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Scientists develop AI-based method to diagnose Alzheimer's or Parkinson's

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Alzheimer's disease, which currently affects more than 40 million people, is the most common neurodegenerative disease in elder people. Credit: UGRdivulga

Alzheimer's disease, which currently affects more than 40 million people, is the most common neurodegenerative disease in elderly people. Early diagnosis is crucial both to treat the disease and to help the development of new medicines, as it hasn't been possible to find a cure so far. The development of Alzheimer's has been proven to be closely linked to both structural changes in gray matter and functional changes in the white matter connecting the regions of the brain. In the brain connectivity network, a significant loss of white matter fibers also causes functional alterations such as memory loss. However, diagnosis remains a challenge, and to date, it hasn't been possible to determine how functional cerebral activity contributes to the deterioration of structural activity and vice versa.

In this regard, computer-aided diagnosis (CAD) is an important tool that helps physicians to understand multimedia content obtained in tests carried out with patients, which allows simpler treatment. One such procedure is medical imaging, which provides high-resolution "live" information on the subject. The BioSip research team of the University of Malaga, in collaboration with a group of researchers from the University of Granada, has been studying biomedical images and signals for years.

Researchers Andrés Ortiz, Jorge Munilla, Juan Górriz and Javier Ramírez have recently published an article in the *International Journal Of Neural Systems* titled "Ensembles of deep learning architectures for the early diagnosis of the Alzheimer's disease." The study presents a deep-learning technique for the diagnosis of Alzheimer's by the joint analysis of functional and structural images.

This artificial intelligence (AI) technique aims to model high-level data abstractions in order to enable computers to differentiate the brain of a healthy person from that of an ill person by automatically extracting the affected regions of interest. The researchers write, "The study uses deep

learning techniques to calculate brain function predictors and magnetic resonance imaging to prevent Alzheimer's disease. To do this, we have used different neural networks with which to model each region of the brain to combine them afterwards."

The study explores the construction of classification methods based on deep learning architectures applied to brain regions defined by a digital atlas of the human brain called Automated Anatomical Labeling (AAL). To this end, images of the gray matter of each area of the brain have been divided according to the regions separated in different sectors by the AAL, which have been used to train deep-learning neural networks specialized in the different regions of the brain. The knowledge acquired by the networks is subsequently combined by different fusion techniques presented in this paper.

Classification architecture

The result of this work is a powerful classification architecture that combines supervised and unsupervised learning to automatically extract the most relevant features of a set of images. The proposed method has been evaluated using a large database from the Alzheimer's Disease Neuroimaging Initiative (ADNI).

The results of this work, which included patients with other cognitive deficits that can develop Alzheimer's within two years, show the potential of AI techniques to reveal patterns associated with the disease. The accuracy rates obtained for the diagnosis contribute to the knowledge of the neurodegenerative process involved in the development of the disease, and is also useful as a starting point for the development of more effective medical treatments.

More information: Andrés Ortiz et al, Ensembles of Deep Learning Architectures for the Early Diagnosis of the Alzheimer's Disease,

International Journal of Neural Systems (2016). DOI: 10.1142/S0129065716500258