

2022_ “ShuWei Cup”

Problem C: How to Diagnose Alzheimer's Disease Using Brain Structural

Features and Cognitive Behavioral Features

Alzheimer's disease (AD) is a progressive neurodegenerative disease with an insidious onset. It is characterized clinically by a full spectrum of dementia, including memory impairment, aphasia, dysfluency, agnosia, impairment of visuospatial skills, executive dysfunction, and personality and behavioral changes, the cause of which is still unknown. It is characterized by a progressive decline in the ability to perform activities of daily living, with various neuropsychiatric symptoms and behavioral disturbances. The disease is usually progressive in the elderly, with progressive loss of independent living skills and death from complications 10 to 20 years after the onset of the disease.

The preclinical stage of Alzheimer's disease, also known as mild cognitive impairment (MCI), is a transitional state between normal and severe. Due to the limited cognition of the disease by patients and their families, 67% of patients were diagnosed as moderate to severe and had missed the best intervention stage. Therefore, early and accurate diagnosis of Alzheimer's disease and mild cognitive impairment is of great significance.

The attached data contain specific information characteristics of 4850 cognitive normal elderly (CN), 1416 patients with subjective memory complaint (SMC), 2968 patients with early mild cognitive impairment (EMCI), 5236 patients with late mild cognitive impairment (LMCI) and 1738 patients with Alzheimer's disease (AD) collected at different time points (one time point is a quantity). Please use the brain structural characteristics and cognitive behavioral characteristics of the different categories of people provided in the Appendix to construct an Alzheimer's disease identification model and design an intelligent diagnostic method to accurately diagnose Alzheimer's disease.

(1) Preprocess the characteristic indicators of the attached data to investigate the correlation between data characteristics and the diagnosis of Alzheimer's disease.

(2) Use the attached structural brain features and cognitive behavioral features to design an intelligent diagnosis of Alzheimer's disease.

(3) First, cluster CN, MCI and AD into three major classes. Then, for the three subclasses contained in MCI (SMC, EMCI, and LMCI), the clustering was continued to be refined into three subclasses.

(4) The same sample in the annex contains features collected at different time points, please analyze them in relation to the time points to uncover patterns in the evolution of different categories of diseases over time.

(5) Please consult the relevant literature to describe the early intervention and diagnostic criteria for the five categories of CN, SMC, EMCI, LMCI, and AD.