approach of functional electrical stimulation (FES), assisting sit to stand transfers in complete paraplegic patients where lower limbs stimulation is coordinated with upper limb motions of the subject performing the transfer.

This selection of articles is obviously not a complete overview of the existing research in the field, but it illustrates in a nice way the different axes of interest. Robotic devices developed can directly facilitate individual motions like with prosthetic devices or FES but can also be external systems like robotic arms performing the tasks for the person. Observing the motion of the user in a non invasive and disturbing way leads researchers to explore portable sensors based on MEMs technology (accelerometer, gyrometers, magnetometers...) and increase the knowledge on the estimation of the subject intentions based on the interpretation of measurements of physiological changes, such as muscle contraction (EMG). Social robotics has an important role to play in this field; acceptance of the systems by the users is still an issue as well as the choice of coaching style in assisted rehabilitation. The community has dedicated a lot of efforts in developing solutions for both rehabilitation and assistance of post-stroke survivors as illustrated in this special issue.

References

- [1] Guglielmelli E., Johnson M. J., Shibata T., "Guest Editorial Special Issue on Rehabilitation Robotics," *Robotics, IEEE Transactions on*, vol.25, no.3, pp.477-480, June 2009