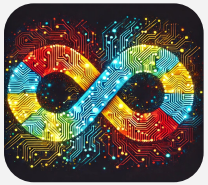
International Conference on Autism Advanced Research and Management
Olympia City Music Theatre “Maria Callas”, Athens, Greece
Hybrid @ Athens - Greece & Web
September 27-29, 2024



Harnessing Artificial Intelligence for Early Identification of Autism Spectrum Disorder

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Overview

- ➔ Intro to ASD and detection challenges
- ➔ Early identification
- ➔ AI to the rescue! Correlate data from:
  - ◆ questionnaires
  - ◆ short videos
- ➔ Build an AI tool to identify early signs of ASD
  - ◆ 6-24 months
- ➔ Conclusions

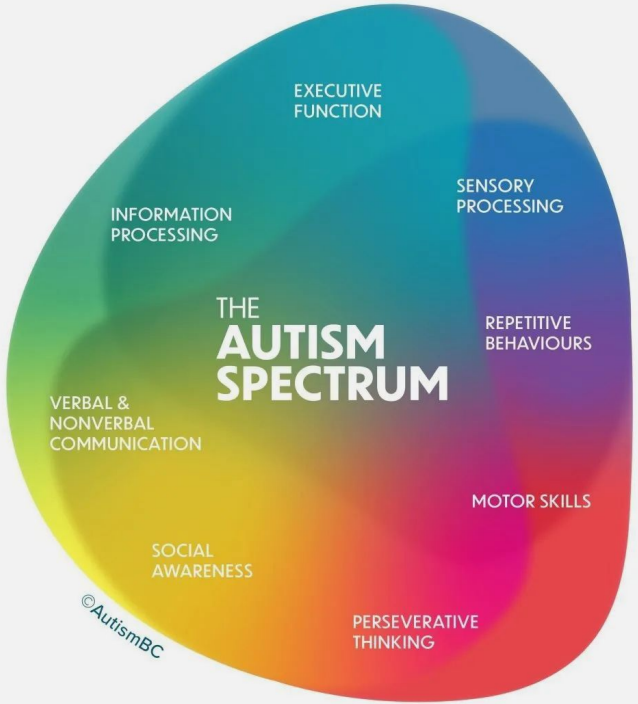
Intro - Early detection

Definition & Characteristics:

➔ ASD is:

- ◆ a complex neurodevelopmental disorder
- ◆ characterized by
  - deficits in social communication and
  - repetitive behaviors

➔ early detection and intervention improves cognitive, social and language skills

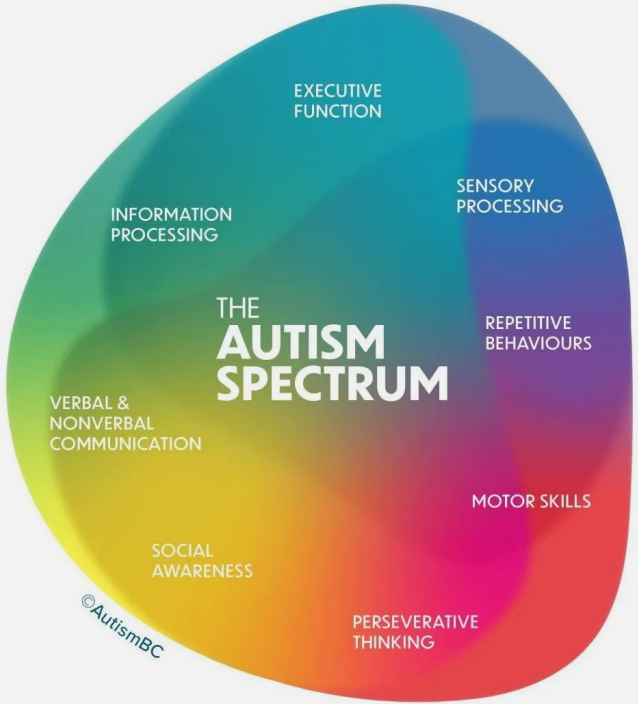


Intro - Challenges

Challenges in Traditional Diagnosis:

- ➔ time-consuming
- ➔ requires specialized resources (multidisciplinary teams)
- ➔ often delayed

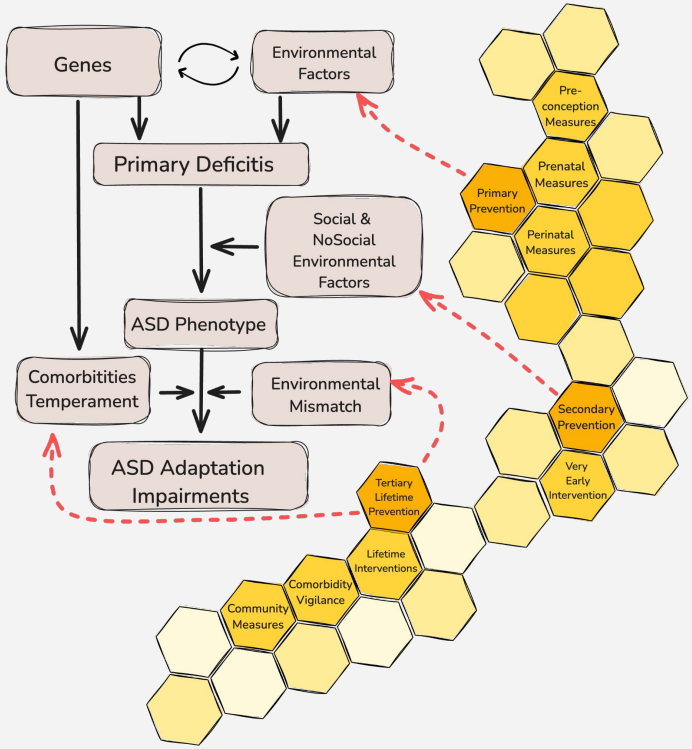
Variability of ASD symptoms, making early detection difficult



Intro - Prevention

Prevention:

- ➔ Primary
  - preconception
  - prenatal
  - perinatal
- ➔ Secondary
  - very early intervention
- ➔ Tertiary
  - lifetime intervention
  - community measures
  - comorbidity vigilance



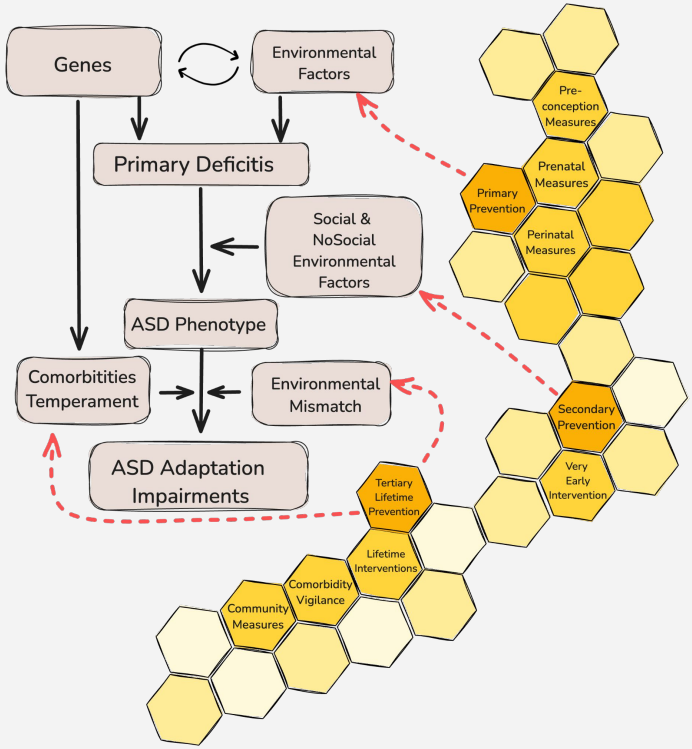
Intro - Prevention

Time-Consuming Process:

- ➔ Multidisciplinary evaluations involving **pediatricians**, **psychologists**, and **speech therapists**
- ➔ Delays in diagnosis due to **accessibility issues**, especially in **underserved areas**.

Diagnostic Limitations:

- ➔ Symptoms of ASD vary widely, **overlapping** with other disorders
- ➔ Gold-standard tools like ADOS are not feasible for **large-scale screening**



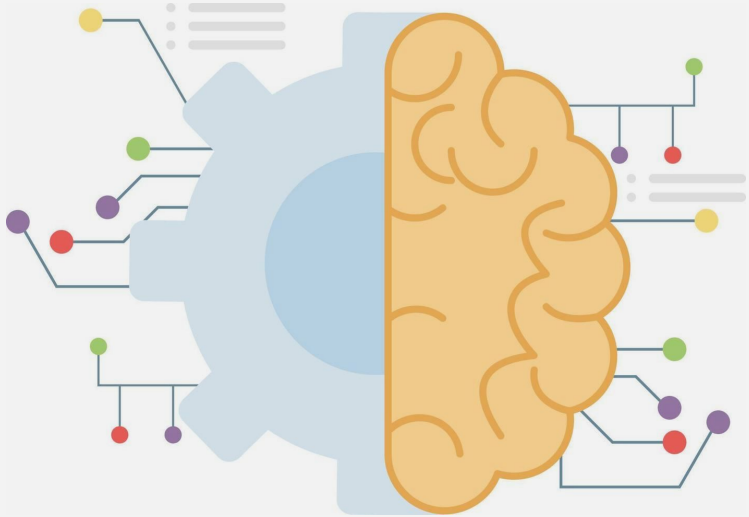
Early Detection

Early red flags of Autism	
Before 12 Months	**After 12 Months**
No eye contact	No copying your actions or sounds
No smiling or giggling	No words (16 months)
Not sharing of sounds or facial expressions	No meaningful two-word phrases (24 months)
Not babbling	Lack of social interaction
No gestures such as waving or pointing	Prevalence of behavioral issues
Sensory hypersensitivity	
Not engaging in playful interactions	
No response to their name	

AI as a Game Changer for ASD Detection (I)

➔ AI Advantages:

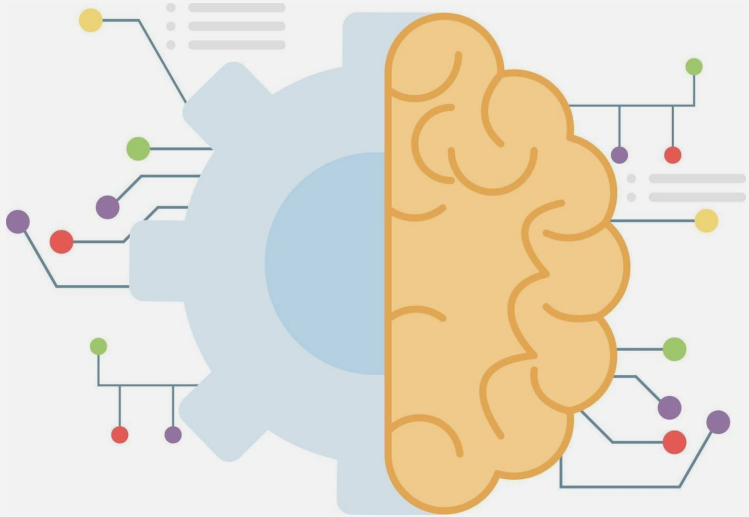
- **Efficiency**: AI-based tools can screen large datasets quickly and accurately
- **Accessibility**: Mobile applications and web platforms make AI tools available even in remote areas
- **Cost-Effectiveness**: Reduce the need for specialized personnel and expensive assessments



AI as a Game Changer for ASD Detection (II)

➔ AI and ML Potential:

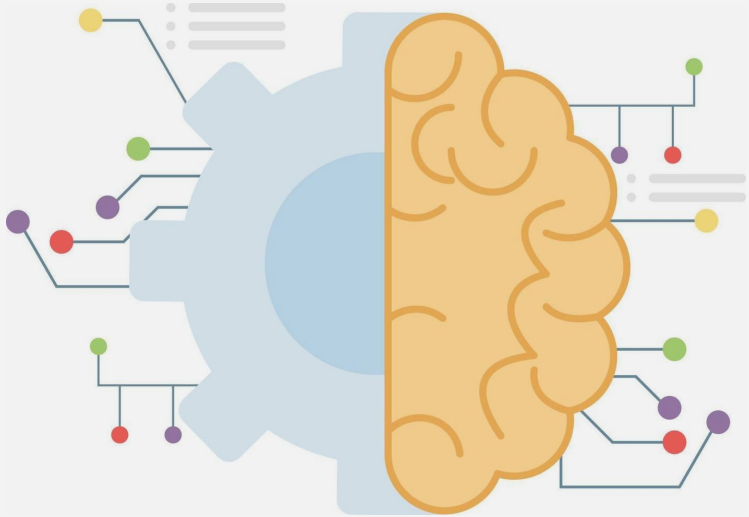
- AI excels in **pattern recognition**, capable of identifying subtle behavioral markers of ASD.
- ML techniques such as **supervised** and **unsupervised** learning, deep learning, and Bayesian Networks for detecting anomalies.
- AI can **democratize** access to diagnostic tools, reducing **cost** and improving **scalability**.



AI as a Game Changer for ASD Detection (III)

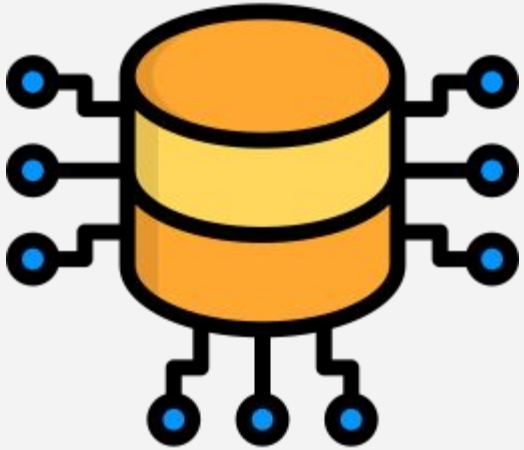
➔ AI-Based Detection:

- Uses **machine learning** to analyze parent-completed questionnaires and audiovisual data.
- Example: Detection of **atypical eye gaze patterns** and **social interactions**.



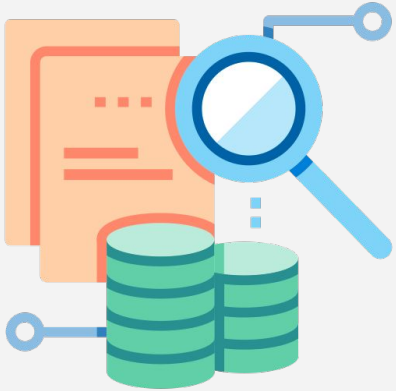
Methodology of AI Tool - Data Collection

- ➔ Two main data sources:
  - parent / caregiver **questionnaires**
  - short **audiovisual recordings**
- ➔ Use of ML and AI to **extract features** relevant to:
  - social interaction / behavior
  - eye contact
  - facial expressions
  - behavior
- ➔ **Homogenize** content to include a **single**, feature-rich set of **characteristics**



Methodology of AI Tool - Data Analysis

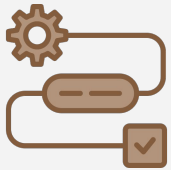
- ➔ Analyze data to extract autism risk
- ➔ Machine learning algorithms analyze both structured and unstructured data to extract:
  - ◆ features from audiovisual content
  - ◆ features from questionnaires
- ➔ The tool correlates behavioral deviations from typical development, flagging potential ASD signs:
  - ◆ low
  - ◆ medium
  - ◆ high

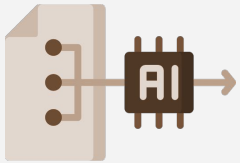


AI Tool - Pipeline

Questionnaire

- ➔ structured questionnaire that captures parents' observations
- ➔ identify potential concerns related to
  - ◆ social interactions
  - ◆ communication
  - ◆ other developmental milestones





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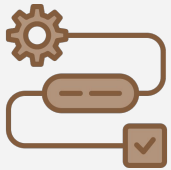
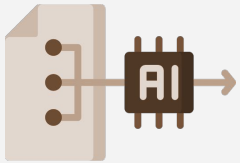
Audiovisual Material

- ➔ parents submit short audiovisual recordings (1-5 minutes) of their child
- ➔ recordings of interactions:
  - ◆ with family members
  - ◆ playtime
  - ◆ other everyday situations.





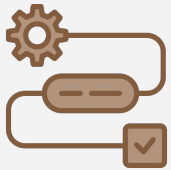
AI Tool - Pipeline

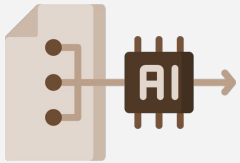
Questionnaire → **Audiovisual Material** → **Behavior Analysis**

- ➔ structured questionnaire that captures parents' observations
- ➔ identify potential concerns related to
  - ◆ social interactions
  - ◆ communication
  - ◆ other developmental milestones

- ➔ parents submit short audiovisual recordings (1-5 minutes) of their child recordings of interactions:
  - ◆ with family members
  - ◆ playtime
  - ◆ other everyday situations.

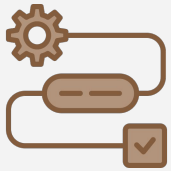
- ➔ AI analyzes the submitted video content for key behavioral indicators such as:
  - ◆ eye contact
  - ◆ facial expressions
  - ◆ social engagement
- ➔ extract quantifiable features related to the above indicators criteria for typical and atypical development

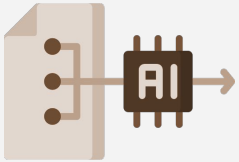




AI Tool - Pipeline

Questionnaire	Audiovisual Material	Behavior Analysis	AI Model Scoring
➔ structured questionnaire that captures parents' observations ➔ identify potential concerns related to ◆ social interactions ◆ communication ◆ other developmental milestones	➔ parents submit short audiovisual recordings (1-5 minutes) of their child ➔ recordings of interactions: ◆ with family members ◆ playtime ◆ other everyday situations.	➔ AI analyzes the submitted video content for key behavioral indicators such as: ◆ eye contact ◆ facial expressions ◆ social engagement ➔ extract quantifiable features related to the above indicators criteria for typical and atypical development	➔ input from coded questionnaire responses and coded behavioral features extracted from video analysis ➔ input processed through the AI model ➔ correlates data to create a comprehensive profile of the child





AI Tool - Pipeline

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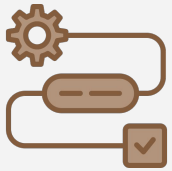

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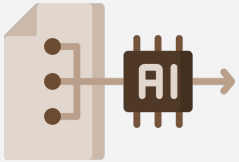


Behavior Analysis

- AI analyzes the submitted video content for key behavioral indicators such as:
  - eye contact
  - facial expressions
  - social engagement
- extract quantifiable features related to the above indicators criteria for typical and atypical development

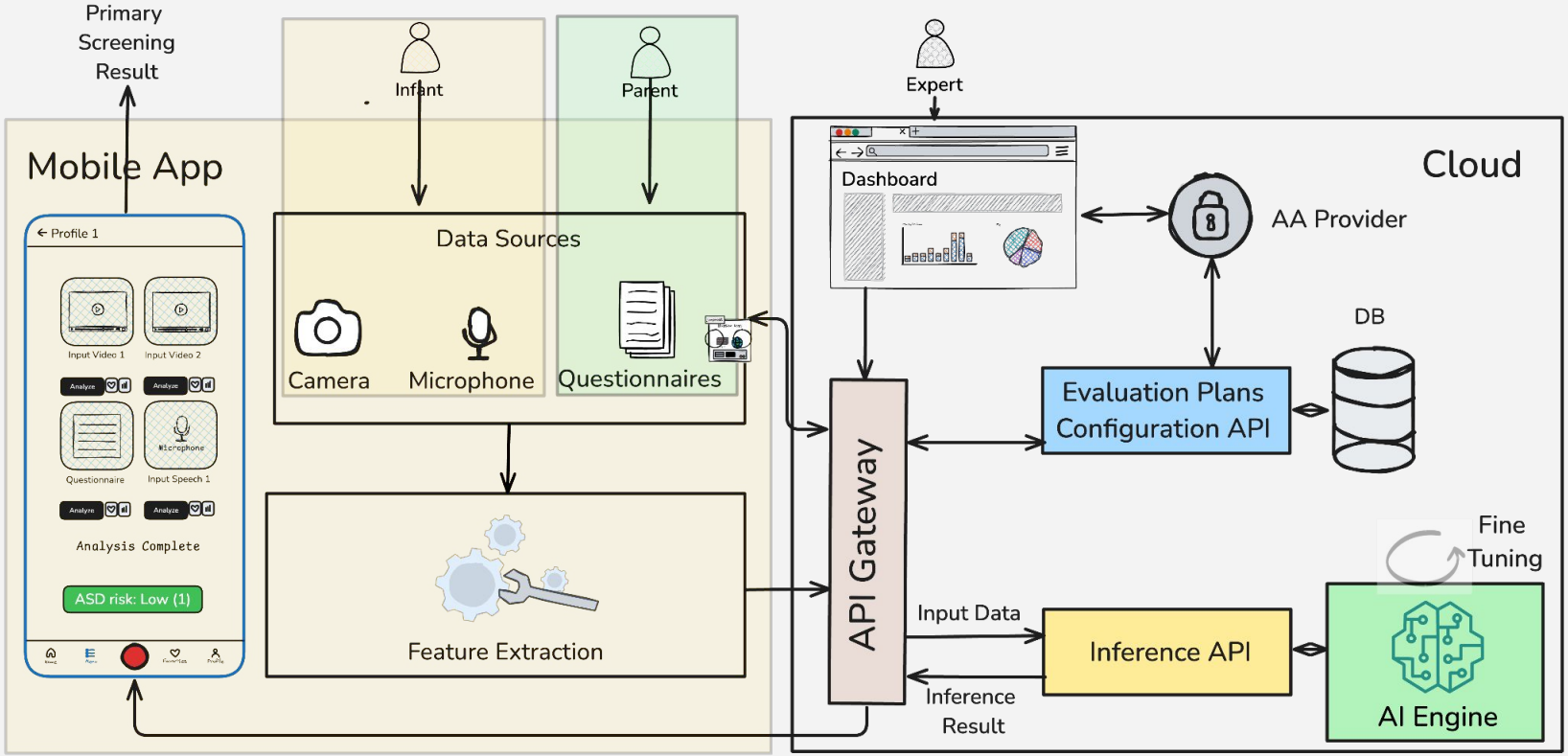
AI Model Scoring

- input from coded questionnaire responses and coded behavioral features extracted from video analysis
- input processed through the AI model
- correlates data to create a comprehensive profile of the child

Risk Assessment

- the tool generates a calibrated risk assessment scale
- risk for ASD:
  - low
  - medium
  - high
- the tool offers recommendations for:
  - further evaluation
  - intervention based on the level of risk detected

AI Tool Architecture

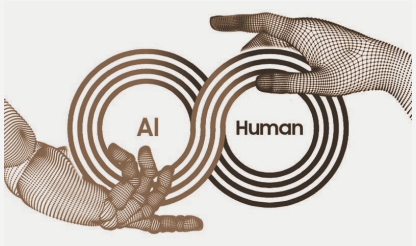


AI Tool - Benefits

- ➔ Simple & low-cost:
  - ◆ App interface to guide parents through recording videos and filling out questionnaires
- ➔ Accurate:
  - ◆ AI reduces human error, ensuring a higher degree of precision in early ASD screening
- ➔ Anonymous offering enhanced Data Security:
  - ◆ Strong encryption and data anonymization to protect users' privacy
- ➔ Remote and Scalable Solution:
  - ◆ Families can submit data from home, democratizing access to early detection

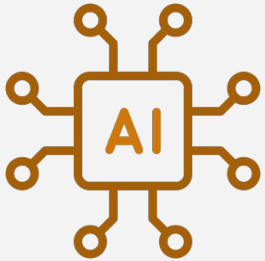
Summary & Conclusions

- ➔ Transformative Potential of AI:
  - identify subtle behavioral markers that traditional methods might miss
- ➔ Benefits of Early Detection:
  - timely intervention, leading to better developmental outcomes
  - reduced diagnostic cost & delays
- ➔ Key Advantages:
  - Accuracy: process audiovisual data and questionnaires with precision
  - Accessibility: usable for families in underserved or rural areas
  - Anonymity & Security: ensures data privacy, encouraging wider adoption



Future Research Directions

- ➔ Improving AI Models:
  - Refining Models: improve sensitivity and specificity of autism red flags
  - Incorporating Multimodal Data: Integrating diverse data eg genetic and environmental factors
  - Longitudinal Data Analysis: track developmental changes over time
- ➔ Wider Clinical Implementation:
  - Real-world Validation: pilot programs to test AI tools
  - Training Healthcare Providers: guidelines and training materials to incorporate AI-based tools



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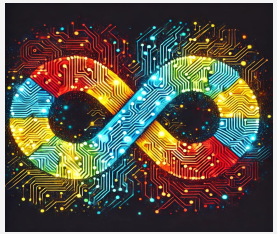

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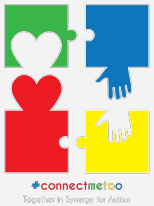

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