From online resources to collaborative global neuroscience research: where are we heading?

ABSTRACT

Neuroscience has emerged as a richly transdisciplinary field, poised to leverage potential synergies with information technology. To investigate the complex nervous system in its normal function and the disease state, researchers in the field are increasingly reliant on generating, sharing and analyzing diverse data from multiple experimental paradigms at multiple spatial and temporal scales. There is growing recognition that brain function must be investigated from a systems perspective. This requires an integrated analysis of genomic, proteomic, anatomical, functional, topological and behavioural information to arrive at accurate scientific conclusions. The integrative neuroinformatics approaches for exploring complex structure-function relationships in the nervous system have been extensively reviewed. To support neuroscience research, the neuroscientific community also generates and maintains web-accessible databases of experimental and computational data and innovative software tools. Neuroinformatics is an emerging sub-field of neuroscience which focuses on addressing the unique technological and computational challenges to integrate and analyze the increasingly high-volume, multi-dimensional, and fine-grain data generated from neuroscience experiments. The most visible contributions from neuroinformatics include the myriad reference atlases of brain anatomy (human and other mammals such as rodents, primates and pig), gene and protein sequences and the bioinformatics software tools for alignment, matching and identification. Other neuroinformatics initiatives include the various open-source preprocessing and processing software and workflows for data analysis as well as the specifications for data format and software interoperability that allow seamless exchange of data between labs, software tools and modalities.

Keyword: Neuroinformatics; Machine learning; Bioinformatics; Brain project; Online resources; Databases