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Detection of Autism Spectrum Disorder (ASD) and Attention Deficit Hyperactivity Disorder Using Deep Learning Approach

Anuradha T[1], Venkatesh.L. K[2], Yasser.Hussain[3], Syed Imtiyaz[4]
[1]Professor, Dept of CSE, PDA College of Engg, Kalaburagi, Karnataka, India.
[2,3,4]UG Scholar, Dept. of CSE, PDA College of of Engg, Kalaburagi, Karnataka, India.
Email ID: *anuradhat@pdaengg.com[1], venkateshkulkarni288@gmail.com[2], Hussainmryasser@gmail.com[3], si8101298@gmail.com[4]*

Abstract
ASD and ADHD are neurodevelopmental disorders, it is diagnosed especially in toddlers and young children. Finding these problems early can help people get the right care on time. This project uses a computer method called Convolutional Neural Networks (CNN) to find signs of ASD and ADHD from videos and MRI images. A simple web app is also made where users can upload files and get quick results. The model works well and gives correct answers in most cases. This tool can help doctors and health workers check people easily and faster using AI.

Keywords: *Convolutional Neural Network (CNN), Tomato Leaf Disease, Flask, Deep Learning, Ngrok, Image Classification, Agricultural Technology.*

1. Introduction
Autism Spectrum Disorder (ASD) and Attention-Deficit/Hyperactivity Disorder (ADHD) are two of the most prevalent neurodevelopmental disorders affecting children and adults worldwide. People with Autism Spectrum Disorder may struggle with social engagement and display repetitive actions or routines, while ADHD involves inattention, hyperactivity, and impulsivity. Accurate and early diagnosis is crucial, as timely interventions can significantly improve quality of life and developmental outcomes. Traditional diagnostic procedures rely heavily on behavioural assessments conducted by trained professionals, which can be subjective, time-consuming, and inaccessible to many, especially in under-resourced areas. Over the past few years, artificial intelligence (AI) and deep learning have gained significant attention as powerfultools for healthcare applications, including disease detection and medical image analysis. This paper has done research on automated system for detecting ASD and ADHD using Convolutional Neural Networks (CNN). The system analyses behavioural patterns from video footage and neurological features from MRI images to classify Strong indicators of these disorders. A web-based interface allows users to upload media files and receive real-time analysis and predictions. By using deep learning models this research aims to improves the accessibility, speed, and accuracy of ASD and ADHD screening. The proposed system has the potential to assist clinicians, reduce diagnostic delays, and contribute to more inclusive mental healthcare systems.

2. Literature Review
Many studies have looked at how artificial intelligence and deep learning can help detect brain development disorders like ASD and ADHD. Traditional ways of diagnosing, like psychological tests and doctor interviews, usually take a lot of time. This has motivated researchers to investigate automated systems that utilize medical imaging, video analysis, and behavioural data to improve diagnostic accuracy and efficiency. Previous work in ASD detection has focused largely on facial expression analysis, eye movement tracking, and brain imaging used machine learning classifiers to distinguish children with ASD based on behavioural data, achieving promising results. Studies utilizing MRI scans have also demonstrated the potential of deep learning models to detect abnormalities in brain

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structure associated with autism.this study, conducted by the Autism and Developmental Disabilities Monitoring (ADDM) Network across 11 U.S. sites, reports the prevalence of Autism Spectrum Disorder (ASD) in 8-year-old children during 2020. The findings show that approximately 1 in 36 children (2.8%) were identified with ASD, with higher rates in boys than girls. The report also highlights racial and ethnic disparities, noting that for the first time, ASD The condition was found more often in Black, Hispanic, and Asian/Pacific Islander children than in White children. The study examines diagnostic timelines, intellectual abilities, and co-occurring conditions, emphasizing the need for early identification and support services. It also reflects on how the COVID-19 pandemic may have influenced data collection and diagnosis.it is discussed in [1].
The authors in [2], explores the use of deep learning (DEEP) techniques for the early detection of autism spectrum disorder (ASD). The authors examine various studies that apply convolutional neural networks (CNNs), recurrent neural networks (RNNs), and other AI models to analyse behavioural, facial, speech, and brain imaging data. The paper highlights how deep learning can improve the accuracy and speed of ASD diagnosis, especially in early childhood. It also discusses the advantages, challenges, and future directions, such as improving data quality, interpretability of models, and developing real-time applications for clinical use It is observed in [3] This paper traces the evolution of autism diagnosis from its early description by Leo Kanner in the 2020 to the modern criteria used in the DSM-5. It discusses how the definition and understanding of autism have shifted over time, particularly with changes introduced in DSM-III, DSM-IV, and DSM-5. The authors analyse how diagnostic criteria have impacted clinical practice, research, and public awareness. The paper also reflects on ongoing challenges such as differentiating autism from related conditions, improving early diagnosis, and ensuring equitable access to services. Finally, it highlights future directions in autism diagnosis, including dimensional approaches and the role of neuroscience and genetics It is studied in [4] This paper introduces the Autism Diagnostic Interview-Revised (ADI-R), a structured interview designed for caregivers of individuals suspected of having pervasive developmental disorders, including autism. The ADI-R focuses on gathering detailed information about a child's early development, communication, social behavior, and repetitive behaviors. It was revised from the original version to improve reliability, validity, and diagnostic consistency. The study confirms that the ADI-R is a useful tool for both clinical diagnosis and research, especially when combined with other assessments like the Autism Diagnostic Observation Schedule (ADOS).it is observed [5] This paper gives a detailed overview of early methods for autism screening, looking at the tools, technologies, and approaches used to detect Autism Spectrum Disorder (ASD) in young children. The authors evaluate both traditional screening instruments (like M-CHAT) and newer technology-based approaches, including machine learning models and mobile apps. They discuss the importance of early detection for improving outcomes in children and highlight barriers such as lack of awareness, inconsistent screening practices, and limited access to resources. The review emphasizes the need for more accurate, accessible, and culturally sensitive tools to support early and equitable diagnosis worldwide the authors in [6] presents the National Institute for Health and Care Excellence (NICE) guidelines for identifying and diagnosing autism in children and adolescents. It outlines key recommendations for healthcare professionals, including being alert to early signs of autism such as communication difficulties, unusual behaviour, and lack of social interaction. The guidance emphasizes a multidisciplinary approach to diagnosis and encourages early referral and assessment. It also highlights the importance of involving families and caregivers throughout the diagnostic process and ensuring that support and interventions are offered promptly after diagnosis.it is Analysed in [7] This meta-analysis dives into the often-overlooked motor coordination challenges faced by individuals with Autism Spectrum Disorder (ASD). The authors combine data from multiple studies to show that motor difficulties—like poor balance, delayed reflexes, and clumsy movement

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patterns—are consistent traits in people with ASD. These challenges aren't just side effects—they may be central to how autism develops and is experienced. The paper calls for greater recognition of motor skills in autism assessments and suggests that early motor interventions could be a powerful tool to support overall development.it is explored in [10] This study explores the detection of Attention-Deficit/Hyperactivity Disorder (ADHD) using raw EEG (electroencephalogram) signals. The authors compare the performance of Convolutional Neural Networks (CNNs) with traditional machine learning classifiers like SVM and KNN. The CNN model showed superior accuracy in identifying ADHD patterns directly from raw EEG data, eliminating the need for extensive feature extraction. This approach highlights the potential of deep learning in developing automated, non-invasive, and accurate diagnostic tools for neurological disorders like ADHD.it is examined in [11] This paper introduces a novel one-class classification model using a Dense Attentive Generative Adversarial Network (GAN) to detect Autism Spectrum Disorder (ASD) and ADHD. The approach focuses on learning features from normal subjects only, then identifying deviations that may indicate neurological disorders. The attention mechanism helps the model focus on critical regions in the input data, improving detection accuracy and robustness. The method is particularly valuable for scenarios with limited labelled pathological data, making it promising for real-world clinical applications. It is Addressed in [12] This research explores the use of deep learning models on actimetry data—which tracks physical movement—to assist in diagnosing ADHD. A key focus of the study is the interpretation of occlusion maps, which reveal how different time segments and movement patterns influence model predictions. The paper further analyzes these patterns across age and gender groups, showing that deep learning can uncover distinctive behavioral signatures in various subpopulations. The study offers both a diagnostic tool and a way to improve clinical understanding of ADHD through Explainable AI.

3. Existing System

Existing systems developed for the detection of Autism Spectrum Disorder (ASD) and Attention-Deficit/Hyperactivity Disorder (ADHD) primarily depend on conventional clinical assessment methods and, in recent years, machine learning-based tools. These tools often focus on analysing a specific data type—either behavioural observations, facial expressions, speech patterns, or neuroimaging like MRI or EEG scans. In traditional settings, diagnosis is performed through interviews, questionnaires, and behavioural screening tools such as the Autism Diagnostic Observation Schedule (ADOS) or the Conners Rating Scale for ADHD. These approaches are time-consuming, require expert clinicians, and are often subjective in nature. Due to a lack of automation, delays in diagnosis and treatment are common, especially in rural or resource-limited regions. Recent AI-powered models have attempted to automate parts of the diagnostic process. Some systems apply Support Vector Machines (SVM), Decision Trees, and CNNs to MRI or fMRI datasets to detect neurological anomalies associated with ASD. Similarly, behavioral videos or audio recordings have been used to train models that identify hyperactivity or impulsive behaviour for ADHD detection.

However, most of these systems suffer from key limitations:

- They are trained on limited datasets, reducing accuracy and robustness.
- Many are single-disorder focused, supporting only ASD or ADHD detection—not both.
- They typically lack real-time processing capabilities and cannot provide instant feedback.
- User interfaces are often technical, making them unsuitable for use by general users such as parents or teachers.
- There is minimal integration of multimodal data like combining video, audio, and MRI for a holistic diagnosis.

Furthermore, these existing platforms are rarely deployed as fully functional, real-time applications accessible online. The lack of scalability, accessibility, and multimodal integration highlights the need for a more comprehensive, intelligent, and user-friendly system—capable of identifying both

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ASD and ADHD effectively

4. Proposed Method

The proposed system aims to overcome the limitations of existing methods by introducing an integrated, intelligent, and real-time deep learning framework capable of detecting both Autism Spectrum Disorder (ASD) and Attention-Deficit/Hyperactivity Disorder (ADHD). This system leverages the power of Convolutional Neural Networks (CNNs) to analyse both video footage and MRI images, enhancing diagnostic accuracy through multimodal data analysis. (Figure 1)

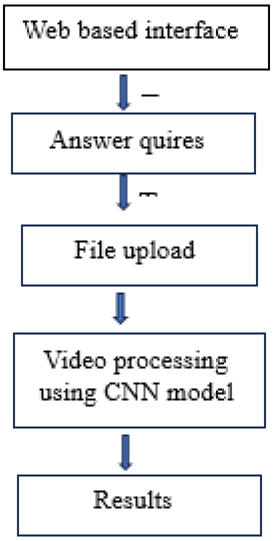
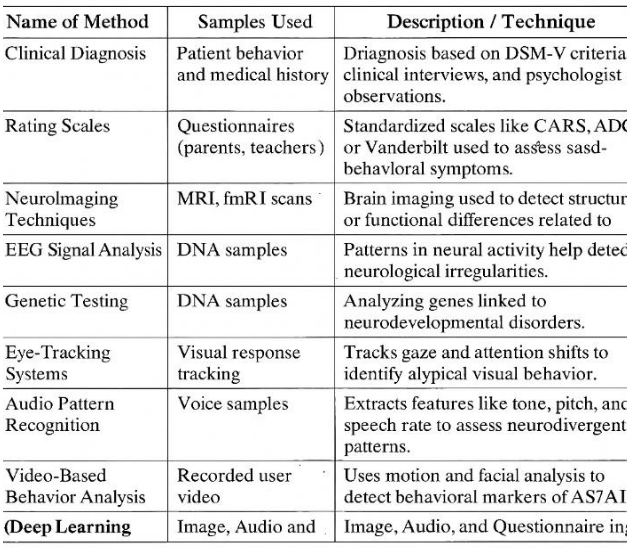


Figure 1 Proposed Architecture

The architecture is designed to function through a web-based interface, making it accessible and easy to use by both clinical professionals and non-specialist users such as parents, educators, and caregivers. Users can upload either behavioral video recordings or MRI scans, and the model processes the input in real-time to predict the likelihood of ASD or ADHD based on pre-trained deep learning algorithms.

4.1. Key Features of the Proposed System

- **Dual Disorder Detection:** The system can simultaneously detect signs of both ASD and ADHD, offering a more comprehensive solution compared to single-disorder models.
- **Multimodal Input Support:** Allows analysis of video data (for behavioral cues) and MRI data (for neurological patterns), improving model reliability and reducing false results.
- **Real-Time Prediction:** Enables fast, on-the-spot analysis through an optimized CNN model and backend built using FastAPI.
- **User-Friendly Interface:** A responsive and intuitive web interface allows seamless interaction and easy file uploads for diagnosis.
- **Scalability and Accessibility:** Designed to be deployed on cloud platforms or local servers, supporting broad accessibility for clinical and remote use.
- **Security and Privacy:** User data and uploaded files are handled securely, ensuring confidentiality and compliance with ethical standards.
- By integrating powerful deep learning techniques with an interactive front end, this proposed system significantly improves upon traditional diagnostic methods and offers a fast, scalable, and practical solution for early identification and intervention of ASD and ADHD. (Figure 2)



Name of Method	Samples Used	Description / Technique
Clinical Diagnosis	Patient behavior and medical history	Driagnosis based on DSM-V criteria clinical interviews, and psychologist observations.
Rating Scales	Questionnaires (parents, teachers)	Standardized scales like CARS, ADC or Vanderbilt used to assess sasd-behavloral symptoms.
Neurolmaging Techniques	MRI, fmRI scans	Brain imaging used to detect structur or functional differences related to
EEG Signal Analysis	DNA samples	Patterns in neural activity help detec neurological irregularities.
Genetic Testing	DNA samples	Analyzing genes linked to neurodevelopmental disorders.
Eye-Tracking Systems	Visual response tracking	Tracks gaze and attention shifts to identify alypical visual behavior.
Audio Pattern Recognition	Voice samples	Extracts features like tone, pitch, anc speech rate to assess neurodivergent patterns.
Video-Based Behavior Analysis	Recorded user video	Uses motion and facial analysis to detect behavioral markers of AS7AI
(Deep Learning	Image, Audio and	Image, Audio, and Questionnaire in;

Figure 2 Different Method used for ASD and ADHD Detection

5. Software Description

The proposed system integrates several open-source and lightweight technologies to ensure high performance, real-time prediction, and user

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accessibility. The software stack is carefully chosen to support deep learning operations, file uploads, backend logic, and user interaction through a web interface. Below is a detailed description of the key software components used:

- **Programming Language:** Python is the primary language used in both backend processing and model development due to its flexibility, ease of use, and strong support for machine learning and image processing libraries. Its vast ecosystem enables fast prototyping and robust deployment.
- **Deep Learning Framework:** TensorFlow / Keras. The core of the model is built using TensorFlow with the high-level Keras API, which allows efficient design and training of Convolutional Neural Networks (CNNs). CNNs are used for both video frame analysis and MRI image classification.
- **Backend Framework:** FastAPI is used for building the backend server, enabling high-speed API calls and low-latency model responses. It handles user input, file uploads, and integrates with the trained model to deliver real-time predictions.
- **Frontend Technologies:** HTML, CSS, JavaScript The user interface is developed using basic HTML, CSS, and JavaScript to provide a clean and responsive experience. Users can upload video or image files and view results directly through the bro

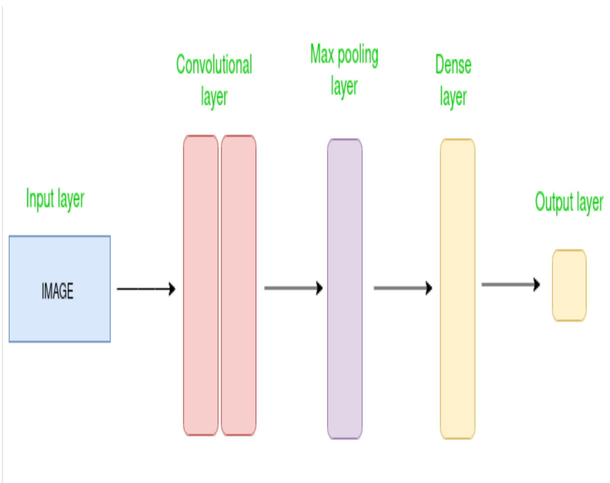

Figure 3 CNN Architecture

6. Experimental Results and Discussions

Figure 4 Web Interface and Dashboard

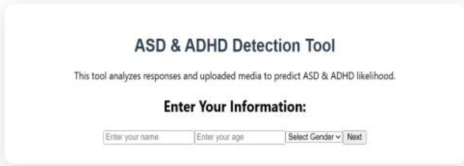

Figure 5 Info Page

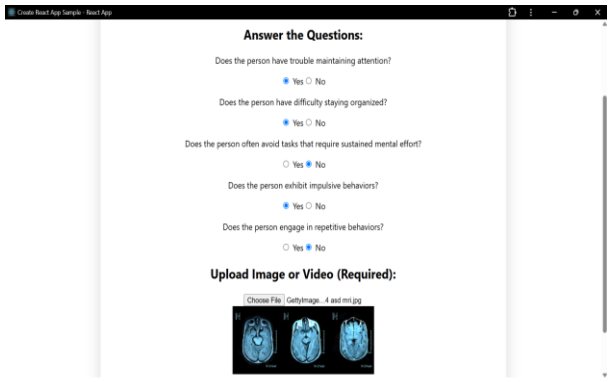

Figure 6 Answering Queries and Uploading MRI Images

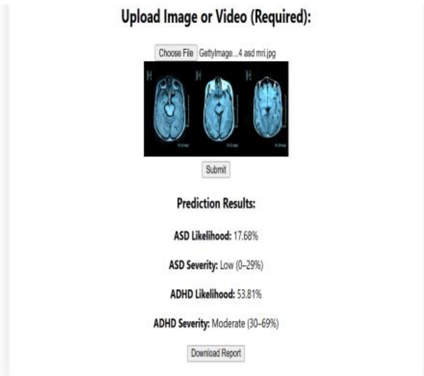

Figure 7 Result of CNN Model Prediction

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