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Interpretable Alzheimer's Disease Detection with Minimal Data: Zero-Shot and Few-Shot Approaches Using Large Language Models

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Abstract : Alzheimer's disease (AD) is an incurable neurodegenerative disorder, underscoring the need for early diagnosis and intervention. Traditional clinical approaches pose challenges due to their inconvenience and high costs. In contrast, automatic AD screening systems based on speech analysis provide a noninvasive and scalable alternative. These systems commonly rely on extensively annotated datasets to fine-tune pre-trained language models for classification. Nevertheless, the diversity and complexity of the AD patient population, compounded by the limited availability of data for diverse groups, often result in suboptimal detection across various demographics. This research explores the effectiveness of large language models in zero-shot and few-shot learning scenarios for AD detection. Specific prompt engineering techniques have been developed for these scenarios, and large language models, including GPT-3.5 and GPT-4, have been employed on the ADReSSo test set. The models achieved an accuracy rate of 83.3%, which exceeds the results of traditional, data-intensive methods. Additionally, a 'thought chain' mechanism was designed to guide the models in a step-by-step analysis of AD symptoms, yielding not only accurate but also interpretable results. The findings suggest that minimal data, when strategically applied through disease-specific prompt engineering and large language models, can significantly improve AD detection, presenting a viable direction for future medical diagnostic research.

Keywords : Alzheimer's disease, few-shot, interpretability, large language model, zero-shot
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