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INNOVATIONS AND RESEARCH IN SCIENCE AND TECHNOLOGY VOLUME IV

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AI-DRIVEN DETECTION AND TREATMENT RESPONSE PREDICTION IN OBSESSIVE–COMPULSIVE DISORDER: A SYSTEMATIC REVIEW

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Abstract:
Obsessive–compulsive disorder (OCD) is a chronic and disabling neuropsychiatric condition characterized by intrusive thoughts and repetitive behaviours that cause significant functional impairment. Despite its prevalence, diagnosis is often delayed by an average of 7.1 years, and in some cases up to 17 years, leading to poorer outcomes and increased socioeconomic burden. Recent advances in artificial intelligence (AI), including traditional machine learning (ML) and deep learning (DL), offer promising solutions for improving early diagnosis and predicting treatment response in OCD. Although findings demonstrate the significant potential of AI-driven methods in OCD research, substantial methodological heterogeneity remains across studies, emphasizing the need for standardized protocols, larger datasets, and clinically interpretable models.

Keywords: Obsessive–Compulsive Disorder (OCD), Artificial Intelligence (AI), Machine Learning, Deep Learning, Electroencephalography (EEG), Neuroimaging

Introduction:

OCD is common and disabling, with a lifetime prevalence of 2% and significant functional impairments impacting work, relationships, and quality of life. AI is a promising research tool for improving the early detection and diagnosis of Obsessive-Compulsive Disorder (OCD), primarily by assisting human clinicians. OCD starts early in life, however, symptoms often go undetected and undiagnosed, and hence there is a delay of 17 years from the onset of OCD symptoms until diagnosis and treatment. The diagnosis of obsessive-compulsive disorder (OCD) is typically achieved through clinical assessment and psychological testing. In recent years, neuroimaging and related fields of artificial intelligence have also shown promising results in diagnosing OCD.

Literature review

The table presents information on studies from 2024–2025 that applied various machine learning, deep learning, and AI techniques—such as SVM, CNN, LSTM, RF, ANN, DT, and NLP—for detecting, classifying, and predicting severity of obsessive–compulsive disorder.

S.No	Year	Author	Journal	Title	Methodology	Result
1	2024	Mahdiyeh *et al.*	Science Direct	Machine learning in obsessive-compulsive disorder medications	Decision Tree CHAID (Chi-square Automatic Interaction Detection), Linear Model, EWKM Clustering	94.8% accuracy; key drugs identified—clomipramine, duloxetine, pindolol.
2	2025	Mahdi *et al.*	BMC Psychiatry	A systematic review of EEG-based machine learning classifications for obsessive-compulsive disorder: current status and future directions	SVM, CNN, LSTM, RF, ANN models	Accuracy ranges from 57% to 100%.
3	2025	Jiyeong *et al.*	Springer	Artificial Intelligence in Obsessive-Compulsive Disorder: A Systematic Review	Uses ML, DL, NLP, GenAI models, and text/brain feature embeddings	AI helps detect OCD, but accuracy varies due to small, non-standard dataset
4	2025	Brian *et al.*	Frontiers	Deep learning in obsessive-compulsive disorder: a narrative review	Systematic review shows CNN, RNN, and LSTM are the main DL algorithms used in OCD research	Deep learning studies show OCD diagnostic accuracy ranging from 80% to 98%
5	2024	Kabita *et al.*	Eurobiotech	Machine Learning Approaches for Obsessive Compulsive Disorder Detection	SVM, RF, DT, LDA, KNN	SVM gives best accuracy (96.44%) for OCD detection
6	2024	Brian A. *et al.*	Elsevier	Predicting OCD severity from religiosity and personality: A machine learning and neural network approach	LR, DT, RF, NN	Best model accuracy: Linear Regression (RMSE ≈ 10.99)

OCD Diagnosis Methods

Only trained therapists can diagnose OCD. Therapists will look for three things:

- The person has obsessions.
- He or she does compulsive behaviors.
- The obsessions and compulsions take a lot of time and get in the way of important activities the person values, such as working, going to school, or spending time with friends.

Steps to help diagnose obsessive-compulsive disorder may include:

- **Psychological evaluation.** This includes talking about your thoughts, feelings, symptoms and behavior patterns to find out if you have obsessions or compulsive behaviors that get in the way of your quality of life. With your permission, this may include talking to your family or friends.
- **Physical exam.** This may be done to rule out other issues that could cause your symptoms and check for any related complications.

Diagnostic challenges

It's sometimes hard to diagnose OCD because symptoms can be like those of obsessive-compulsive personality disorder, anxiety disorders, depression, schizophrenia or other mental health disorders, and lack of provider training, often leading to delayed identification and treatment.

Key Challenges in Diagnosis

- **Symptom Similarity**: OCD symptoms (worry, anxiety, rituals) mimic other disorders like Generalized Anxiety Disorder (GAD), Depression, or even schizophrenia, leading to misdiagnosis.
- **Patient Secrecy**: Fear of judgment or shame makes individuals hide obsessions and compulsions, delaying professional help.
- **High Comorbidity**: OCD frequently coexists with other mental health issues (anxiety, depression, ADHD, BDD), complicating diagnosis if only one aspect is addressed.
- **Diagnostic Heterogeneity**: OCD presents very differently in different people (e.g., contamination, symmetry, harm fears), making a single diagnostic picture elusive.
- **Provider Knowledge Gaps**: Some healthcare providers lack specific training in recognizing and assessing OCD effectively, especially in complex cases.
- **Obsessive-Compulsive Personality Disorder (OCPD)**: Symptoms can overlap significantly with OCD, requiring careful differentiation.

AI in OCD Diagnosis

Artificial intelligence (AI) has emerged as a transformative tool in mental health, offering innovative solutions for diagnosis, treatment personalization, and research in psychiatric disorders.

Machine learning algorithms facilitate early diagnosis, predict treatment outcomes, and optimize pharmacological interventions by analyzing neuroimaging and clinical data.

Machine learning (ML) techniques are increasingly being integrated into the diagnostic process of OCD. Using MRI scan data sets, ML algorithms can automate the identification of patterns in brain structure that differentiate individuals with OCD from healthy controls.

Additionally, AI-powered neurostimulation methods, such as closed-loop deep brain stimulation, have demonstrated efficacy in treatment-resistant OCD cases. Natural language processing algorithms enhance early detection and differential diagnosis of OCD by extracting patterns from clinical narratives and patient histories.

Studies have increasingly applied AI techniques to neuroimaging modalities such as electroencephalography (EEG), magnetic resonance imaging (MRI), and functional MRI (fMRI), as well as clinical and behavioural data. In addition, recent systematic reviews highlight the growing use of EEG-based classification models and generative AI approaches, including natural language processing (NLP), for early symptom detection and treatment optimization.

Highlights

- Machine learning algorithms facilitate early diagnosis, predict treatment outcomes, and optimize pharmacological interventions by analyzing neuroimaging and clinical data.
- AI-enhanced neuro stimulation, such as closed-loop deep brain stimulation, has shown promise for treating cases resistant to conventional therapies.
- Natural language processing enhances diagnostic accuracy by extracting patterns from patient histories.
- AI-powered neuro feedback and virtual therapy platforms enhance exposure and response prevention therapy, increasing treatment accessibility and effectiveness.
- Data privacy, algorithmic transparency, and ethical considerations remain.

Conclusion:

AI-based neuroimaging approaches, especially EEG-driven models, show strong potential for early OCD diagnosis and treatment response prediction. While SVM remains widely used, deep learning and explainable AI are essential for capturing complex neural patterns and enabling clinical trust. Standardization, larger datasets, and external validation are critical for real-world implementation. AI tools are meant to assist, not replace, qualified mental health professionals. A complete assessment by a trained professional is still the standard for accurate diagnosis and care.

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