



Brain and Mental Health in the Era of Artificial Intelligence

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In the decade just beginning, artificial intelligence (AI) is and will increasingly be a fundamental catalyst for medical innovation. Due to its technological novelty, ability to process large volumes of data, capacity for autonomous action, and general-purpose nature, AI holds potential for transforming medicine and healthcare at greater pace and in greater magnitude compared to any other technology. The transformative potential of AI has been deemed “revolutionary” by experts [1, 2], with authors referring to the introduction of AI techniques in healthcare as a socio-technical revolution capable of reshaping entire areas of medicine. In recent years, most attention has been devoted to the use of AI systems in medical domains such as pathology [3] and radiology [4]. In particular, a rapidly growing body of research is showing how approaches to AI such as machine learning (ML) can improve the delivery of healthcare services by improving prognostics, diagnostics, treatment, clinical workflow, and expanding the availability of clinical expertise [5].

Addressing the ethical and social challenges of such socio-technical advances is a complex task, which requires a meticulous scrutiny of both the technology itself and the socio-cultural context in which the technology is embedded. Many of these ethical-social challenges are inherent in the very application of automatic and self-learning systems to medical data, regardless of the physical implementation of those systems (e.g., embodied vs disembodied), the type of data being processed, the institutional setting, medical specialty, patient population, and clinical purpose in which or for which such systems are deployed. For example, aligning AI systems with data privacy requirements, minimizing the effects of algorithmic bias, and achieving transparency have been notably recognized as cross-domain normative requirements which extend to the whole medical domain. However, several ethical and social implications of medical AI are qualitatively dependent on the technological medium, clinical setting, patient group, socio-cultural context as well as on the

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ontological properties, values, power structures, and discourses which characterize those technological mediums, settings, or groups.

Compared to other areas of medicine, the use of AI to improve brain and mental health has not yet received sufficient attention and systematic assessment. This gap in the scientific literature raises both oddity and concern in the light of the intimate historical nexus between AI and the sciences of the mind and brain. In fact, the history of AI is inextricably intertwined with the history of neuroscience and psychology. Since the first conceptualizations of AI, scientists and philosophers turned to the human brain as a source of guidance for the development of intelligent machines [6]. Still today, AI borrows most of its lexicon from neuropsychological categories (e.g., machine *learning*, computer *vision*, *natural language* processing) while many areas of AI research such as artificial neural networks are based on and inspired by neurobiological structures and processes.

Most importantly, brain and mental health constitute a domain of fundamental ethical significance. This is primarily because neural processes and mental phenomena are the closest correlates of fundamental ethical categories such as moral agency, personal identity, and free will. Furthermore, faculties of the brain such as memory, consciousness, and language represent the core set of properties that make us human and through which we self-identify as persons. Therefore, the use of AI in brain and mental health elicits a complex interactive dynamics between artificial and human cognition, whose effects may have profound implications for both individuals and humanity at large. Anticipating and proactively assessing the ethical and social implications of this interactive dynamic between brains, minds, and cognitive technology is of paramount importance to responsibly navigate the AI revolution [7]. A context-specific ethical assessment of AI for brain and mental health is all the more important as people with chronic mental conditions, people with neurocognitive or physical disabilities, elderly adults, and people with dementia all belong to vulnerable groups, and hence experience higher risk of harm and consequently require special protective and some degree of priority consideration, even in the face of severe resource constraints. As AI advances fast, we have a moral obligation to ensure the responsible development and deployment of artificial intelligence for the benefit of millions of neurological and psychiatric patients worldwide.

This book attempted to fill this gap in the scientific and ethical literature by providing a comprehensive overview of the key applications of AI for brain and mental health and a systematic assessment of their ethical and social implications. The various chapters of this volume explored a wide spectrum of AI systems for brain and mental health such as social robots, chatbots, automated text analysis programs, predictive analytics software, brain-computer interfaces, neurostimulation tools, neurorehabilitation aids, smartphone-based mental health apps, neuromonitoring and neurofeedback tools. This comprehensive overview adds to previous work on the ethics of AI-driven technological trends such as intelligent assistive technologies for dementia [8], digital mental health [9], clinical neuroimaging [10], neural motor prostheses [11], and other neural devices [12].

Much editorial attention, in this volume, was devoted to ensuring that such technological innovations were not presented as value-free artifacts but as

socio-technical systems embedded in a socio-cultural context, designed for or accessible to specific patient groups, influenced by pre-existing values, and inscribed in a rich grid of ethical-legal norms. The fifteen chapters here contained depict a rich set of AI-enabled opportunities to improve the health and mental wellbeing of both patients and healthy citizens. At the same time, they identify complex areas of ethical problematicity which require careful considerations.

Featuring contributions from world-leading experts from the areas of computer science, robotics, neurology, psychiatry, clinical psychology, bioethics, neuroethics, and the law, this book marks an important milestone in the public understanding of the ethics of AI in brain and mental health. Furthermore, it provides a useful resource for any future investigation in this crucial and rapidly evolving area of AI application.

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