บทความฟื้นฟูวิชาการ
Review Article

บทบาทของปัญญาประดิษฐ์ในการวินิจฉัยโรคทางจิตเวช

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บทคัดย่อ

วัตถุประสงค์: เพื่อศึกษาบทบาทของปัญญาประดิษฐ์ ในการวินิจฉัยโรคทางจิตเวชในหลายมิติ ได้แก่ บทบาทของปัญญาประดิษฐ์ที่เกี่ยวข้องกับการวินิจฉัยโรคทางจิตเวช ประโยชน์ของปัญญาประดิษฐ์ ข้อจำกัดและจุดท้าทาย ทิศทางในอนาคตของปัญญาประดิษฐ์ในการวินิจฉัยโรคทางจิตเวชทั้งในระดับประเทศไทยและระดับสากล

วิธีดำเนินการศึกษา: ตระหนักถึงบทบาทของปัญญาประดิษฐ์ในทางการแพทย์ รวมถึงทางด้านการวินิจฉัยโรคทางจิตเวช จึงได้มีการศึกษาทบทวนงานวิจัย คิดวิเคราะห์และนำเสนอเป็นบทความในหลายแง่มุม เพื่อเป็นการพัฒนาองค์ความรู้ด้านปัญญาประดิษฐ์ที่มีผลต่อวงการแพทย์รวมถึงการวินิจฉัยโรคทางจิตเวช

ผลการศึกษา: การใช้ปัญญาประดิษฐ์ทางด้านจิตเวช ช่วยเพิ่มความแม่นยำในการวินิจฉัยโรคทางจิตเวช ซึ่งปัญญาประดิษฐ์จะช่วยวิเคราะห์ข้อมูลที่ซับซ้อน โดยการเรียนรู้ของเครื่องคอมพิวเตอร์ การเรียนรู้เชิงลึก และการประมวลผลภาษาธรรมชาติ รวมถึงการสแกนสมองและข้อมูลพฤติกรรม ทำให้สามารถตรวจจับโรคในระยะเริ่มต้นและปรับปรุงผลการรักษาได้ดีขึ้น นอกจากนี้ ปัญญาประดิษฐ์ยังช่วยเพิ่มประสิทธิภาพในการวินิจฉัย ลดเวลาในการทำงาน และเข้าถึงการรักษาได้มากขึ้น โดยเฉพาะในพื้นที่ที่ขาดแคลนผู้เชี่ยวชาญ ปัญญาประดิษฐ์ยังช่วยออกแบบแผนการรักษาที่เหมาะสมกับผู้ป่วยแต่ละราย และลดปัญหาการตีตราทางจิตเวช อย่างไรก็ตาม ยังมีข้อจำกัด เช่น คุณภาพข้อมูลที่อาจมีอคติจากกลุ่มตัวอย่างที่จำกัดและการขาดความโปร่งใสในบางชุดข้อมูลของปัญญาประดิษฐ์ ซึ่งอาจทำให้เกิดความไม่มั่นใจในการนำไปใช้ในทางการแพทย์ นอกจากนี้ ยังมีความกังวลเกี่ยวกับความเป็นส่วนตัวและการประมวลผลข้อมูลส่วนบุคคล

บทความฟื้นฟูวิชาการ
Review Article

บทบาทของปัญญาประดิษฐ์ในการวินิจฉัยโรคทางจิตเวช

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บทคัดย่อ (ต่อ)

สรุป: ปัญญาประดิษฐ์มีศักยภาพในการเปลี่ยนแปลงทางด้านจิตเวช โดยช่วยเพิ่มความแม่นยำในการวินิจฉัยและการวินิจฉัยตั้งแต่ระยะเริ่มต้น ผ่านการวิเคราะห์ข้อมูลซับซ้อน และการตรวจจับรูปแบบที่อาจมองข้าม รวมทั้งปัญญาประดิษฐ์ยังสามารถปรับแผนการรักษาให้เหมาะสมกับแต่ละบุคคล อย่างไรก็ตาม การใช้ปัญญาประดิษฐ์ในทางการแพทย์ต้องเผชิญกับความท้าทายเรื่องคุณภาพข้อมูล ความโปร่งใสของชุดข้อมูล และข้อพิจารณาทางจริยธรรม ซึ่งต้องได้รับการแก้ไขเพื่อใช้ศักยภาพของปัญญาประดิษฐ์ให้เกิดประโยชน์สูงสุดทางด้านจิตเวช

คำสำคัญ: ปัญญาประดิษฐ์ การวินิจฉัยโรคทางจิตเวช การเรียนรู้ของเครื่องคอมพิวเตอร์ การเรียนรู้เชิงลึก การประมวลผลภาษาธรรมชาติ

บทความฟื้นฟูวิชาการ
Review Article

The role of artificial intelligence in psychiatric diagnosis

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Abstract

Objective: This study seeks to investigate the role of Artificial Intelligence (AI) in diagnosing psychiatric disorders through multiple dimensions. It addresses AI's contributions to psychiatric diagnosis, the associated benefits, limitations and challenges, and prospective developments for AI application within the field at the national level in Thailand and internationally.

Method of study: This study incorporated a review of existing research to understand the role of AI in medicine, particularly its application in diagnosing psychiatric disorders. The analysis presented aimed to enhance understanding of AI's implications for the medical field, with a specific emphasis on psychiatric diagnosis.

Results: AI significantly improves diagnostic accuracy in psychiatry by analyzing intricate data by Machine Learning (ML) Deep Learning (DL) Natural Language Processing, (NLP) including brain imaging and behavioral profiles. This capability enables the early detection of psychiatric disorders and enhances treatment outcomes. Furthermore, AI improves operational efficiency, decreases the time required for various tasks, and improves access to mental health care in regions with scarce specialists. AI also aids in the creation of personalized treatment strategies and helps mitigate the stigma surrounding mental health issues. Nevertheless, limitations exist, including potential bias due to data derived from limited sample populations and a lack of transparency in specific AI datasets. This may lead to uncertainty in clinical implementation. Issues related to privacy and the management of personal data continue to be of concern.

Conclusion: AI can transform the field of psychiatry by enhancing diagnostic accuracy and facilitating earlier identification of psychiatric disorders. Through the analysis of complex data and the recognition of subtle patterns, AI can customize treatment plans for individual patients. However, integrating AI into medical practice encounters challenges concerning data quality, transparency, and ethical considerations that must be effectively addressed to realize AI's potential in the realm of psychiatry fully.

Keywords: artificial intelligence, psychiatric diagnosis, machine learning, deep learning, natural language processing

Introduction

The integration of Artificial Intelligence (AI) into the healthcare sector has significantly transformed various medical fields, notably psychiatry. Mental health disorders represent a considerable global health challenge, affecting millions of individuals annually. The field of psychiatry encounters distinct diagnostic challenges, as mental illnesses frequently lack definitive biomarkers. Diagnoses are predominantly reliant on clinical judgment, patient interviews, and subjective reports. As a result, the diagnostic process can be inconsistent, delayed, and susceptible to errors, which adversely affects treatment outcomes.

In recent years, AI has emerged as a promising solution for addressing these diagnostic challenges. By utilizing advanced methodologies such as Machine Learning (ML)[1] and Deep Learning (DL),[2] psychiatry has the potential to enhance diagnostic accuracy, tailor treatments to individual patients, and improve early detection capabilities.[3] The potential of AI to refine psychiatric diagnosis is particularly noteworthy in light of the inherent subjectivity, variability, and limited resources commonly associated with this area of medicine.[4] Furthermore, AI's ability to analyze large datasets, identify hidden patterns, and generate predictive insights is becoming increasingly valuable in clinical practice.[5,6]

This review article aims to explore various applications of AI in the diagnosis of psychiatric disorders, highlighting its strengths, challenges, and future prospects. The utilization of AI in healthcare has experienced remarkable growth, demonstrating promising applications in the diagnosis and management of psychiatric conditions.

In Thailand, where mental health challenges are escalating as a result of social, economic, and demographic shifts, AI is emerging as an instrumental tool for facilitating timely diagnosis and management of mental health disorders.[5-7] Psychiatry in Thailand faces numerous obstacles, including a shortage of mental health professionals, societal stigma surrounding mental illness, and limited access to specialized care.[7,8] AI possesses the potential to mitigate some of these challenges by offering more accurate, efficient, and accessible diagnostic solutions.[3]

Method of data collection

The author conducted a comprehensive review of research studies published within the past ten years, primarily using PubMed and Google Scholar as the main databases. The search began with a broad exploration of the role of AI in medicine and gradually narrowed down to focus specifically on AI in psychiatric diagnosis. The review included both international studies and research conducted within Thailand.

Key search terms included AI in medicine, AI in psychiatric diagnosis, and AI in Thailand. To deepen the understanding of AI applications, additional technical terms such as machine learning, deep learning, and natural language processing were also explored. Each selected study was carefully reviewed and synthesized to form the basis of this review article.

AI technologies in psychiatric diagnosis

Artificial Intelligence (AI) encompasses a broad range of technologies, prominently featuring Machine Learning (ML) and Deep Learning (DL) in the realm of psychiatric research and clinical applications.[1,2] ML algorithms are designed to analyze extensive datasets, identifying patterns and correlations that may be challenging for human clinicians to recognize. DL, a specialized subset of ML, utilizes neural networks that simulate the functioning of the human brain and adeptly process complex, unstructured data, including images, text, and audio.[9] AI pertains to machines' simulation of human cognitive processes, particularly computer systems. Within the field of psychiatry, both ML and DL play pivotal roles in enhancing the identification, diagnosis, and management of mental health disorders.[10] The successful application of these technologies necessitates substantial datasets and sophisticated algorithms to unearth patterns and predict outcomes. AI systems exhibit capabilities traditionally associated with human cognition, such as pattern recognition, data-driven learning, and decision-making.[3,5,6] In psychiatric practice, AI is utilized in various capacities, notably ML, DL, and Natural Language Processing (NLP)[11] These technologies facilitate the analysis of extensive datasets, deriving insights that assist clinicians in diagnosing mental health conditions by examining neuroimaging, behavioral data, and clinical interviews. Furthermore, AI is employed to construct predictive models, enhance diagnostic accuracy, and refine decision-making processes in psychiatric care.[3,6]

1. Machine Learning (ML) and Deep Learning (DL) techniques in psychiatry

Machine Learning (ML): Machine learning is a core component of AI that employs statistical methods to analyze data, learn patterns, and make predictions. In psychiatric diagnostics, supervised learning (which uses labelled data) and unsupervised learning (which works with unlabeled data) are particularly valuable.[12] ML uses algorithms to analyze data, learn from it, and make decisions or predictions based on the analysis.[13] Standard ML techniques in psychiatry include supervised, unsupervised, and reinforcement learning.[14] Supervised learning, where algorithms are trained on labelled data, is often used to predict psychiatric conditions like depression, bipolar disorder, and schizophrenia.[1] For instance, supervised learning can be trained to anticipate whether a patient may develop depression based on behavioral data or brain imaging scans.[15] In contrast, unsupervised learning can cluster patients into groups based on similar characteristics or conditions, even when the underlying disorders are unknown.

A significant application of ML in psychiatry is predictive analytics.[1,12] ML algorithms can analyze longitudinal data, including patient history, family history, and environmental factors, to predict the onset of psychiatric disorders like schizophrenia, bipolar disorder, and Major Depressive Disorder (MDD).[1] These predictive models can identify subtle early warning signs in patients, enabling earlier interventions and improving long-term outcomes. In Thailand, where mental health conditions such as depression and schizophrenia are

prevalent.[16] AI has shown promise in detecting early warning signs, predicting relapse, and offering early interventions.[7]

Deep Learning (DL): Deep learning, a subfield of ML, involves neural networks with multiple layers (hence the term "deep"). This approach excels in processing unstructured data, including text, speech, and images.[2,17] DL models have been applied in neuroimaging research to identify structural and functional brain abnormalities related with psychiatric disorders.[18] The ability to detect subtle changes in brain structure or connectivity patterns in patients with disorders like schizophrenia can lead to earlier and more accurate diagnoses.[19,20] DL has demonstrated significant potential in analyzing brain scans, speech patterns, and other complex data sources to identify potential psychiatric conditions. This is especially useful in psychiatry, where data can be highly complex and multidimensional.[21]

2. Natural Language Processing (NLP) in psychiatric diagnosis

Natural Language Processing (NLP) is a specialized branch of artificial intelligence (AI) that focuses on the comprehension and processing of human language.[22] It is instrumental in analyzing the extensive volumes of text generated within psychiatric settings. The application of NLP encompasses various dimensions of psychiatric diagnosis,[1] which include:

Speech and text analysis: NLP algorithms can analyze linguistic patterns in spoken and written communication forms, facilitating the detection of symptoms indicative of psychiatric disorders.[22] For instance, alterations in speech characteristics such as speech rate, monotony, or incoherent language can serve as preliminary indicators of disorders such as schizophrenia or major depressive disorder.[1] Furthermore, NLP models are adept at appraising the emotional tone of patient responses, which may provide critical insights into the severity of conditions such as anxiety and depression.

Clinical documentation: psychiatric clinicians frequently depend on documentation, including notes, reports, and case histories accumulated over time.[23] NLP algorithms can efficiently extract relevant information from these text-heavy documents to reveal insights into a patient's mental health condition. For example, NLP tools can discern recurrent phrases, terms, or expressions that are associated with specific disorders, such as negative language prevalent in cases of depression. This analytical capability aids in tracking symptom progression and identifying patterns that may signify a diagnosis shift.[24]

In Thailand, NLP has been employed to analyze clinical notes, therapy transcripts, and patient interviews.[7] AI models trained on these datasets can identify linguistic markers associated with particular psychiatric conditions, such as speech pattern changes in patients diagnosed with schizophrenia or depression.[1] Additionally, NLP can be applied to the analysis of social media content, thus providing valuable insights into a patient's mental health beyond traditional clinical environments. Given the substantial role that online platforms and social media occupy in Thai communication,[24] this application holds the potential

to facilitate the early identification of mental health issues for individuals who may refrain from seeking professional assistance due to stigma.[22]

3. Neuroimaging and AI in psychiatry

Neuroimaging analysis represents a critical field in which Deep Learning (DL) has demonstrated remarkable potential. For example, deep Convolutional Neural Network (CNN) models can be trained to identify structural brain abnormalities associated with psychiatric conditions.[25] AI has proven to be advantageous in the interpretation of neuroimaging data.[26,27] Traditional methods for analyzing brain images often rely heavily on the expertise of trained radiologists; however, AI can automate this process, thereby enhancing both the speed and accuracy of diagnoses.[19,25] Research indicates that DL models can detect microstructural alterations in brain regions, such as the hippocampus, which may serve as early indicators of neurodegenerative diseases, frequently with greater accuracy than traditional radiology interpretations.[28,29]

Structural imaging: AI technologies can analyze structural brain scans to identify abnormalities such as grey matter loss or disruptions in white matter. Empirical studies have demonstrated that AI can effectively identify brain anomalies in conditions such as schizophrenia, bipolar disorder, and depression, even prior to the manifestation of observable clinical symptoms.[1] For instance, the utilization of MRI scans has allowed AI models to discern structural changes in the brains of patients diagnosed with schizophrenia that correlate with cognitive and functional impairments.[30,31]

Functional imaging: Functional MRI (fMRI) provides real-time measurements of brain activity, thereby offering insights into the engagement of various brain regions during distinct tasks.[32] AI models have been deployed to analyze fMRI data, revealing patterns of brain activity linked to psychiatric conditions. Alterations in the Default Mode Network (DMN), a network of brain regions implicated in self-referential thought, have been associated with depression and schizophrenia.[31,33,34] AI can accurately detect these variations, serving as a valuable instrument for the early diagnosis and ongoing monitoring of psychiatric conditions.[35,36]

In the context of Thailand, Artificial Intelligence (AI) algorithms have been utilized to analyze brain MRI data for the detection of abnormalities pertinent to neurodegenerative disorders and mental illnesses.[7] Research indicates that AI-based models possess the capability to predict early alterations in brain regions associated with cognitive function, thereby providing valuable insights into conditions such as Alzheimer's disease and major depressive disorder.[35,36]

4. Predictive analytics for early psychiatric diagnosis

Predictive analytics, which employs historical data to forecast future occurrences, represents another area where AI demonstrates considerable potential within psychiatry. Specifically, when addressing psychiatric disorders.[37-39] AI can facilitate the anticipation of mental health conditions prior to their progression to a clinically significant stage, thereby enabling earlier interventions and potentially more favorable outcomes.[3,6] Machine learning

algorithms can be trained on diverse types of data, including behavioral patterns, genetic information, sleep and activity levels, and historical medical records,[40,41] to assess the probability of a patient developing conditions such as depression, anxiety, or psychosis.[1,38] For example, studies have leveraged AI to monitor speech patterns, social media engagement, and sleep disturbances, thus providing clinicians with critical information for early diagnosis,[36] and it has also been found that AI plays a significant role in predicting suicide risk and self-harm reduction, enabling more personalized and targeted suicide prevention. By collecting individualized risk data across multiple domains including psychiatric conditions AI can accurately assess a person's risk level. This allows for more precise identification of high-risk individuals and supports the development of systematic strategies for early detection and effective intervention.[42-45] Furthermore, AI may assist in predicting which individuals are likely to benefit from specific treatments, thereby optimizing personalized care plans.[1,3,6,15]

Benefits of AI in psychiatric diagnosis

1. Improved diagnostic accuracy and standardization

The standardization challenge is significant in psychiatry, as diagnoses can vary based on a clinician's expertise or the diagnostic criteria employed.[3,4] AI can contribute to standardizing psychiatric diagnoses, thereby mitigating variations that may arise due to human factors. This aspect is particularly critical in psychiatry, where disparate interpretations of symptoms and the application of various diagnostic criteria by different clinicians can lead to inconsistencies.[5,6] By employing AI models, mental health professionals across various healthcare settings can adhere to uniform diagnostic approaches, ensuring greater patient care consistency.[8] This is especially important in the diagnosis of conditions such as schizophrenia, which frequently exhibit overlapping clinical features with other mental health disorders.[34]

Furthermore, AI has the potential to reduce diagnostic errors in psychiatry substantially. Traditional diagnostic methods predominantly rely on subjective assessments, clinical interviews, and patient self-reports.[5,6] AI enhances objectivity by analyzing extensive datasets and identifying patterns that human clinicians may overlook. For instance, an AI model designed to analyze speech patterns could identify early indicators of cognitive dysfunction in patients with Alzheimer's disease, thereby providing opportunities for interventions that might otherwise be neglected.[46,47] AI's capacity to process various data sources including neuroimaging, genetics, behavioral data, and clinical history renders it particularly effective in offering a holistic view of a patient's mental health status.[18] Machine learning models can generate predictions considering various factors, thus improving diagnostic accuracy relative to solely relying on clinical judgment. A particular study illustrated that machine learning models could accurately differentiate among schizophrenia, bipolar disorder, and major depression based on brain imaging data.[1,11-14] This degree of accuracy can expedite and improve the reliability of diagnoses,

thereby reducing the duration of patients' diagnostic uncertainty.

AI can significantly enhance the accuracy of psychiatric diagnoses within Thailand. One of the primary challenges in psychiatry is the subjectivity inherent in clinical evaluations,[7] where diagnoses frequently depend on patient interviews and clinician observations. By leveraging vast datasets for analysis, AI minimizes human error and enhances diagnostic precision. For instance, machine learning algorithms trained on comprehensive datasets can recognize patterns in patient data that may not be immediately discernible to clinicians.[48] This can lead to more accurate diagnoses, particularly in complex or comorbid conditions. By its ability to rapidly process substantial amounts of data, AI can provide clinicians in Thailand with timely and reliable diagnostic support.

2. Efficiency and time-saving

Time constraints and high patient volumes can significantly impede accurate diagnoses in clinical practice. Artificial Intelligence (AI) can help mitigate these challenges by automating time-intensive tasks, such as medical imaging analysis and assessment of extensive datasets.[4,5] For example, AI tools can rapidly process neuroimaging scans, identify abnormalities, and present results to clinicians.[36] This capability allows healthcare professionals to allocate more time to patient engagement and to make informed decisions based on AI-assisted analyses.[3-5]

3. Enhancing access to mental health care

Thailand faces a notable shortage of mental health professionals, particularly in rural regions. According to the World Health Organization (WHO), the country possesses approximately 0.38 psychiatrists per 100,000 individuals, a figure that is considerably lower than the global average.[16] AI solutions could address this disparity by providing primary care providers practical tools for screening and diagnosing psychiatric conditions.[3-5] Furthermore, AI-powered diagnostic systems could be deployed in remote areas, enabling healthcare providers to assess and manage mental health conditions even without specialist psychiatrists. This initiative can decrease the interval between symptom onset and diagnosis, enhancing patient outcomes.[3,5,6]

4. Early detection and prevention

One of the most significant advantages of AI in psychiatric diagnosis lies in its capacity for early prediction and detection of psychiatric disorders.[37,38] AI algorithms can analyze historical and behavioral data, facilitating the identification of subtle early warning signs that may precede overt psychiatric episodes[6]. Early detection is critical for effective treatment, as it allows for timely interventions that can prevent or alleviate the severity of mental health conditions.[25,37,47] For example, collecting individualized data can enhance suicide and self-harm prevention efforts by making them more targeted and effective.[42-45]

Research indicates that machine learning models can predict the risk of developing psychiatric ailments such as depression or psychosis months or even years prior to the manifestation of symptoms[1]. For instance, AI algorithms that monitor a patient's sleep patterns, social media activity, or cognitive performance can forecast future depressive episodes,[15,33] thus enabling clinicians to implement preventive measures.[13,29]

5. Personalized treatment plans

The ability of AI to analyze complex datasets enhances the development of personalized treatment plans. By assessing individual patient data encompassing genetics, neuroimaging, and behavioral patterns.[25,29] AI can assist clinicians in customizing interventions tailored to each patient's unique requirements.[29,36,43] This approach may yield more effective treatments with fewer adverse side effects, as AI can anticipate which therapies or medications are most likely to benefit each individual.[29,43]

A particularly promising application of AI in psychiatry is its ability to predict mental health conditions before their clinical emergence.[7,38,47] In a nation such as Thailand, where mental health care is frequently underutilized due to stigma,[22] the predictive capabilities of AI could foster earlier intervention. For instance, AI models that scrutinize patient data, including medical history, sleep patterns, and social behaviors, can predict the onset of disorders such as depression, anxiety, bipolar disorder or Alzheimer's disease.[1,15,29,38] This predictive ability can lead to personalized treatment plans tailored to the individual's needs and risk factors.[29,36,47]

6. Reduction of mental health stigma

The stigma associated with mental illness represents a significant barrier to the pursuit of care in Thailand.[7,48] Many individuals may postpone or forgo treatment due to fears of social repercussions.[22] AI technologies could reduce this stigma by offering remote diagnostic and therapeutic options.[3,6] For example, AI-driven virtual therapists or diagnostic chatbots could provide preliminary mental health assessments without directly interacting with a human clinician, thereby alleviating the embarrassment or anxiety that some patients may experience.[6,47]

Challenges and limitations of AI in psychiatric diagnosis

1. Data quality and bias

One of the principal challenges confronting Artificial Intelligence (AI) in psychiatry is the quality and diversity of the data utilized to train algorithms. AI models necessitate extensive datasets for effective learning; however, in psychiatry, these datasets often exhibit size, representation, and diversity limitations, thereby contributing to potential biases.[6,28] For instance, numerous psychiatric datasets are primarily derived from a narrow population, resulting in AI models that may be less efficacious in diagnosing individuals from varied demographic backgrounds, including racial minorities or those with co-occurring conditions.[28] Many AI models have been predominantly trained on datasets composed of individuals from Western urban populations.[2] These may introduce biases affecting their performance across other demographic groups, such as rural populations and racial minorities.[6,16,28]

To address this challenge, enhancing the diversity and quality of mental health data is imperative, ensuring that AI algorithms are trained on datasets that accurately reflect a range of populations and contexts.[6,7] Researchers must prioritize the collection of diverse, high-quality datasets encompassing a wide variety of demographic, cultural, and clinical factors.[3,6,47] Moreover, AI models should undergo continual

updates to align with the evolving understanding of psychiatric conditions.[29]

While AI presents substantial potential in psychiatric diagnosis, the quality and representativeness of the training data are crucial. In Thailand, for instance, the availability of expansive, diverse, and high-quality datasets poses significant challenges.[7] Data biases related to ethnicity, socioeconomic status, and geographical location may result in AI systems not being well generalized to the Thai population.[16] Accordingly, AI models primarily trained on Western datasets may not perform optimally in Thailand unless they are appropriately adapted to the local cultural and demographic context.[2,19] This situation underscores the need for localized research and creation of datasets representative of the Thai population.[7]

2. Interpretability and transparency of AI models

Many AI models, particularly those employing deep learning algorithms, are frequently criticized for their classification as "black boxes". Such models generate outputs without clearly explaining how those outputs are produced, rendering the decision-making processes difficult for human comprehension.[4,5,8,10] This lack of interpretability presents significant concerns in clinical settings, wherein clinicians must understand the reasoning behind AI recommendations.[3,4,8] The inability to elucidate how an AI model reaches a particular conclusion may hinder the adoption of AI in routine clinical practice, as clinicians must be capable of justifying these decisions to patients.[8]

Efforts are underway to develop "explainable AI" (XAI), which seeks to enhance the interpretability and transparency of AI models.[14,49] Such advancements would enable clinicians to comprehend AI diagnostic suggestions' rationale and facilitate more informed decision-making.[4,5] For example, researchers are devising methods that allow practitioners to understand the decision-making processes of neural networks by highlighting relevant features of input data, such as specific speech patterns or brain regions, that influenced the AI's predictions.[3,6,8] In Thailand, ensuring that AI models deliver transparent and comprehensible explanations for their diagnoses will be essential for their integration into routine clinical practice.[7,48]

3. Ethical and privacy concerns

The deployment of AI in psychiatry frequently involves processing sensitive patient data, including mental health histories, neuroimaging scans, and genetic information.[3,25,27,41] This raises substantial ethical and privacy concerns. It is critical to obtain patient consent and implement robust security measures to safeguard this data from breaches or misuse.[6,22,28] Improper handling of personal health information could precipitate privacy violations, discrimination, or exploitation. Consequently, establishing rigorous data protection protocols and securing patient consent is essential to mitigate these concerns.[6,28]

Furthermore, ethical issues arise concerning the potential for AI to reinforce existing biases or perpetuate discrimination, especially if algorithms are not trained on diverse datasets.[28] Clinicians and

researchers must remain vigilant in addressing these biases to ensure equitable access to AI-driven psychiatric care.[5,6,28] In a nation like Thailand, where data protection regulations are still developing, the assurance of patient confidentiality and security is paramount.[7] Additionally, the utilization of AI in psychiatric diagnosis must be guided by ethical considerations to prevent the reinforcement of biases or the making of decisions that may adversely impact marginalized populations.[6,25,28]

Future directions

The future of Artificial Intelligence (AI) in psychiatric diagnosis appears highly promising, with several significant advancements anticipated: integration with wearables and digital health tools: the integration of AI with wearable technologies, including smartwatches and fitness trackers, which monitor real-time health metrics, is expected to increase.[32,40,47] These devices can collect data on sleep patterns, physical activity, heart rate variability, and additional health indicators, providing continuous information for AI algorithms to analyze.[3-5] Such integration will facilitate ongoing mental health monitoring, enabling clinicians to intervene at an earlier stage when necessary.

Multimodal approaches: Future AI systems are likely to incorporate multiple data sources, such as genetic, behavioral, neuroimaging, and environmental information, to create a comprehensive view of a patient's mental health.[8,13,25,41] These multimodal models are expected to enhance diagnostic precision and support individualized treatment planning.[29,36,47]

Real-time diagnostics: Artificial intelligence may enable real-time diagnostics, providing clinicians with immediate feedback during patient consultations.[3,47] For example, during a clinical interview, an AI tool could analyze a patient's speech patterns and offer insights regarding the likelihood of conditions such as depression or anxiety.[1,15] This capability would empower clinicians to make more informed decisions promptly.

Advancements in explainable Artificial Intelligence (XAI) are anticipated to improve AI models' transparency and interpretability, thereby fostering clinicians' trust and understanding regarding AI-generated recommendations.[49] Additionally, data collection and standardization improvements are likely to enhance the quality of datasets utilized to train AI models, increasing their accuracy and applicability across diverse populations.[8,19] In the long term, AI has the potential to become a crucial tool in delivering personalized, predictive, and preventive mental health care.[25,29,38]

Furthermore, AI could be increasingly vital in mental health monitoring and treatment over time. With advancing wearable technologies and mobile applications, AI can continuously assess an individual's mental health status.[32,40,47] The ongoing development of explainable AI is projected to bolster clinicians' transparency and trust in AI-driven diagnoses.[3,19,47] The integration of wearable devices, mobile applications, and remote monitoring tools will enable AI to constantly evaluate mental health conditions while providing real-time feedback to patients and clinicians. This continuous

monitoring may lead to more proactive interventions and improved long-term mental health outcomes.

In Thailand, there exists considerable potential for growth in several key areas: integration with telemedicine: given the rapid expansion of telemedicine in Thailand, AI could be integrated into virtual consultations to furnish clinicians with real-time diagnostic assistance.[7,48] AI tools may analyze patient responses during telehealth sessions to provide diagnostic support, thereby enhancing the efficiency and accuracy of remote mental health services.[19,25,47]

AI for personalized mental health care: as AI systems become increasingly sophisticated, they may offer highly personalized treatment plans based on individual patient data, including genetic, environmental, and behavioral factors.[50] This tailored approach has the potential to yield more effective treatments with minimal side effects, specifically designed to address each patient's unique needs.[29,36,47] Collaboration with Government and NGOs: in Thailand, the government and various Non-Governmental Organizations (NGOs) have diligently worked to improve access to mental health services, particularly in underserved communities.[7,48] Through collaboration with AI researchers, policymakers can ensure that AI tools are accessible and affordable for the broader Thai population,[51] enhancing mental health care accessibility and overall outcomes.[7,16,48]

Conclusion

Artificial intelligence possesses significant transformative potential within psychiatry, offering innovative tools that enhance diagnostic accuracy, standardization, and early intervention. By analyzing complex, multimodal datasets and detecting patterns that may elude human clinicians, AI can improve the precision of psychiatric diagnoses and facilitate the personalization of treatment approaches. However, the successful integration of AI into clinical practice necessitates the resolution of challenges related to data quality, model transparency, and ethical considerations. As research in artificial intelligence progresses, it is imperative to fully address these challenges to harness its potential in the psychiatric domain.

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