Combating Alzheimer’s Disease: An Exploration of Resveratrol Treatment and Early Disease Detection Using Drosophila melanogaster and Machine Learning

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Alzheimer's Disease (AD) is a neurodegenerative disease that destroys memory and thinking. This study focused on two critical gaps in AD research: novel treatment identification and early disease detection. The first phase of this study addressed the need for novel AD treatments by investigating one potential treatment, resveratrol. A Presenilin (Psn) Drosophila melanogaster model of AD was employed to test the effect of resveratrol on short-term memory through olfactory conditioning. Resveratrol was found to significantly improve the short-term memory of Psn flies, but only when it was administered immediately upon the birth of the flies. This demonstrated resveratrol's potential as an AD treatment, but also indicated that early administration is crucial to maximizing the effectiveness of the treatment. Notably, past literature has demonstrated that this is not unique to resveratrol. The second phase of this study strove to address the need for early disease detection — a crucial step in allowing for early treatment administration. Specifically, a machine learning classifier was developed to predict AD diagnoses based on patient MRI data. Unlike past machine learning models, this classifier was based on multiple cluster dense convolutional neural networks (DenseNets), a novel structure of convolutional neural networks that connects all layers in a feed-foward fashion, thus reusing features from all previous layers and achieving better performance. When the classifier was trained and tested using longitudinal MRI data from AD, mild cognitive impairment (MCI), and healthy patients, an overall accuracy rate of over 95% was achieved. Ultimately, the two facets of this study unite to provide valuable insights for discovering and maximizing AD treatments.

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