A Novel Amyotrophic Lateral Sclerosis Diagnostic Tool Using Machine Learning and Biomarkers

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The last 40 years have seen monumental advances in the understanding of Amyotrophic Lateral Sclerosis (ALS). ALS is a neurodegenerative illness that affects upper and lower motor neurons. The prevalence of ALS is between 0.6 and 3.8 cases per 100,000 people, and upon diagnosis, 34% of patients will die within a year. Although ALS doesn't have a cure, the earlier it is diagnosed, the longer patients tend to survive. However, an early differential ALS diagnosis is difficult to reach, as in its first stages, ALS has numerous mimics, and the technology necessary for a diagnosis (magnetic resonance imaging and electromyogram) can be expensive. Alternatively, ALS can cheaply and accurately be diagnosed through biomarkers, notably cytokines and neurofilaments. Machine learning presents an innovative and accurate solution to diagnose ALS via biomarkers. This study aimed to find the biomarkers that, when used as the basis for training data in a gradient-boosted model, provided the most accurate results. After analyzing the performance of 12 biomarkers as individuals and in combinations, the results were the following: the individual biomarkers that performed the best were MCP-1, IL-2, and IL-10. The combinations of biomarkers that performed the best were inflammatory cytokines (IL-33, IL-36, sIL-R4, sIL-R2, IL-2, IL-6, IL-10, IFN gamma, TNF alpha) and all twelve biomarkers together. Thus, a gradient-boosted model, coded with Xcode's CreateML, combining all twelve biomarkers was finalized. This prototype provides a basis for a biomarker-based ALS diagnosis via machine learning, which allows for an early and accurate diagnosis of ALS patients, and has the potential to accelerate treatment, match patients with appropriate clinical trials, and improve patient survival.

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