**EEG-Based Machine Learning to Unveil Neural Signatures of Autism**

Autism spectrum disorder (ASD) is a neurodevelopmental condition marked by social impairments and restricted, repetitive behaviors. Neuro-oscillatory activity—reflecting synchronized neural communication—is often atypical in ASD, suggesting disrupted information processing and network connectivity. However, findings across studies are difficult to compare, and traditional group-level analyses often overlook individual variability within ASD. To address this, we curated a high-density EEG dataset from 136 individuals across eight sensory, motor, and cognitive tasks, alongside rigorous clinical assessments. Our diverse sample includes autistic children, typically developing peers, and unaffected siblings of individuals with ASD. We propose a novel, multi-pronged machine learning approach to identify neural biomarkers and clinically meaningful subgroups. This approach offers a powerful framework to explore heritable neural signatures in ASD (and subgroups) to improve diagnostic precision.