Developing a Pre-Risk Assessment Incorporating Machine-Learning and Biomarkers to Diagnose Alzheimer's Disease

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Objective: Alzheimer’s Disease (AD) is a neurodegenerative disease with confirmation only from post-mortem autopsy. This study was done to aid diagnosis for the expected 14-million future patients through 3 distinct phases: Phase A – Machine learning (ML) with MRI, Phase B – Biomarker study within Cerebrospinal Fluid (CSF)/Blood, and Phase C – Theoretical/Computational Analysis. Methods: A) First, data from mice MRI with different cognitive classifications were analyzed using ImageJ. B) Second, a ML model to process component values within CSF was developed using Python and a dataset provided by the National Alzheimer’s Coordinating Center (NACC) in January 2020. B) Third, a protein solution was tested with protease to quantify the resulting reaction. A) Fourth, a ML model to process human MRI & determine patient cognitive status was developed. The NACC dataset consists of human MRIs of patients with different onsets of AD. Results: From initial Mice-MRI-Analysis, trends were identified within brain mass of Mice diagnosed with and without AD. The CSF-ML-Model achieved an accuracy of 100%. The Protein Solution showed temperature, pH and Potential variance, but not conductivity. The Human-MRI-Model training achieved a range of accuracies with mean of 78%. Conclusion: A) The feature parameters identified through Mice-MRI-Analysis were incorporated in the Human-MRI Model to enhance accuracy. This model trained with an average of 78%, barely surpassing the national average. Further training may increase the accuracy to above 90% based on the result range. B) The CSF model was able to identify the CDR® value of all 8,228 patients based on the components located within the CSF. Model weights found correlations between different variables leading to protein solution tests.

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