Title of the Technology

Detection system for Alzheimer's disease using brain structural and/or functional magnetic resonance image processing and machine learning techniques

Background/Problem to be addressed

Early and accurate identification of dementia, such as Alzheimer's disease (AD) is of utmost importance. However, despite several decades of biomarker research, there is still no single diagnostic test or biomarker to definitively diagnose dementia and its underlying neurodegenerative disorder. Combination of structural MRI (sMRI) and functional MRI (fMRI) derived image analysis may provide unique ability to capture the dynamic state of change in the degenerating brain.

Scientific merit /Technical highlights over existing solutions

Most of the existing software/programs are not readily available, technically not amenable, and require equivalent multi-component third party software packages and demands multiple dependencies. A single platform which could process raw MRI and fMRI data and extract features to identify structural and functional anomalies and subsequently utilize those features to train powerful machine learning systems to detect/diagnose AD is missing.

Our system is composed of two independent yet complimentary diagnosing approaches where one part is capable of processing and analyzing brain structural MRI (sMRI) data followed by implementation, customization, and standardization of convoluted neural network (CNN) algorithms to distinguish AD patients from normal healthy cohort. In the other part, this package processes, analyzes, and predicts AD /MCI status using functional MRI (fMRI) slices.

Societal Relevance

This detection system has huge societal importance in clinical diagnostics of AD and AD like symptoms. Till now there is no single diagnostic test or biomarker to definitively diagnose dementia and its underlying neurodegenerative disorder. This embedded system could easily be synced with the clinically used MRI/fMRI machines. This detection system can aid clinical diagnostics of AD and AD like symptoms in an efficient manner.

Market size/Commercial Potential

This detection system has huge commercial importance in clinical diagnostics of AD and AD like symptoms. Till now there is no single diagnostic test or biomarker to definitively diagnose dementia and its underlying neurodegenerative disorder. This detection system has huge commercial importance in clinical diagnostics of AD and AD like symptoms.

Current stage of Development (Technology Readiness Level (TRL))

TRL-4. A prototype has been made which is capable of predicting the AD/MCI/healthy status of the query sMRI and/or fMRI data.

USP of technology/Competitive products and advantages over competition

Biomedical imaging based development of diagnostic systems is a popular and lucrative field for both academia and industry. Hence, a large group of inventors are working on development of effective image processing and machine learning based diagnostic systems for Alzheimer's disease (AD) detection. However, our method is unique in the sense of its trained models and the derived features which are specific. Hence, the performance and the underlined coding and logical systems are unique to us. Similarly, utilization of both sMRI and fMRI images and their derived features are also novel and unique. Further, enrichment and diversification of the training models via additions of broader patient cohorts and hitherto unknown important features would be specific to our package.

**Extent of indigenisation & import substitution, if applicable**

This invention is indigenised.

Scope for overseas market penetration related to the Technology

Alzheimer's disease (AD) and other forms of dementia are ranked as the 7th leading cause of death. It is estimated that there are approximately 44 million people worldwide living with Alzheimer's disease or a related form of dementia. Hence, early detection of the disease and its prodromal form named mild cognitive impairment (MCI) is very important.

This invention may have huge scope in countries like India, USA, Brazil, Argentina.

High Resolution image of the technology prototype, if developed
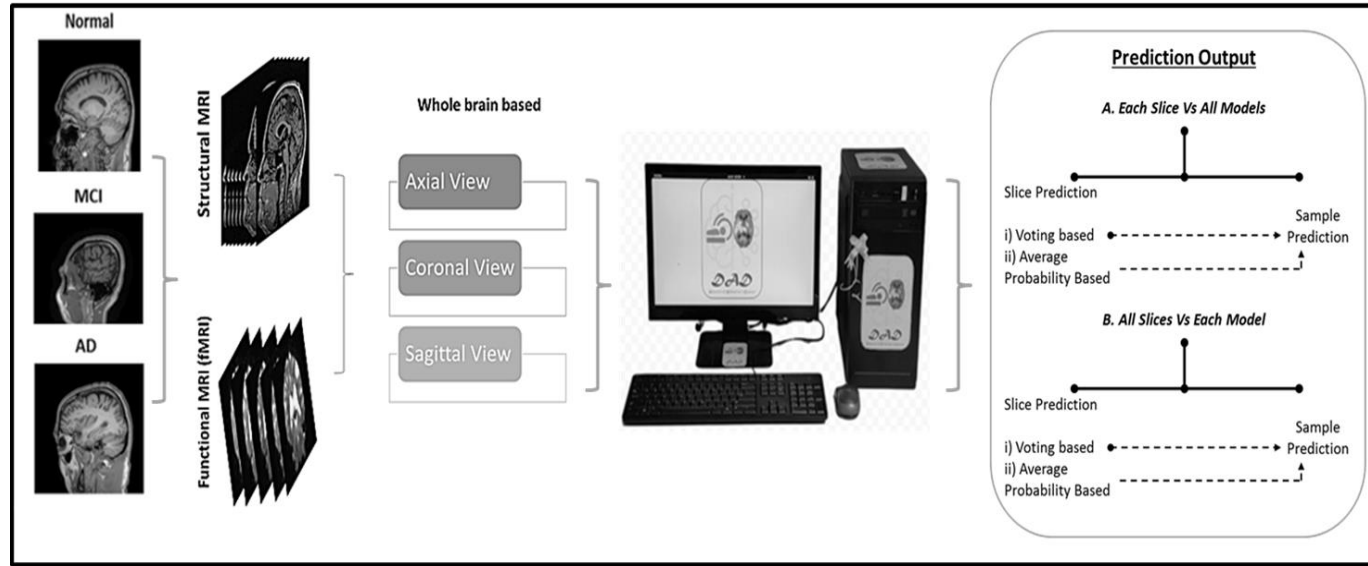
Number of samples tested/validated
fMRI: 640 samples; sMRI: 1709 samples

Cost of Sampling/testing

Studies conducted for getting regulatory approval, if any

Any other information relevant for evaluating the technology

Novelty, IP and Competitive Landscape and IP/Patent Applications, filed/granted
Indian Patent filed (PCT/IN2024/050632)

Details of PIs, funding agency and third party, if involved in development
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