Brain−Net: Educational Applications

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Abstract:

Brain−Net is the process of transferring information from one brain to another. It looks like downloading files from internet to computers. Cells in the brain receive information throughout Brain−Net. Brains should be analyzed to discover the acceptability of these brains to receive information. This paper discusses the nature of brain, Functions of a Brain, Mid−Brain, Brain−Net and human neuroscience, progress in brain computer interfaces, factors influencing BCI performance, challenges face the process of Brain−Net, Brain−Net and learning, Brain, Mind and Education and the future of Brain−Net.

Keys words: Brain−Net, Mid−brain, Brain−Net and human neuroscience

شبكة الدماغ : تطبيقات تربوية

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مستخلص:

شبكة الدماغ هي عملية نقل المعلومات من دماغ إلى آخر. إنها عملية تشبه تنزيل الملفات من الإنترنت إلى أجهزة الحاسوب. حيث تتلقى الخلايا الموجودة في الدماغ المعلومات من خلال شبكة الدماغ. ويجب تحليل كل دماغ لاكتشاف مدى قبول هذه الادمغة لتلقي المعلومات. ومن ثم تناقش هذه الورقة طبيعة الدماغ، وظائف الدماغ ، الدماغ الأوسط ،

شبكة الدماغ وعلم الأعصاب البشري ، التقدم في واجهات كمبيوتر الدماغ ، العوامل التي تؤثر على أداء واجهات كمبيوتر الدماغ (BCI) ، التحديات التي تواجه عمليات شبكة الدماغ ، شبكة الدماغ والتعلم ، العقل والتعليم ومستقبل شبكة الدماغ .

الكلمات المفتاحية: شبكة الدماغ ، منتصف الدماغ ، شبكة الدماغ وعلم الأعصاب البشري

Introduction

Brain-Net is the first multi-person non-invasive direct brain-to-brain interface in order to perform collaborative problem solving across Brains. The interface combines electroencephalography (EEG) for recording brain signals and transcranial magnetic stimulation (TMS) for delivering information noninvasively to the brain. Using direct brain-to-brain communication, the interface allows three human individuals to collaborate and solve a task. Two of the three are labelled "Senders" whose brain signals are decoded using real-time EEG data analysis. The decoding process extracts each Sender's decision about whether to rotate a block in a Tetris-like game before it is dropped to fill a line. The Senders' decisions are transmitted through the Internet to the brain of a third one, the "Receiver". The Senders' decisions are delivered to the Receiver's brain via magnetic stimulation of the occipital cortex. The Receiver integrates the information received from the two Senders and uses an EEG interface to take a decision about either turning the block or keeping it in the same orientation. A second round of the game gives an additional chance for the senders to evaluate the receiver's decision and send feedback to the Receiver's brain, and for the Receiver to rectify a possible incorrect decision occurred in the first round (Jiang et al., 2019).

Brain–Net permits receivers to learn to trust the Sender who is more reliable, in this case, based solely on the information transmitted directly to their brains. This shows the way to future brain–to–brain interfaces that enable cooperative problem solving by humans using a “social network” of connected brains (Jiang et al., 2019).

Early interest in human BBIs came from the potential for expanding human beings' communication and social interaction capabilities (Rao, R., & Stocco, A., 2014). Direct brain–to–brain interfaces (BBIs) in humans are interfaces which combine neuroimaging and neurostimulation methods to extract and deliver data between brains, allowing direct brain–to–brain communication. A BBI extracts specific content from the neural signals of a “Sender” brain, digitizes it, and delivers it to a “Receiver” brain. Because of ethical and safety considerations, existing human BBIs rely on noninvasive technologies, typically electroencephalography (EEG), to record neural activity and transcranial magnetic stimulation (TMS) to deliver information to the brain (Rao et al., 2014 & Stocco et al., 2015).

The past BBIs have several limitations. First, Brain–Net is designed to be a BBI for more than two human subjects; its current implementation allows two Senders and one Receiver to communicate, but it can be readily scaled up to include larger numbers of Senders. The Senders have the same role in observing the current state of the task and conveying their decisions to the Receiver. The Receiver has the role of integrating these independent decisions and deciding on a course of action. Second, Brain Net's design incorporates a second round of interactions between the Senders and the Receiver, so that the action of the Receiver in the first round can be perceived by the Senders, giving them a second chance to convey (potentially corrective) decisions to the Receiver. Third, the Receiver is equipped with both TMS (to receive Senders' decisions) and EEG (to perform an action in the task), thereby eliminating the need to use any physical movements to convey information (Jiang et al., 2019).

Nature of Brain

The brain is a complex interconnected network that balances segregation and specialization of function with strong integration between regions, resulting in complex and precisely coordinated dynamics across multiple spatiotemporal scales (Sporns, 2018).

Studying brain network organization provides insight in understanding global network connectivity abnormalities in neurological and psychiatric disorders (Avena-Koenigsberger et al., 2018).

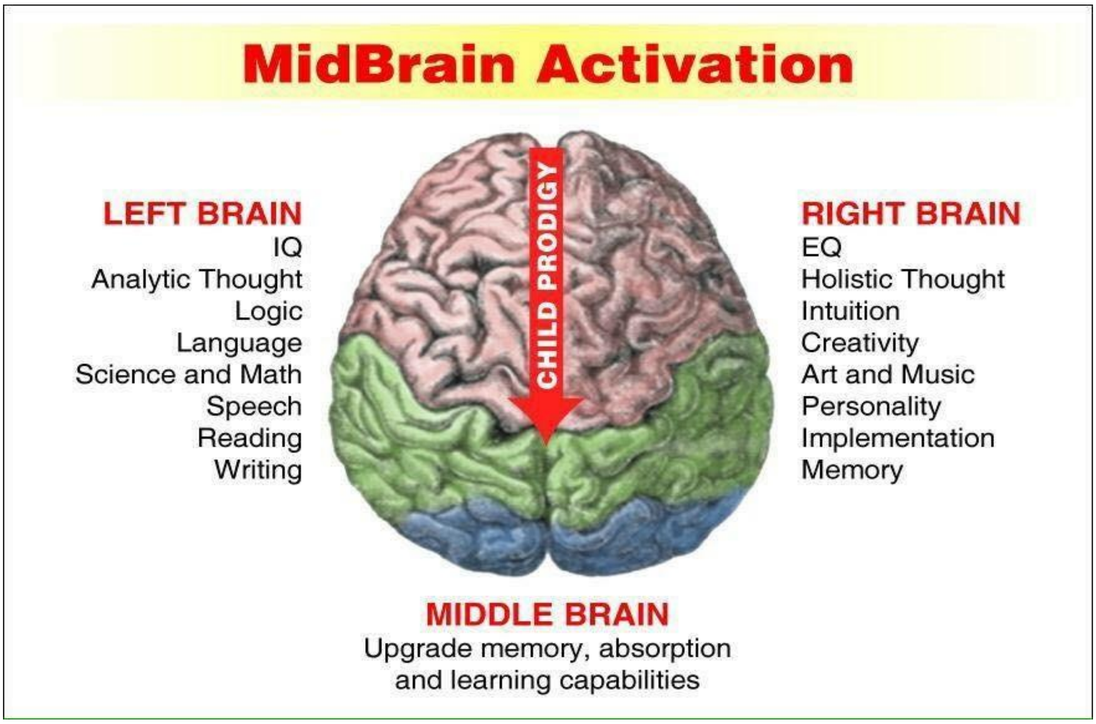
Brain-Net Viewer is a network visualization tool for human brain connectomics. The human brain is a complex system whose topological organization can be represented using connectomics. Recent studies have shown that human connectomes can be constructed using various neuroimaging technologies and further characterized using sophisticated analytic strategies, such as graph theory. These methods reveal the intriguing topological architectures of human brain networks in healthy populations and explore the changes throughout normal development and aging and under various pathological conditions (Xia et al., 2013).

Functions of The Brain

The brain is divided into main functional sections, called lobes. These sections or brain lobes are called the Frontal Lobe, Temporal Lobe, Parietal Lobe, Occipital Lobe, the Cerebellum, and the Brain Stem. Each has a specific function as described below.

The functional sections or lobes of the brain are also divided into right and left sides. The right side and the left side of the brain are responsible for different but specific functions. Understanding the associated issues with these particular situations can help caretakers or healthcare providers better understand the needs of an individual (ElAdmin, 2017)

MidBrain



Midbrain also called mesencephalon region of the developing vertebrate brain that is composed of the tectum and tegmentum. The midbrain serves important functions in motor movement, particularly movements of the eye, and in auditory and visual processing. It is located within the brainstem and between the two other developmental regions of the brain, the forebrain and the hindbrain;

compared with those regions, the midbrain is relatively small (Britannica, 2020)

Individual Differences in Brain Networks

Although there is strong evidence of common networks underlying cognitive processes, there are also individual differences in their details that influence the efficiency of the network. These differences are likely to reflect both genes and experience. The rapid development of fMRI methods has begun to provide a basis for understanding differences among individual brains both anatomically and in terms of functional activations. These differences are to be expected, because people are not identical in their thoughts, feelings, or behaviors. Several studies have shown that individual differences in functional activation can be reliably assessed. Studies have also examined the role of genetic differences in the strength of activation of networks involved in attention and memory. These studies demonstrate that at least part of the which children are likely to benefit from the kinds of interventions (Posner, M., & Rothbart, M., 2005).

Brain-Net and Human Neuroscience (Koslow et al., 2013)

The “decade of the brain,” was initiated in the US has been an explosion of neuroscientific insights that have been applied to translational clinical neuroscience and clinical trials. The increasing integration of neuroscience, psychiatry, neurology, and clinical care is needed to effectively achieve a significant understanding of which outcomes will directly translate into the clinic and into novel treatments.

The Brain Research and Integrative Neuroscience Network (Brain-Net) created the first free infrastructure for large-scale sharing of human neuroscience data with these values. Its initiation was stimulated to facilitate independent scientific collaborative for access to the Brain Resource International Database (BRID).

Brain-Net is complementary to other data sharing efforts in at least six specific ways:

- Brain-Net provides scientists with access to thousands of datasets obtained and quantified using standardized protocols and objective methods rather than a collective of datasets from smaller individual studies lacking any standardization in method collection or study design.
- These datasets span multiple modes of measurement of brain function and appropriate corresponding clinical data. Brain-Net data include demographic, clinical, self-report, behavioral measures of cognition and emotion, physiology (EEG, ERPs, autonomics), imaging [functional magnetic resonance imaging (fMRI), MRI, and diffusion tensor imaging, (DTI)], and genetic information.
- These datasets also include healthy subjects as well as a continually growing spectrum of multiple specialized patient cohorts. The database continues to expand in its disease areas and new studies and is supplemented from scientists using the standardized methodology in new discovery projects.
- Brain-Net has developed a centralized bioinformatics infrastructure by which datasets are accessed, analyzed, and

distributed, and collaborating members can share projects and data, thereby facilitating ongoing collaboration.

- The standardized, centralized approach allows for new methods of data quantification to be incorporated. The data provide “test beds” for development of new analytic methods and for testing new hypotheses.
- The Brain-Net standardized data sharing approach and infrastructure offers researchers new ways to conduct and raise funds for research.

Progress in Brain Computer Interfaces

The brain computer interface (BCI) is a direct and sometimes a bidirectional communication tie-up between the brain and a computer or an external device, which involves no muscular stimulation, and has shown promise for rehabilitating subjects with motor impairments as well as for augmenting human working capacity either physically or cognitively. Brain computer interfaces (BCI) provide a direct communication link between the brain and a computer or other external devices. They offer an extended degree of freedom either by strengthening or by substituting human peripheral working capacity and have potential applications in various fields such as rehabilitation, affective computing, robotics, gaming, and artificial intelligence (Saha et al., 2019).

Significant research efforts on a global scale have delivered common platforms for technology standardization and help tackle highly complex and nonlinear brain dynamics and related feature extraction and classification challenges. Psycho-neurophysiological phenomena and their impact on brain signals impose another challenge for BCI researchers to transform the technology from laboratory experiments to plug-and-play daily life (Saha et al., 2019).

Factors Influencing BCI Performance

Many factors influence BCI performance such as understanding the underlying neuronal mechanisms of cortical-subcortical networks. Some issues can significantly impede BCI performance. Maintaining an acceptable signal-to-noise ratio in noninvasive long- term recordings is critical. Event-induced brain waves or oscillations are dynamic while being affected by unstable resting state networks (RSNs). Time-variant psychophysiological, neuroanatomical factors and user's fundamental traits cause unreliable estimates of RSNs, causing short and long-term signal variation within and across individuals (Saha et al., 2019).

Challenges

Underlying emotional and mental processes, neurophysiology associated with cognition and neurological factors, i.e., functions, anatomy, play crucial roles in BCI performance and give rise to significant intra- and inter-individual variability. Psychological factors including attention, memory load, fatigue and competing cognitive processes as well as users' basic characteristics such as lifestyle, gender, and age influence instantaneous brain dynamics. For example, individuals with lower empathy participate less emotionally in a P300-BCI paradigm and can produce higher amplitudes of P300 waves than subjects with greater empathetic involvement (Saha et al., 2019).

Brain-Net and Learning (McCandliss, B. & Toomarian, E., 2020)

How can the role of educational experiences be directly linked to changes in brain structure and function? Remarkably, many brain imaging technologies are now sensitive to changes in brain circuits that accrue from one week to the next, allowing researchers to better understand how specific learning experiences drive changes in brain function and structure. In one study, researchers used MRI imaging to take pictures of the brains of struggling readers who tested in the dyslexic range and were undergoing several weeks of intensive tutoring. Brain scans collected every two weeks revealed remarkable changes in both reading skills and in the structural brain scan measures of white matter tracts (the long fiber bundles that connect one part of the brain to another). A control group scanned across weeks of “business as usual” education allowed researchers to make powerful claims about the extent to which this tutoring actually caused changes in the brain circuits. Such results are challenging and even changing our understanding of the term “learning disability.” These findings place increasing focus on how the right educational supports can lead to positive changes in both the mind and brain.

Teachers, of course, play a central role in guiding a child’s learning experiences. The way a teacher focuses a student’s attention can affect the nature of learning-induced changes in specific brain circuits. One recent brain-imaging study asked students to learn to read words made up from a set of artificial symbols, not traditional letters, that the students had never seen before. Two different sets of learning instructions either biased them toward a “whole-word” strategy or a “letter-sound” strategy. Words learned under whole-word instructions produced a pattern of brain activity associated with novice learners or unfamiliar words. In contrast, words learned under letter-sound instructions produced a left hemisphere response in regions associated with adult-level word recognition. This adds to a growing body of work suggesting that with their instructional choices, teachers can play a significant role in helping to direct learning, which may have an impact on which brain circuits are changing as a result.

When children understand how their brains change as they learn new things, the whole idea of learning in school could change profoundly for them.

Around the world, there is a growing number of collaborations between cognitive neuroscientists and schools that are beginning to tackle a large set of issues. This will help us understand how critical factors such as empathy, creativity, self-control, and problem solving develop in school experiences and how schools can influence the brain circuits involved in much of what makes us human.

By working directly in schools, educational neuroscientists are learning a great deal about the notion of learning itself. The students in these schools, of course, get to see scientists in action. They also get a chance to learn as the researchers go about their work and to see their own brains as the complex entities that they are, that change and adapt to their experiences. And that is a great lesson for all of us: For when children understand how their brains change as they learn new things, the whole idea of learning in school could change profoundly for them (McCandliss, B. & Toomarian, E., 2020).

Brain-Net and Implications in Education

In our view, a central issue in relating brain development to education is whether classroom interventions can alter neural networks related to cognition in ways that generalize beyond the specific domain of instruction. This issue depends upon understanding how neural networks develop under the influence of genes and experience. Imaging studies have revealed common networks underlying many important tasks undertaken at school, such as reading and number skills. Studying how genes and experience work together to shape the development of these networks. There is a need to conduct research-based interventions that could be useful in improving the ability of children to adjust to the school setting and to acquire skills like literacy and numeracy (Posner, M., & Rothbart, M., 2005).

Brain, Mind and Education

People have a keen appetite for research information about how the brain works and how thought processes develop. Interest runs particularly high in stories about the neurodevelopment of babies and children and the effect of early experiences on learning. The fields of neuroscience and cognitive science are helping to satisfy this fundamental curiosity about how people think and learn. In considering which findings from brain research are relevant to human learning or, by extension, to education, one must be careful to avoid adopting faddish concepts that have not been demonstrated to be of value in classroom practice. Among these is the concept that the left and right hemispheres of the brain should be taught separately to maximize the effectiveness of learning. Another is the notion that the brain grows in holistic "spurts," within or around which specific educational objectives should be arranged. Advances in neuroscience are confirming theoretical positions advanced by developmental psychology for several years, such as the importance of early experience in development (National Research Council, 2000).

Language and Brain Development

Brain development is often timed to take advantage of particular experiences, such that information from the environment helps to organize the brain. The development of language in humans is an example of a natural process that is guided by a timetable with certain limiting conditions. Like the development of the visual system, parallel processes occur in human language development for the capacity to perceive phonemes, the "atoms" of speech. A phoneme is defined as the smallest meaningful unit of speech sound. Human beings discriminate the "b" sound from the "p" sound largely by perceiving the time of the onset of the voice relative to the time the lips part; there is a boundary that separates "b" from "p" that helps to distinguish "bet" from "pet." Boundaries of this sort exist among closely related phonemes and in adults these boundaries reflect language experience. Very young children discriminate many more phonemic boundaries than adults, but they lose their discriminatory powers when certain boundaries are not supported by experience with spoken language (Kuhl, 1993).

Examples of Effects of Instruction on Brain Development

There are similarities between sign language users with normal hearing and sign language users who are deaf that result from their common experiences of engaging in language activities. In other words, specific types of instruction can modify the brain, enabling it to use alternative sensory input to accomplish adaptive functions, in this case, communication. Another demonstration that the human brain can be functionally reorganized by instruction comes from research on individuals who have suffered strokes or had portions of the brain removed (National Research Council, 2000)

The Future of Brain-Net

Because of the strong interest in educational applications, several commercial companies and public agencies have begun to provide information to the public on educational innovation based on brain research. All these efforts need to be shaped by an ongoing dialogue between educators, educational researchers, and cognitive and brain scientists. The study of neural networks underlying thought and emotion is not at all limited to the specific skills of reading, number, and attention. In the future, increased understanding of how networks are developed and shaped by experience could allow many school subjects to benefit from research. Moreover, the methods need not be limited to cognitive development, but can promote children's social adaptation and moral development (Posner, M., & Rothbart, M., 2005).

Kurzweil says about brain net in humans: "Human brains can connect to the cloud, which will allow us to send thoughts or memories". It is necessary to highlight that Michio Kaku, the main promoter of the Internet, has expressed that he only reports on technological innovations in humans such as the brain net, when prototypes already exist. Kaku mentioned: "I know it's going to happen because I see the prototypes". He also mentioned that: "Telepathy, telekinesis, uploading memories, are now possible but, the Brain net release is announced in very close dates like 2020. The brain net promoters emphasize: "the Internet might be replaced by a Brain-net, in which emotions, sensations, memories and thoughts are sent over the Internet". Schmidt mentioned: "I respond very simply; the Internet will disappear". The mystery is that the brain net only has been reported in experiments with animals, such as monkeys and rats (Salinas, 2018).

Neither the promoting scientists nor the press explain how it is developing in humans; its development necessarily requires risky human experimentations. Given the almost impossibility that there are volunteers for this kind of high-risk illicit human experiments with brain nanobots or microchips, the suspicion of forced and secret human experimentations in the world appears, mainly in Latin America.The Brain net problem aggravates given the easiness of its development. Recent scientific research alert that the nanobots could be secretly and illicitly administered in drinks and food, mainly in alcohol drinks like beer, that facilitate the actions of brain nanobots (Salinas, 2018).

It is necessary to stand out that Brain net allows getting the private life mainly the sex one, getting the audiovisual extortion material, stealing intellectual information, and getting brain algorithms, judicial information, confession secrets, prayers, credit cards passwords or any other kind of private information. The Brain net aims to become the most powerful extortion, mind control, honor destruction and privacy violation weapon owned by the common crime, organized crime, the state terrorism and the cyberwar (Salinas, 2018).

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