Unveiling the Spectrum of Cognitive Decline: MRI Differentiation of Alzheimer's Disease and Mild Cognitive Impairment

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Introduction

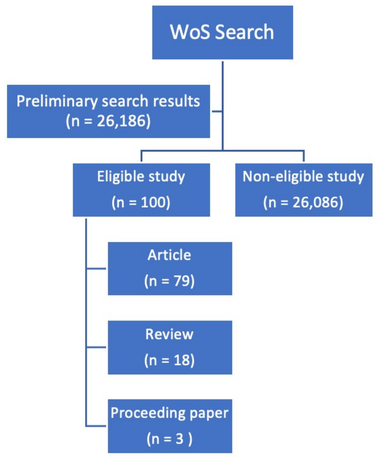
Globally, the escalating prevalence of Alzheimer's Disease (AD) presents a formidable challenge. The difficulty in achieving precise diagnoses underscores the need for advancements. In recent years, there has been a growing recognition among scientists that Alzheimer's disease should be viewed as a disease continuum, meaning that there is a spectrum of cognitive decline from normal aging to mild cognitive impairment (MCI) to AD. Research in understanding various stages is paramount in addressing this intricate neurodegenerative condition.

Objective

The study aimed to identify the existing trend in Magnetic Resonance Imaging (MRI) and Alzheimer's research by comparing articles from the Web of Science databases. The trend would provide an outlook for future researchers, providing insights to improve diagnostic accuracy to classify different stages of AD.

Methods

Literature searches (from inception to Jan 2024) were conducted using the Web of Science database to identify articles related to MRI and Alzheimer's disease. The preliminary search on keywords "MRI" and "(Alzheimer's disease OR AD OR dementia)" yielded 26,186 results. Two reviewers screened the top 200 most-cited articles for eligibility based on inclusion and exclusion criteria. The top 100 most-cited articles were selected for further analysis.



Results

Among the top 100 most-cited literature on MRI and Alzheimer's Disease, the top three most contributed journals are *Neurology*, *Neuroimage* and *Lancet Neurology* respectively (Figure 1). Most frequent collaboration was observed between the United States and other countries (Figure 2).

The keywords "atrophy", "mild cognitive impairment" and "diagnosis" appeared most frequently (Figure 3). 29 studies focused on diagnosing AD and its prodromal stage, Mild Cognitive Impairment. Studies also suggested combining various biomarker modalities, such as MRI, PET, and CSF biomarkers, could improve diagnostic accuracy.

Specifically, 36 studies demonstrated that regions including the entorhinal cortex and hippocampus played a pivotal role in differentiating MCI and AD based on the location and extent of brain atrophy. Findings reveal that neuroimaging serves as an important predictor of cognitive decline.

The most popular articles revealed the use of deep learning in performing brain segmentation (Figure 4). Our findings predicted the trend of artificial intelligence in neuroimaging in advancing the field.

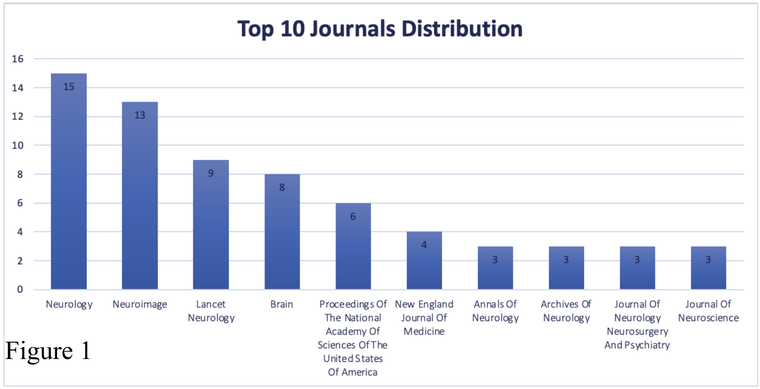


Figure 1

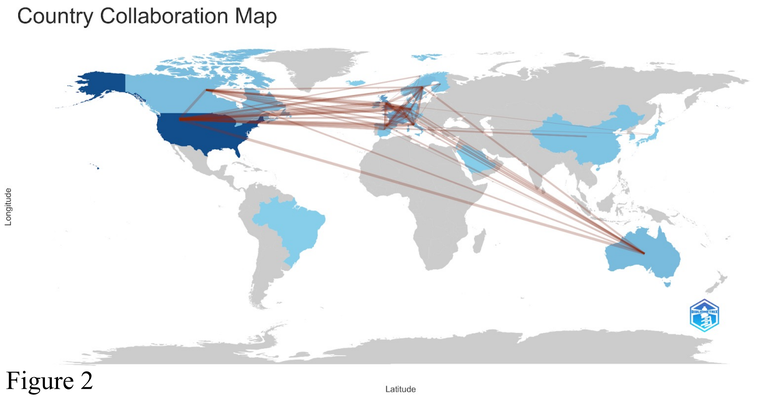


Figure 2

Conclusion

This bibliometric analysis provides valuable insights in MRI and Alzheimer's research, which highlights the urgent need for accurate diagnosis of different stages of Alzheimer's, including the detection of MCI, the precursor stage. The research introduces a multimodal approach, combining MRIs with FDG-PET and CSF biomarkers, to enhance diagnostic accuracy.

However, further investigation into the relationship between specific brain regions and the progression of the disease is crucial to develop personalized intervention plans in medicine. The continued exploration of the multimodal approach in addition to deeper integration of AI can ultimately open doors to novel early detection therapies, ultimately improving patients' lives in battling Alzheimer's Disease.

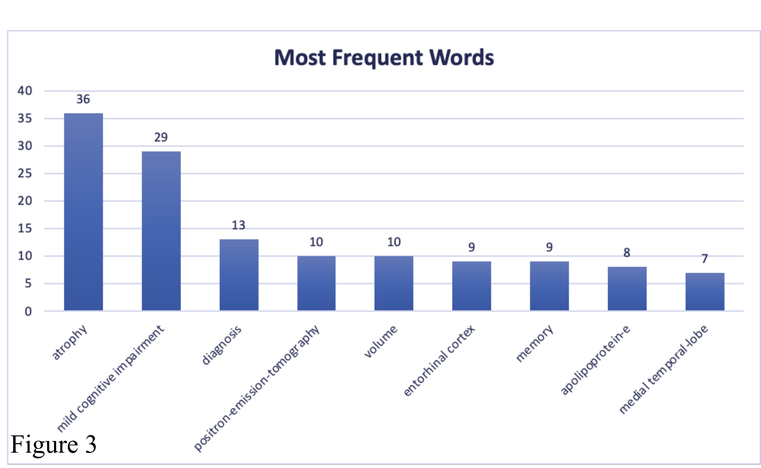


Figure 3

Most cited	First Author	Article Title	Source Title	Affiliations	Country	Publication Year	Times Cited, WoS Core
1	Desikan RS	An automated labeling system for subdividing the human cerebral cortex on MRI scans into gyral based regions of interest	Neuroimage	Boston University	USA	2006	7960
2	Fischl B	Whole brain segmentation: Automated labeling of neuroanatomical structures in the human brain	Neuron	Harvard University	USA	2002	6155
3	Petersen RC	Current concepts in mild cognitive impairment	Arch Neurol-Chicago	Mayo Clinic	USA	2001	3617
4	Wardlaw JM	Neuroimaging standards for research into small vessel disease and its contribution to ageing and neurodegeneration	Lancet Neurol	University of Edinburgh	Scotland	2013	3355
5	Avants BB	Symmetric diffeomorphic image registration with cross-correlation: Evaluating automated labeling of elderly and neurodegenerative brain	Med Image Anal	University of Pennsylvania	USA	2008	3194

Figure 4

References

1.Web of science database
2.R-Studio
3.Biblioshiny