Big Data in Neuroscience: Transforming Research and the Understanding of Brain Function

Adina DZIȚAC

Ciprian Porumbescu Str., no. 83, 300217 Timişoara, Romania.
E-mail: dinadzitac41@icloud.com

* Author to whom correspondence should be addressed;

Abstract
Neuroscience, like many medical sciences, is slowly but surely moving closer to the orbit of Big Data with new advances in neuroimaging, genomics, and electrophysiology generating massive amounts of information. Since the year 2000, artificial intelligence and machine learning have transformed neuroscience research and have revolutionized data analysis and made it possible for researchers to discover complex patterns in brain activity, relating this to neurological disorders and cognitive functions. After the year 2010, many large-scale projects have emerged: the Human Connectome Project and the BRAIN Initiative. These provide insight into brain communities and activity. This article explores how Big Data is reshaping neuroscience, showcasing applications such as AI- driven fMRI (functional magnetic resonance imaging) and EEG (electroencephalography) data analysis and predictive modeling for neurodegenerative diseases such as Alzheimer's disease, Parkinson's disease, Huntington's disease, ALS (amyotrophic lateral sclerosis), and MS (multiple sclerosis). The paper also tackles various technical and ethical challenges facing neural data on a large scale, such as those arising from standardization of data, associated storage, the nature of computation, and privacy concerns associated with access. Big Data continues to provide discoveries for neuroscience, and for a proper propulsion of neuroscience, collaboration is essential amongst neuroscientists, data scientists, and clinicians. The future of neuroscience lies within data-driven approaches capable of deciphering the complexities of the human brain and improving the diagnosis and treatment of neurological diseases.

Keywords: Big Data; Neuroscience; Artificial Intelligence; Machine Learning; Neuroimaging.