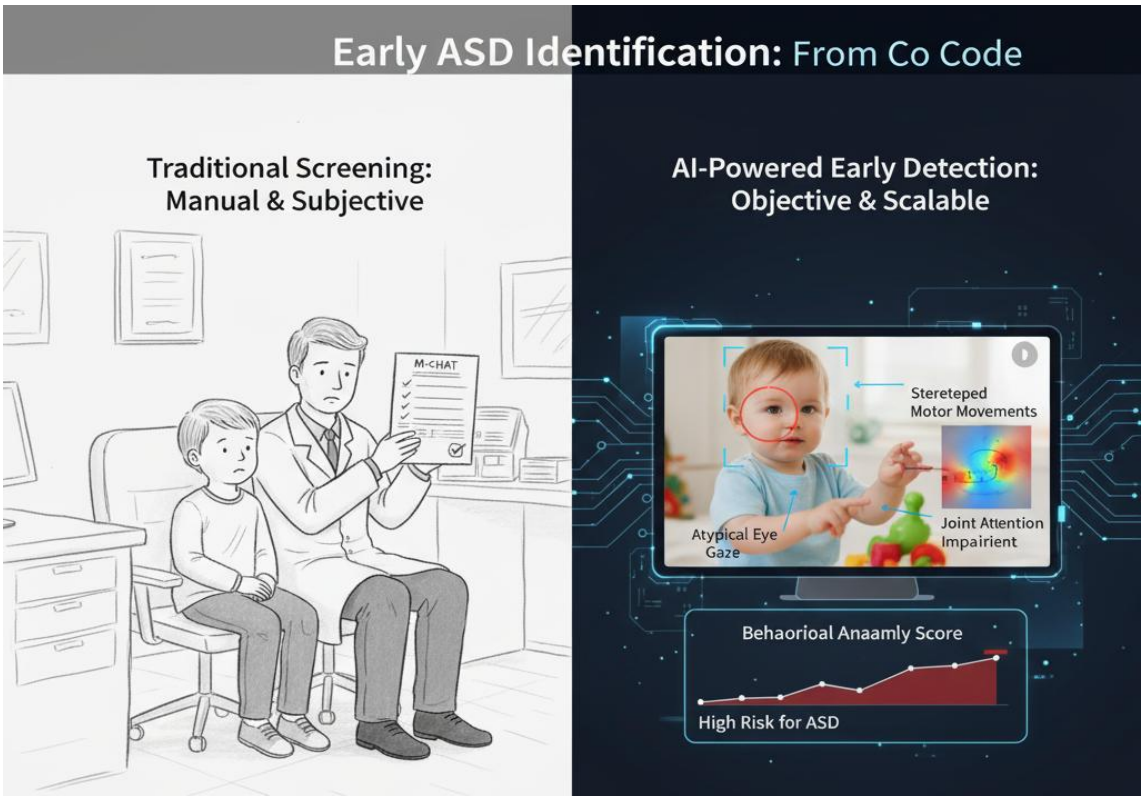
Chapter 5: Real-World Applications and Case Studies

The number one imperative in the clinical world of ASD is early identification, as early diagnosis and intervention play a key role in maximizing long-term developmental outcomes. Artificial intelligence (AI) and machine learning (ML) have gained momentum in this regard, offering an objective, scalable, and very accurate substitute to traditional diagnostic paradigms. The analysis of behavior data collected through digital technologies is one of the most potentially interesting applications. For instance, such a system might examine a toddler's home videos to detect subtle early signs of ASD, including atypical social orienting, stereotyped motor movements, or joint attention impairment. Using a deep learning model built from large video datasets of both autistic and neurotypical children, an algorithm can detect subtle behavioral dynamics often missed in short clinic visits that are markers for autism. This methodology is designed to supplement conventional screening tools (e.g., M-CHAT or the Modified Checklist for Autism in Toddlers) and introduce a quantitative, statistically based approach that can identify at-risk children for further clinical follow-up. An increasing number of use cases demonstrates that such AI-driven screening tools can accurately distinguish between neurotypical and future ASD children, leading to interventions initiated much earlier than current conventional means allow (Solek et al., 2024; Tariq et al., 2023).



The idea of incorporating ML into the diagnostic process is not to replace doctors, but instead to provide them with better ones. In a clinical application, the pediatrician could leverage a digital health app based on an ML model. As a parent fills out a digital questionnaire or uploads a short video of their child, the app's backend algorithm can quickly process and analyze the information. It would then output a risk score or an overall summary of unusual behavior. This empirically informed report provides clinicians with an evidence base for referring the child to a specialist for further evaluation, such as the ADOS-2. This accelerated path drastically shortens the timeline to receiving a diagnosis, which is often years in the making for many families. It also has the potential to reduce diagnostic inconsistencies, particularly among historically underserved groups, by providing a standardized screening tool that is not reliant on a single clinician's subjective judgment. ML-based early detection will transform the current "See and Refer" diagnostic process, with a new focus on identifying early signs, ensuring that children are not missed in early development considerations from the simulation walking period.

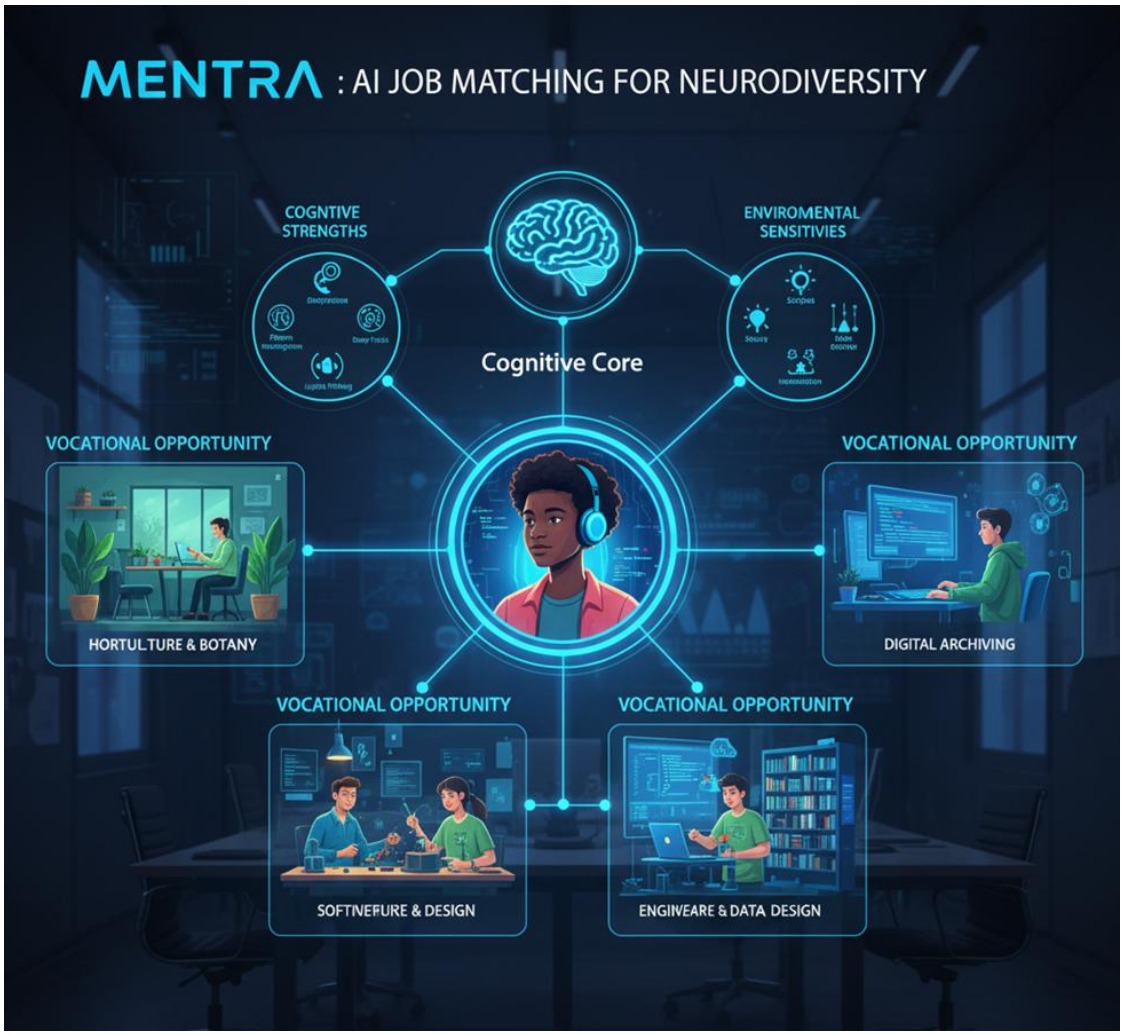
5.1 Machine Learning in Treatment and Intervention

Beyond diagnosis, predictive modeling is also transforming the way autism treatment is approached, with personalized and data-driven interventions. In view of the significant heterogeneity of ASD, a single one-size-fits-all treatment is frequently not ideal. Machine learning models can take diverse data, such as a patient's behavior history, genetic indicators, and past treatment responses, and make predictions about which therapeutic approach would be most effective for that individual. For example, a reinforcement learning algorithm might be integrated with a virtual reality social skills training intervention. The software model would constantly assess a person's performance in real-time, including their eye-gaze patterns, social engagement, and emotions, to refine the difficulty and content of the program for maximum learning impact. Such an adaptive learning system can ensure that the intervention is optimally adjusted at all times to meet each patient's individual requirements, thereby achieving maximum therapeutic effect.

Another important application is the ML for predicting treatments longitudinally. For example, researchers apply a model trained on longitudinal data obtained from a cohort of individuals with ASD to identify patterns indicative of a successful response to interventions (e.g., ABA, speech pathology). A model may describe individuals who have a genetic marker or a behavioral phenotype characteristic of those who are more likely to experience a significant consequence from the particular intervention. With this predictive knowledge, clinicians can be guided to more effective and less expensive treatment modalities at an early stage. For instance, if a model entails a low probability of success with standard intervention, it can suggest an alternative approach or the combination of therapies, thereby saving time and resources. The (very long-term) goal is to transition from a trial-and-error system to a precision medicine model of care for autism, where data and predictive analytics inform every aspect of the clinical process, from initial diagnosis to long-term intervention planning

5.2 Machine Learning in Adult ASD Support and Vocational Training

Although the focus has primarily been on early childhood diagnosis and intervention, machine learning can also contribute to lifelong support for individuals with autism. Adults with autism often experience significant barriers to obtaining and maintaining employment, with unemployment rates rarely less than 30% - 40%, a substantially higher percentage when compared to other disability populations (Giving Compass, 2023). Traditional recruitment methods, which often rely on subjective social cues and unstructured interviews, can be a significant barrier. As a solution to this, AI and ML are now more frequently used to close this gap and help drive neuroinclusive recruitment.



AI-driven platforms and tools are emerging top air neurodiverse candidates with jobs that actually match their exceptional skills and job-site preferences not just those that happen to contain specific keywords on a resume. A company such as Mentra, for instance, is utilizing artificial intelligence to create a “neuroinclusive jobs network” that considers details like an individual’s cognitive strengths, strongest skills, and sensitivities in their environment (Giving Compass, 2023). Such systems circumvent the conventional recruiting process and instead focus on a person's abilities, thereby reducing the biases associated with socially challenging interview situations. In addition,

artificial intelligence social lesson guides, including the chatbot “Noora,” provide a safe and low-stakes space for adults with ASD to rehearse social communication skills. With tools that provide real-time feedback and support scaffolded conversations, users learn how to cultivate and generalize the skills (empathy and conversational reciprocity) that pay dividends in professional settings. The overall objective of these applications is to enhance an individual's professional skills and boost self-esteem and self-efficacy, ultimately leading to improved social and workforce inclusion.