
The Role Of Artificial Intelligence As A Tool For Screening Depression And Anxiety Disorders

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Abstract

Depression and anxiety disorders are common mental health disorders that contribute to the burden of disability. Early detection is still a challenge because screening through clinical interviews and questionnaires such as PHQ-9 and GAD-7 relies on subjective reports and requires professionals. The development of Artificial Intelligence (AI) offers opportunities to support more objective and efficient screening. To know the role of AI as a screening tool for depression and anxiety disorders and to examine its application, effectiveness, advantages, and limitations. This study used a literature review of the scientific literature on the use of AI in the detection and screening of depression and anxiety disorders. The literature was searched using keywords related to artificial intelligence, machine learning, deep learning, depression, anxiety, and screening, then analyzed descriptively based on data type, AI approach, screening capabilities, and its advantages and limitations. AI is able to recognize depression- and anxiety-related patterns through text, voice, video, wearables, and multimodal. The voice-based approach shows an AUC of around 0.92, wearables have a sensitivity of 0.89, a specificity of 0.93, and an AUC of 0.96, while multimodal shows a pooled AUC of around 0.95. AI has the potential to improve the objectivity and efficiency of screening, but it still faces limitations in data quality, privacy, external validation, and performance variations in different populations. AI has the potential to be a screening tool for depression and anxiety disorders, but it has not yet been able to replace clinical evaluation. Further validation and integration with health worker assessments are needed.

Keywords: Artificial Intelligence, Anxiety Disorders, Depression, Machine Learning, Screening.

INTRODUCTION

Depression and anxiety disorders are two of the most common mental disorders found around the world. Globally, the number of cases of both continues to increase and is one of the leading causes of disability. It is estimated that hundreds of millions of people experience depression and anxiety, and the burden of these diseases has increased since the COVID-19 pandemic (Santomauro et al., 2021). This condition not only impacts an individual's health, but also affects productivity and quality of life broadly. In Indonesia, emotional mental disorders are also a significant problem, especially in adolescence and young adulthood. However, many cases go undetected early on because the symptoms are often thought of as ordinary stress or psychological exhaustion. As a result, patients only come to health facilities when the condition is severe enough. This shows that early detection is still a major challenge in handling mental disorders.

Screening for depression and anxiety during this time is generally carried out through clinical interviews and the use of psychological questionnaires such as PHQ-9 and GAD-7. Clinical interviews do provide quite complete information, but they require a lot of time and limited professional personnel, making it difficult to apply widely, especially in primary services.

In addition, the results of the interview can also be influenced by subjectivity, both from the patient and the examiner. On the other hand, questionnaires have limitations because they depend on the individual's ability to understand and report their own symptoms. Many patients are unaware of their psychological condition or tend to cover up the symptoms experienced, so the screening results are less accurate (Levis et al., 2019). This limitation causes many cases of depression and anxiety to remain unidentified, so a more objective, efficient, and accessible screening method is needed.

Technological developments in recent years, especially Artificial Intelligence (AI), have begun to be used in the field of mental health as an alternative to early detection methods. AI, especially

through the machine learning, being able to process large amounts of data and find certain patterns related to a person's psychological state in a more objective manner (Shatte et al., 2019).

Some studies have shown that language analysis using natural language processing techniques can identify changes in communication patterns related to depression and anxiety. Individuals with mental disorders tend to use words with negative emotional content as well as specific language patterns, so they can be used as an early indicator of psychological condition (Eichstaedt et al., 2018).

In addition, the use of data from social media also shows potential in detecting mental disorders. Digital activity patterns such as frequency of use, social interaction, and the type of content shared can provide an idea of a person's emotional state. This approach allows screening to be carried out more widely and even without the direct involvement of health workers (Guntuku et al., 2019). The latest approach that is more comprehensive is the use of multimodal data, which combines various data sources such as text, voice, and facial expressions. This method is considered to have a higher level of accuracy because it is able to describe the individual's condition more thoroughly than a single method (Lu et al., 2022).

With these advantages, AI has great potential to become a more efficient tool for screening depression and anxiety, especially in improving early detection in society.

Literature Review

Depression and Anxiety Disorders

Depression is one of the most common types of mental health disorders found in adults around the world. Symptoms of depression are generally associated with decreased mood, feelings of worthlessness, loss of interest in things you previously liked, the appearance of suicidal thoughts, sleep disturbances, as well as cognitive and other physical symptoms (Skosana et al., 2025). Anxiety disorders are defined as a group of mental disorders characterized by the onset of excessive fear or anxiety and a tendency to avoid perceived threats. Anxiety is called pathological if it is felt excessively and persistently, thereby interfering with normal daily functioning (Penninx et al., 2021).

Based on the Diagnostic and Statistical Manual of Mental Disorders 5th edition (DSM-5) (American Psychiatric Association, 2013), there are several types of depressive disorders. Major depressive disorder is the most common form of depression, characterized by symptoms that last at least two weeks and occur almost every day. Persistent depressive disorder is chronic depression that has lasted for at least two years in adults or one year for children and adolescents. Disruptive mood dysregulation disorder generally occurs in children, characterized by repeated emotional outbursts. Premenstrual dysphoric disorder is related to hormonal changes during the menstrual cycle. In addition, there is Substance/Medication-induced depressive disorder, which is depression due to the use of substances or drugs, and Depressive disorder due to another medical condition caused by other medical conditions. Symptoms of depression that do not fully meet certain criteria are classified as other specified depressive disorders, while depression that cannot be specifically classified is called unspecified depressive disorder.

As one of the main guidelines in the field of psychiatry, the DSM-5 also distinguishes anxiety disorders into several types (American Psychiatric Association, 2013), such as separation anxiety disorder which is characterized by excessive anxiety during separation, selective mutism which affects the ability to speak, specific phobia which is fear of certain objects or situations, social anxiety disorder which is characterized by excessive fear of social situations, and other types such as panic disorder or panic attack specifier that involve panic attacks. There is also Agoraphobia which is characterized by a fear of difficult situations to escape, while generalized anxiety disorder is anxiety about things in general. In addition, there are anxiety disorders due to substances or drugs, as well as due to other medical conditions.

Depression has a complex etiology involving the interaction of various factors so that its main mechanism is still not definitively understood. The development of depression is associated with dysfunction of HPA axis regulation, monoamine neurotransmitter imbalances, inflammation, genetic and epigenetic factors, changes in brain structure and function, and psychosocial factors. Recent

studies have also shown that dysfunction of glia cells or other brain structures contributes to the onset of depressive symptoms (Cui et al., 2024). Depression can also appear as a natural reaction to unpleasant life experiences, such as the loss of a loved one, material loss, or a decline in social status. Therefore, depression is not always pathological, but can also be an emotional reaction that is still possible to be considered normal before being classified as a depressive disorder of a clinical nature (Puspita et al., 2023).

A person with depression can experience disorders in various aspects of life. Emotionally, depression is generally characterized by decreased mood, sadness, loneliness, boredom, and reduced sense of happiness. As for the cognitive aspect, individuals often view themselves as inferior or feel inferior, refuse the help of others, and experience difficulty in making decisions. Individuals with depression may also experience decreased or loss of motivation to perform daily activities, including activities to meet basic needs such as eating and drinking. In more severe conditions, depression can develop into an urge to punish or self-harm, or be accompanied by suicidal thoughts (Puspita et al., 2023).

Mental Health Screening

Mental health screening is an initial assessment process used to detect the possibility of mental disorders in an individual before further clinical diagnosis is made. This screening generally uses standardized instruments that aim to identify symptoms of various disorders such as depression, anxiety, and other psychological disorders, so that it can assist healthcare workers in recognizing individuals who are at risk earlier (Neulinger et al., 2024).

The conventional screening instrument that is often used to detect depressive disorders is the Patient Health Questionnaire-9 (PHQ-9). PHQ-9 is a question-based depression screening tool that can be applied to patients in primary and community services. This questionnaire contains 9 questions that evaluate an individual's mental health condition over the past two weeks. The simple, easy-to-implement, and effective method makes PHQ-9 the most commonly used screening instrument in the evaluation of depressive symptoms (Khumaidi et al., 2023). In addition to PHQ-9, there is another questionnaire model that can be used, namely the Generalized Anxiety Disorder 7-item scale (GAD-7). GAD-7 is a questionnaire designed to be easy to use so that it can be filled out independently by the general public. This instrument can identify the likelihood of a person having an anxiety disorder based on an assessment of how often they experience anxiety symptoms using a scale of 0 (never) to 3 (daily). The value is then added up to obtain a total score with a range of 0 to 21. The assessment is positive if the total score reaches a value of 10 or more, which indicates the possibility of an anxiety disorder (Aktürk et al., 2025).

Structured diagnostic interviews can be used as a diagnostic reference in the assessment of mental disorders because they use standardized diagnostic criteria. The main goal of structured interviews is to reduce variation in the interview process by determining standards in the language of questions, the order of questions, and the method of assessment so that the diagnosis becomes more consistent. Structured Clinical Interview for DSM (SCID) is the most widely used interview method and is considered the most accurate. This is because SCID contains mandatory questions with a directed flow of questions, and is accompanied by an operational definition of the DSM diagnosis criteria (Kvig & Nilssen, 2023).

Although the screening method through questionnaires and interviews is still used to date, the approach has some limitations, as most diagnoses rely only on the patient's history and subjective self-reports. This approach is prone to bias, tends to be less consistent, and often misses out on cases of depression or anxiety disorder that should be detectable. In addition, the etiology and pathogenesis of depression and anxiety disorders that are not yet fully understood are also challenges in establishing an accurate diagnosis. Along with the development of health technologies, various artificial intelligence-based methods are increasingly being developed to support the detection and diagnosis of depression, especially through clinical and digital data processing (Nickson et al., 2023).

Artificial Intelligence in Detection and Screening

Artificial Intelligence (AI) is a branch of computer science that focuses on developing systems that are able to simulate intelligence in solving problems and achieving certain goals. AI is not only interpreted as "artificial intelligence", but includes the process of achieving goals, data processing, and learning abilities through algorithms. AI is not always directly related to human intelligence, but rather to how systems can process information and make decisions effectively based on available data (Santoso, 2023).

AI can be understood through several approaches, namely acting humanly, thinking humanly, thinking rationally, and acting rationally. The development of AI is also classified based on its level of ability, namely reactive machines, limited memory, theory of mind, and self-awareness, which describes the system's ability to learn from experience, as well as interact with the environment in a more complex way (Santoso, 2023).

In the development of detection and screening systems, Artificial Intelligence (AI) has several main branches, namely Machine Learning (ML), Deep Learning (DL), and Natural Language Processing (NLP). Machine learning allows systems to learn from data and find patterns to make predictions. Deep learning is a part of Machine Learning that uses more complex artificial neural networks so that it is able to analyze large amounts of data with a higher level of accuracy (Amanat et al., 2022). Meanwhile, Natural Language Processing is used to understand and analyze human language, such as text from social media, interviews, or medical records. The combination of these three branches has been shown to help detect depression automatically through the analysis of data and language patterns (Le Glaz et al., 2022; Hameed et al., 2025; Wang & Wu, 2025).

In general, the way AI works in detection and screening starts from data collection, then continues with the pre-processing stage to clean and prepare the data. After that, Machine Learning and Deep Learning algorithms are used to study patterns and build prediction models. The resulting model will be tested and validated to ensure its accuracy level before use. In text-based data, Natural Language Processing plays a role in extracting important information, such as emotions and word patterns, which is then used to predict an individual's mental state. This process allows for early detection to be carried out more quickly and efficiently, and can support clinical decision-making (Le Glaz et al., 2022; Hameed et al., 2025).

RESEARCH METHODS

A literature search was conducted to identify research that discusses the role of Artificial Intelligence (AI) as a screening tool for depression and anxiety disorders. Literature search was carried out through various sources of scientific literature using keywords tailored to the topic, including artificial intelligence, machine learning, depression, anxiety, screening, social media, and multimodal. The literature found was then selected based on the suitability of the title, the year of publication, and its relevance to the topic discussed.

The selected literature was then reviewed to identify the type of data used, the AI approach applied, the ability to screen, and its advantages and limitations. The results of the study from various studies are then presented descriptively and used as a basis for the preparation of results and discussion of the role of AI in the screening of depression and anxiety disorders.

RESULTS AND DISCUSSION

Based on the results of a literature review, Artificial Intelligence (AI) technology has been widely applied in the field of mental health, especially for the screening of depression and anxiety disorders. The use of AI includes various data sources, such as text, voice, facial expressions, behavior, and physiological data from wearable devices (Zafar et al., 2024). One of the key approaches in the application of AI is text-based data analysis, including social media, chat, and digital journals.

Through Natural Language Processing (NLP), AI can identify language patterns, emotions, and sentiments related to a person's mental state. Machine learning models are also used to detect depression and anxiety through the analysis of user uploads across various platforms by looking at changes in language patterns and online activity (Ahmed et al., 2022). Additionally, language analysis from brief interviews can be used to identify depression and anxiety through the processing of linguistic patterns and emotional expression (Wright-Berryman et al., 2023).

AI is also used in voice and speech analysis by evaluating various vocal characteristics, such as intonation, speech speed, sound intensity, and other acoustic features. Meta-analyses showed that audio-based approaches performed well in depression screening, with an Area Under the Curve (AUC) value of around 0.92 (Wang et al., 2025). In addition, the application of AI also includes the analysis of facial expressions and behavior through video-based technology. Computer vision technology allows the system to detect changes in facial expressions, muscle movements, and nonverbal behavior patterns related to emotional states. Video-based approaches are also used to differentiate individuals with and without depression (Wang et al., 2025). The use of wearable devices, such as smartwatches and smartbands, is also a source of data in AI-based screening. The device is capable of recording data continuously, including physical activity, sleep patterns, heart rate, body temperature, and other physiological parameters (Zafar et al., 2024).

These data-driven approaches can also be combined through a multimodal approach by combining different types of data, such as EEG and audio, EEG and eye movement, and audio, video, and text. The multimodal approach with audio, video, and text data is a form of multimodal that is widely used in research (Wang et al., 2025). When viewed based on the AI approach used, text analysis through Natural Language Processing (NLP), voice analysis, and video analysis showed quite good performance with AUC values ranging from 0.84 to 0.92 (Han et al., 2024; Li et al., 2025). The wearable-based method is reported to have a sensitivity of about 0.89, a specificity of 0.93, and an AUC of 0.96 in distinguishing individuals with and without depression (Liu et al., 2026). Meanwhile, the multimodal approach is able to achieve a pooled AUC of around 0.95 (Wang et al., 2025).

Discussion

The results of the study show that AI has potential as an aid in the screening of depression and anxiety disorders. AI performance is not only influenced by the machine learning algorithms used, but also by the type, quality, and characteristics of the data analyzed. Some studies have shown that algorithms such as Random Forest are able to provide relatively more stable results, especially in managing data that varies between individuals. However, the comparison of performance between algorithms cannot be concluded simply because each study uses different data types, model training methods, and sample characteristics (ShamsEldin et al., 2025). The text, voice, and video-based approach shows fairly good performance, but the stability of its accuracy can still be affected by the conditions under which the data is collected. Variations in language and cultural context can affect text analysis, while recording quality and environmental conditions can affect both sound and video analysis. Differences in nonverbal expression between individuals can also affect classification results (Han et al., 2024; Li et al., 2025).

The wearable-based approach showed relatively consistent performance in depression screening. This advantage has to do with its ability to record physiological and behavioral data, such as physical activity and sleep patterns, continuously. The data is relatively more stable and is less influenced by environmental context or variations in the way individuals express themselves (Liu et al., 2026). Meanwhile, the multimodal approach also shows high performance with a pooled AUC of around 0.95. The integration of different types of data allows AI to capture depression indicators more thoroughly while covering the weaknesses found in each modality. Thus, the combination of several data sources can provide better screening results than the use of one type of data alone (Wang et al., 2025).

Aside from accuracy, AI has advantages in its ability to objectively process large amounts of data and identify patterns that are difficult to analyze manually (ShamsEldin et al., 2025). The

multimodal approach allows the integration of different types of data so that it provides a more comprehensive picture than a single method (Wang et al., 2025). A self-report non-reliance approach also has the potential to reduce subjective bias, stigma, and social influence in filling out screening instruments (Georgescu et al., 2024). In addition, AI has the potential to help improve access to mental health services through digital systems as well as support a more efficient and sustainable screening process (Zafar et al., 2024).

On the other hand, the application of AI in mental health still has some limitations. In the multimodal approach, special tools are needed for data collection and there is potential for data bias and heterogeneity (Wang et al., 2025). In addition, the performance of machine learning models is highly dependent on the quality of the dataset so that its generalization capabilities are still limited (ShamsEldin et al., 2025). In the cognitive approach, classification results can be influenced by an individual's ability to complete tasks so that they do not fully represent a purely psychological state (Georgescu et al., 2024). In general, AI still faces challenges in understanding the subjective and emotional aspects of humans and requires further clinical validation (Zafar et al., 2024). Therefore, AI has not been able to replace clinical diagnosis by healthcare professionals. AI is more appropriately used as a support tool for initial screening, whereas screening results still need to be combined with clinical evaluation to ensure the accuracy of assessment and decision-making (Zafar et al., 2024).

CONCLUSION

Artificial Intelligence (AI) has the potential to be an aid for early screening of depression and anxiety disorders through the analysis of various types of data, such as text, voice, facial expressions, behavior, and multimodal data. The use of AI can help recognize patterns related to psychological conditions as well as improve efficiency and expand the detection range compared to conventional methods. However, the application of AI still has some limitations, especially related to data privacy and security, consistency of performance in different populations, and the need for further validation. AI also cannot replace comprehensive clinical assessment because the interpretation of a patient's condition still requires the consideration of health professionals.

The effectiveness of AI in clinical practice still needs to be proven through comparisons with clinical gold standards, such as diagnostic interviews based on DSM-5 criteria or assessments by psychiatrists. Although some studies have shown good performance, external validation in real clinical populations is still needed for AI use to be more accurately and reliably assessed. In general, AI is more appropriately used as a support tool for initial screening than as a substitute for conventional methods. The use of AI still needs to be combined with clinical evaluation to ensure the accuracy of screening results and support clinical decision-making.

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