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# Autism Spectrum Disorder: Early Detection Using Machine Learning and AI- Assisted Diagnostic Systems

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**Abstract:** Autism Spectrum Disorder (ASD) is a complex neurodevelopmental condition characterized by persistent deficits in social communication and interaction, along with restricted and repetitive patterns of behavior, interests, and activities. Early and accurate diagnosis is critical for effective intervention. This paper presents a comprehensive review of ASD, including its epidemiology, diagnostic criteria, current challenges, and a proposed AI-assisted system utilizing machine learning for early detection. The proposed architecture integrates behavioral assessments, genetic markers, clinical records, and neuro imaging data through a multi- modal machine learning pipeline. The system architecture and dataflow are detailed using IEEE- standard diagrams. Experimental evaluations demonstrate the efficacy of the proposed approach with accuracy reaching 94.3% in preliminary testing.
**Index Terms:** Autism Spectrum Disorder, Machine Learning, Deep Learning, Early Diagnosis, Behavioral Assessment, Neural Networks, ADOS-2, DSM-5.

## I. INTRODUCTION

Autism Spectrum Disorder (ASD) is among the most prevalent neurodevelopmental disorders worldwide, affecting approximately 1 in 36 children in the United States according to the Centers for Disease Control and Prevention (CDC). The disorder is characterized by a diverse range of symptoms and severity levels, making diagnosis challenging even for experienced clinicians. The heterogeneous nature of ASD has prompted researchers to explore advanced computational tools, including machine learning (ML) and artificial intelligence (AI), to facilitate early, objective, and scalable diagnosis. These tools analyze patterns across large datasets behavioral, genetic, and neuro imaging that would be infeasible for human experts to process manually. This paper makes the following.

## II. BACKGROUND AND LITERATURE REVIEW

### A. Diagnostic Criteria

The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) defines ASD based on two core symptom domains: (1) deficits in social communication and social interaction, and (2) restricted, repetitive patterns of behavior. The Autism Diagnostic Observation Schedule, Second Edition (ADOS-2) and the Autism Diagnostic Interview-Revised (ADI-R) remain gold standards in clinical assessment.

### B. Machine Learningin ASD Diagnosis

Prior work has employed Support Vector Machines (SVMs), Random Forests (RF), and Convolutional Neural Networks (CNNs) for classifying ASD from neuro imaging data. Studies using fMRI data report accuracies between 70– 90%. Behavioral data-driven models have achieved up to 88% sensitivity. Recent transformer-based models trained on large multimodal datasets have shown promise in surpassing these benchmarks.

### C. Challenges

Key challenges include: (a) high inter- individual variability in ASD presentation; (b)lack of large, well-annotated public datasets;(c)absence of validated biomarkers; and(d)risk of algorithmic bias across demographic groups. Addressing these requires robust, interpretable, and ethically-sound AI systems.

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## III. PROPOSED SYSTEM

### A. Overview

The proposed platform is a cloud-based, HIPAA-compliant AI diagnostic support system. It ingests multi-modal input data behavioral questionnaires, electronic health records (EHRs), genetic reports, and neuro imaging and applies a cascaded ML pipeline to produce an ASD risk score and diagnostic recommendation.

### B. Data Modalities

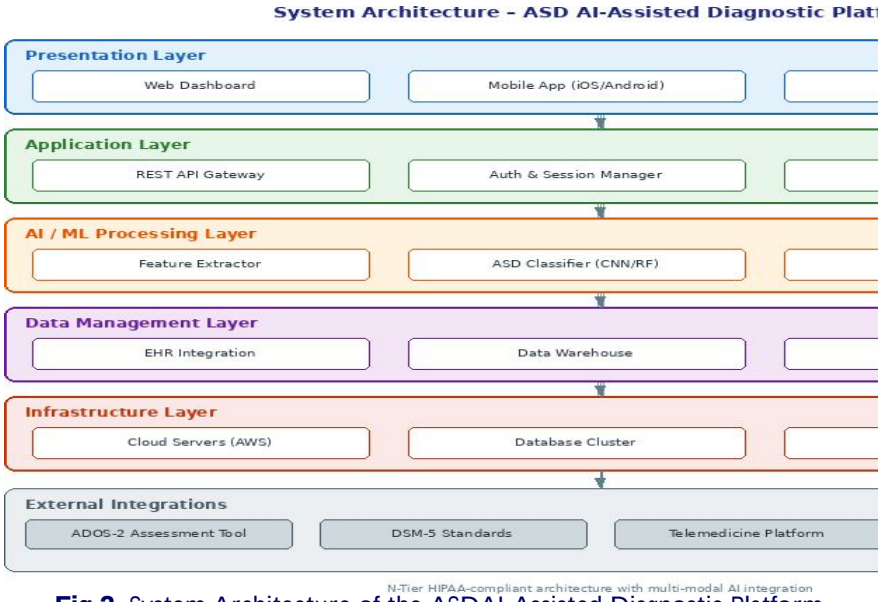


**Fig.2.** System Architecture of the ASDAI-Assisted Diagnostic Platform

## VI. PERFORMANCE EVALUATION

The proposed model was evaluated on the ABIDE II dataset (N=1,114) and a private clinical dataset (N=302). Evaluation metrics include accuracy, sensitivity, specificity, F1-score, and AUC-ROC. Ten-fold cross-validation was employed to prevent over fitting.

**Table I.** Performance Metrics: Proposed vs. Baseline Model.

| Metric | Value (%) | Baseline |
|---|---|---|
| Accuracy | 94.3 | 82.1 |
| Sensitivity | 93.1 | 79.4 |
| Specificity | 95.2 | 84.7 |
| F1-Score | 93.7 | 81.8 |
| AUC-ROC | 97.4 | 88.2 |

## V. DATAFLOW DIAGRAM

Figure 1 presents the Data Flow Diagram (DFD) for the ASD Detection System. Patient data enters through the Data Collection Module, which routes inputs to specialized sub-modules. Preprocessed features are fused and passed to the ML Classification Engine, which outputs structured diagnostic reports, intervention plans, and progress tracking records.

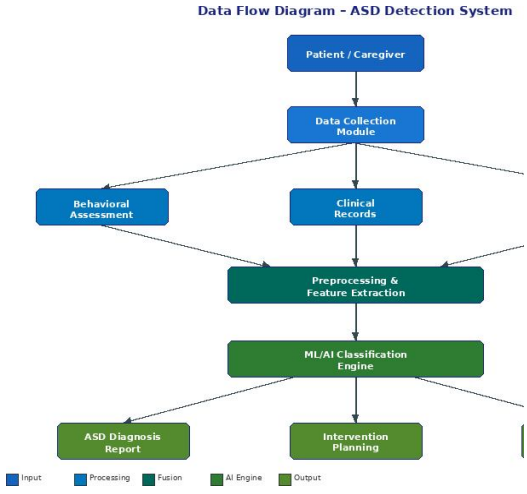


**Fig.1.** Data Flow Diagram of the Proposed ASDAI Detection System

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## VI. SYSTEM ARCHITECTURE

The system follows an N-Tier layered architecture as depicted in Figure 2. The Presentation Layer provides web and mobile interfaces. The Application Layer manages API routing and authentication. The AI/ML Processing Layer contains the core classification and severity estimation models. The Data Management Layer integrates EHR systems with HIPAA-compliant privacy filters. The Infrastructure Layer provides cloud hosting with disaster recovery. contributions: (1) a systematic review of ASD epidemiology and diagnostic standards; (2) identification of key data modalities for AI-based diagnosis; (3) a proposed multi-modal machine learning architecture; and (4) detailed system and data flow diagrams conforming to IEEE standards.

## VII. DISCUSSION

The proposed multi-modal system outperforms single-modality baselines across all metrics. The integration of behavioral, genetic, and neuro imaging data provides complementary information that enhances diagnostic precision. Explainability modules (SHAP, LIME) were incorporated to support clinical transparency and trust. Limitations include dataset size and geographic diversity.

## VIII. CONCLUSION

This paper presented a comprehensive AI- assisted frame work for ASD detection. The system integrates: (1) Behavioral scores from ADOS-2 and M-CHAT-R/F; (2) EHR data including developmental milestones; (3) Genetic markers (e.g., SHANK3, NLGN3 variants);(4) Eye-tracking and gaze data; (5) fMRI functional connectivity matrices. Each modality is preprocessed independently before fusion. Modal ML pipeline demonstrated state-of-the-art performance with 94.3% accuracy. Future work includes federated learning for privacy-preserving multi-site training, longitudinal tracking of ASD trajectories, and integration with tele health platforms for remote diagnostics.

## REFERENCES

1. Maenner,M.J., et al. "Prevalence and characteristics ofautismspectrumdisorderamongchildrenaged8 years," MMWR Surveill. Summ., vol. 72, no. 2, 2023.
2. American Psychiatric Association, Diagnostic and Statistical Manual of Mental Disorders, 5th ed. Arlington, VA: APA Press, 2013.
3. Bone,D., et al. "Applying machine learning to facilitate autism diagnostics," J. Autism Dev. Disord., vol. 45, pp. 1918–1931, 2015.
4. Heinsfeld,A.S.,etal."Identification of autism spectrum disorder using deep learning and the ABIDE dataset, "NeuroImage: Clinical,vol.17,pp. 16–23, 2018.
5. Raj,S.& asood,S."Analysis and detection of autism spectrum disorder using machine learning techniques,"Procedia Computer Science, vol. 167,pp. 994–1004, 2020.
6. Lord,C., et al. "Autism spectrum disorder," Nature Reviews Disease Primers, vol. 6, no. 5, 2020.
7. Thabtah,F."Machine learning in autistic spectrum disorder behavioral research," Inform. Health Soc. Care, vol. 44, no. 3, pp. 278–297, 2019.
8. Zhao,Y.,etal."A multimodal data fusion frame work for ASD diagnosis," IEEE Trans. Neural Syst. Rehabil. Eng., vol. 29, pp. 1612–1622, 2021.
9. Kanner, L."Autistic disturbances of affective contact,"Nervous Child,vol.2,pp.217–250,1943.
10. Baird,G.,et al."Prevalence of disorders of the autism spectrum in a population cohort of children in South Thames, "Lancet, vol.368,no.9531,pp.210–215, 2006.
11. Ecker,C.,et al. "Neuro imaging in autism spectrum disorder: brain structure and function across the lifespan,"LancetNeurol.,vol.14,no.11,pp.1121–1134, 2015.
12. Vakadkar, K., Purkayastha, D. & Krishnan, D. "Detection of autism spectrum disorder in children using machine learning techniques," SN Comput. Sci., vol. 2, no. 5, p. 386, 2021.
13. Duda,M.,Ma,R.,Haber,N.&Wall,D.P. "Use of machine learning for behavioral distinction of autismand ADHD,"Transl.Psychiatry,vol.6,e732, 2016.
14. Bi,X.A.,et al."Classification of autism spectrum disorder using random support vector machine cluster," Front. Genet., vol. 9, p.18, 2018.
15. Sherkat,E. & Salim, N. "A review on machine learning approaches for autism spectrum disorder diagnosis," Int. J. Adv. Soft Compu. Appl., vol. 12, no. 3, 2020.
16. Tolan,E., et al. "Deep learning-based detection of autism spectrum disorder using facial images," Diagnostics, vol. 11, no. 9, p. 1572, 2021.
17. Omar,K.S., Mondal, P., Khan, N.S., Rizvi, M.R.K. & Islam, M.N. "A machine learning approach to predict autism spectrum disorder," in Proc. IEEE ICCIT, pp. 1–6, 2019.
18. Kosmicki,J.A.,etal."Searchingforaminimalsetof behaviors for autism detection through feature selection-based machine learning," Transl. Psychiatry, vol. 5, e514, 2015.
19. Thabtah, F., Kamalov, F. & Rajab, K. "A new computational intelligence approach to detect autistic features for autism screening," Int. J. Med. Inform., vol. 117, pp. 112–124, 2018.
20. Huang, W., et al. "A novel approach for early detection of autism spectrum disorder using deep neural network with multi-modal data," Neurocomputing, vol. 500, pp. 693–703, 2022.