Guest Editorial: Interactive Virtual Environments for Neuroscience

VIRTUAL environment is a technology able to establish a relationship between the user and the environment created, enabling real-time integration with controlled virtual objects. A virtual environment can be explored through visual and haptic devices, without real restrictions. The iteration derives from the communication between human actions and the outcome of these actions, processed by the computer generating a response inside the virtual environment. The interaction can be passive, such as watching television, or active, for instance in the case of users manipulating their body movements or a particular object inside a virtual scenario.

Virtual and augmented reality are computational technologies that provide artificial sensory feedback, allowing a user to experiment activities and events similar to those that can be found in real life and to develop motor and cognitive abilities in immersive three-dimensional environments that resemble the real world, besides being economically viable.

Another reason for the growing use of this type of technology is the enhanced attractiveness of interactive environments in addition to the challenges posed by the environment in pursuit of conquests/rewards following the conclusion of a specific task.

Virtual systems with clinical purposes have an important role in health care: they are easily manipulated by specialists as well as by patients, acting as a motivational source for continued treatment that is less aggressive and tedious than traditional treatments. It is worth emphasizing that the supervision of a clinical expert is extremely necessary for therapeutic success. Virtual environments are incorporated into off-the-shelf commercial entertainment applications or specially developed for clinical purposes.

Lack of motivation and treatment withdrawal due to a delayed perception of patient's progress are two important factors that physicians have to deal with. The use of virtual environments may, thus, be an interesting approach as a complement and alternative to conventional treatment for these patients, establishing a new standard in the individual's rehabilitation strategy.

Furthermore, virtual and augmented environments can provide cost-effective and highly detailed scenarios and settings to be used in medical education, ranging from teaching of complex anatomy or neurophysiological processes to specialized surgical training.

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This special issue is based on the technological advances considered in the process of neurorehabilitation using virtual environments, serious games, brain image analysis and processing, 3D visualization, modeling and animation techniques, motion capture, human computer interaction, brain computer interfaces/interaction, internet of brain things, among other technologies for a playful, non-invasive treatment and diagnostic, showing to be quite efficient and effective in improving the clinical condition of the patients and their (re) insertion into society. Furthermore, it aims to introduce the recent progress of virtual environments in Neuroscience and addresses the challenges in developing dedicated systems for various clinical applications, while proposing new ideas and directions for future development. In this special issue, five papers were selected to exhibit recent development.

The first paper, Lauraitis *et al*. describes a new mobile approach considered for examination of central nervous system motor disorders occurring in patients suffering from Huntington, Alzheimer or Parkinson diseases. In particular, the model tracks tremors, aka involuntary movements, and cognitive, such as memory loss or dementia, impairments using touch and visual stimulus modalities. The proposed model interprets the symptoms from human bodies that indicate one of the diseases of the nervous system.

The second paper, Badia *et al*. presented a design and preliminary validation of a general-purpose architecture for affective-driven procedural content generation in Virtual Reality applications in mental health and wellbeing, called by Emotional Labyrinth, proving that can induce distinctive psychophysiological patterns, generally coherent with the meaning of the metaphors used in the labyrinth design.

The third paper, Huang *et al*. proposed a simple and efficient hybrid feature selection method based on binary state transition algorithm and ReliefF applied on seven well-known datasets and a real biomedical case, being possible to improve satisfactory the accuracy in both datasets.

In the fourth article, Oagaz *et al*. presented a prototype virtual reality and motion analysis framework that can be used by psychologists and neurologists for general purpose neurocognitive assessment and movement analysis, showing that the proposed system is able to provide informative data related to a participant's ability to track visual stimuli, as well as their balance and body posture while performing a task.

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The last paper, Razzak, Imaran and Xu evaluated a new model, named by Two-Pathway Group Convolutional Neural Networks architecture for automatic brain tumor segmentation, which exploits local features and global contextual features simultaneously, concluding that the proposed model is able to improve the overall performance over the currently published works while computational complexity remains attractive.

The guest editors wish to thank all the authors and reviewers for sharing and helping to improve the works published here, respectively, and hope that novel approaches as represented by accepted articles in this special issue will further help deployment of computational technologies to aid the brain disease management and treatment, enabling recover and diagnostic healthcare at reduced cost and time.

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