

Brain Pathologies and Disorders

Neural engineering is an emerging and fast-moving interdisciplinary research area that combines engineering with (a) electronic and photonic technologies, (b) computer science, (c) physics, (d) chemistry, (e) mathematics, and (f) cellular, molecular, cognitive, and behavioral neuroscience. This helps us understand the organizational principles and underlying mechanisms of the biology of neural systems and to further to study the behavioral dynamics and complexity of neural systems in nature. The field of neural engineering deals with many aspects of basic and clinical problems associated with neural dysfunction, including (i) the representation of sensory and motor information, (ii) electrical stimulation of the neuromuscular system to control muscle activation and movement, (iii) the analysis and visualization of complex neural systems at multiscale from the single cell to system levels to understand the underlying mechanisms, (iv) development of novel electronic and photonic devices and techniques for experimental probing, the neural simulation studies, (v) the design and development of human-machine interface systems and artificial vision sensors, and (vi) neural prosthesis to restore and enhance the impaired sensory and motor systems and functions. To highlight this emerging discipline, Dr. Ayman El-Baz and Dr. Jasjit Suri have developed *Advances in Neural Engineering*, covering the broad spectrum of neural engineering subfields and applications. This Series includes 7 volumes in the following order: Volume 1: Signal Processing Strategies, Volume 2: Brain-Computer Interfaces, Volume 3: Diagnostic Imaging Systems, Volume 4: Brain Pathologies and Disorders, Volume 5: Computing and Data Technologies, Volume 6: Advanced Brain Imaging Techniques and Volume 7: Neural Science Ethics. Volume 4 provides a comprehensive review of brain pathologies and disorders, including Parkinson's Disease, Alzheimer's Disease, Attention-Deficit/Hyperactivity Disorder, and Tourette's Syndrome. The authors discuss existing challenges in the domain of diagnosis, detection, analysis, treatment modalities, as well as possible research directions.

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