ISSN: 2454-9940

# INTERNATIONAL JOURNAL OF APPLIED SCIENCE ENGINEERING AND MANAGEMENT

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www.ijasem.org

INTERNATIONAL JOURNAL OF APPLIED SCIENCE ENGINEERING AND MANAGEMENT

ISSN 2454-9940

www.ijasem.org

Vol 19, Issue 2, 2025

# DEEP LEARNING CNN MODAL FOR MULTIMEDICAL IMAGE FUSION

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## ABSTRACT

Alzheimer's disease (AD) is irreversible, progressive brain disorders that slowly destroy memory and thinking skills. Alzheimer's is one of the most common causes of Dementia. Dementia means loss of Cognitive functioning – thinking, remembering and reasoning – and behavioral ability to such an extent that it interferes with Daily life. The image processing is widely used in medical field in order to detect disease and help doctor in decision making based on observation. The paper aims to detect the Alzheimer's disease at earliest so that patient can be prevented before irreversible changes occur in brain. We propose the image processing technique to process the Magnetic Resonance Imaging (MRI) of brain from axial plane, coronal plane and sagittal plane. The image segmentation is used to highlight the affected region in brain MRI. The diagnosed region in brain MRI includes hippocampus and volume of brain. The comparative identification of person affected with the Alzheimer's disease, Healthy cohort and Mild Cognitive impairment is done.

## LITERATURE SURVEY

During the past two decades, lot of research has been done in this field regarding the application of image processing techniques for Alzheimer disease diagnosis. Magnetic resonance imaging (MRI) is one of the imaging techniques to analyze AD, preferred by doctors for the analysis of patient's condition. MRI has produced a beneficial in vivo technique to ingress the deformations that arise in the patient's brain during the advancement of AD disease, and pro-vides potential means for recognizing individuals in the preclinical stages. Desikan and Cabral proposed the technique in which they analyzed the entire brain. They categorized the MRI data in two classes: whole brain analysis and the voxel of interest (VOI) (Desikan et al., 2009).

Voxel-Based Morphometry (VBM) is an automated tool for analysing MRI brain structures, enabling unbiased measurement of affected areas. Independent Component Analysis (ICA) is used for signal separation, identifying unique voxel patterns in specific brain regions. Machine learning techniques like ANN, SVM, and LS-SVM aid in detecting and classifying Alzheimer's disease (AD) and mild cognitive impairment (MCI).

## SYSTEM MODEL

The given System model outlines an automated approach for detecting Alzheimer's disease (AD) using machine learning techniques applied to brain MRI scans. The process follows a structured pipeline consisting of several key stages:

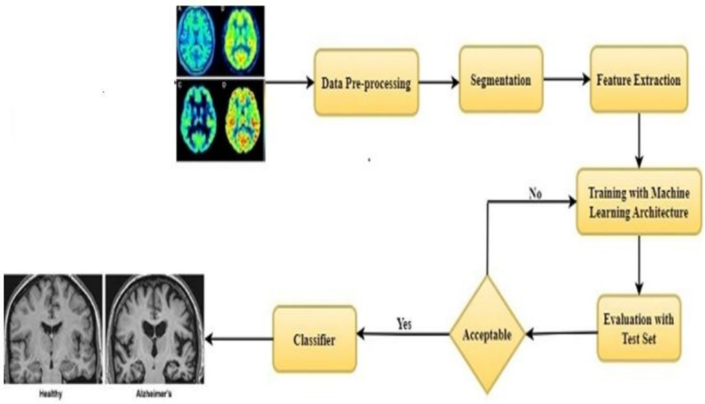


Figure.1 System Model

## PROPOSED SYSTEM

The proposed system aims to enhance Alzheimer's Disease (AD) diagnosis by integrating multi-modal image processing techniques with advanced machine learning algorithms. The system leverages MRI and EEG data, utilizing deep learning-based classification and segmentation methods to improve early-stage detection accuracy.

Key Components

1. **Data Acquisition**
   - MRI scans for structural brain analysis.
   - EEG signals to capture functional abnormalities.
2. **Preprocessing**
   - MRI: Skull stripping, intensity normalization, and noise reduction.
   - EEG: Signal filtering, artifact removal, and feature extraction.
3. **Feature Extraction & Selection**
   - Structural MRI: Gray Matter (GM), White Matter (WM), and Cerebrospinal Fluid (CSF) segmentation.
   - EEG: Power spectral density, event-related potentials, and entropy measures.
4. **Machine Learning Model**
   - Deep Learning: Convolutional Neural Networks (CNNs) for MRI classification.

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ISSN 2454-9940
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- EEG-based classification using Recurrent Neural Networks (RNNs) or Long Short-Term Memory (LSTM) models.
- Hybrid approach: Fusion of MRI and EEG features to improve classification accuracy.

5. **Classification & Decision Support**
   - Binary classification (Healthy vs. AD).
   - Multi-class classification (Mild Cognitive Impairment (MCI) vs. AD).
   - Explainability techniques (e.g., Grad-CAM for MRI and attention mechanisms for EEG).
6. **Validation & Performance Metrics**
   - Accuracy, sensitivity, and specificity evaluation.
   - Comparison with existing approaches.
   - Clinical validation through expert feedback.

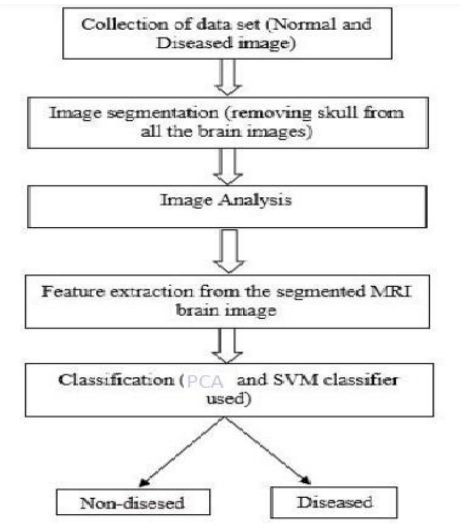


Figure.2 Flow diagram

## STIMULATION RESULTS

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ISSN 2454-9940
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Figure.3 Original image

We masked the outer section of both the images to extract the hippocampus volume. These two masked images shows that how much percentage of black region present in the central section of brain image.

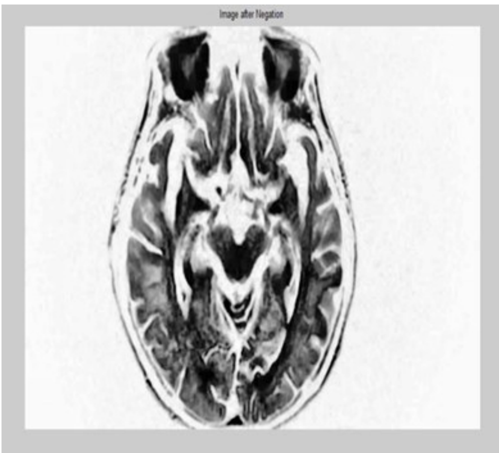


Figure.4 After negation

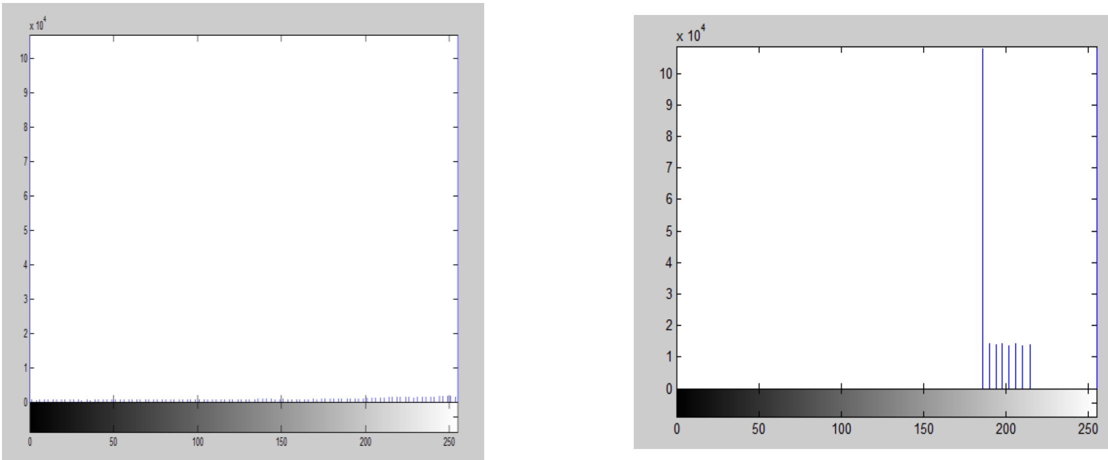


Figure.5 Histogram of bottom hat

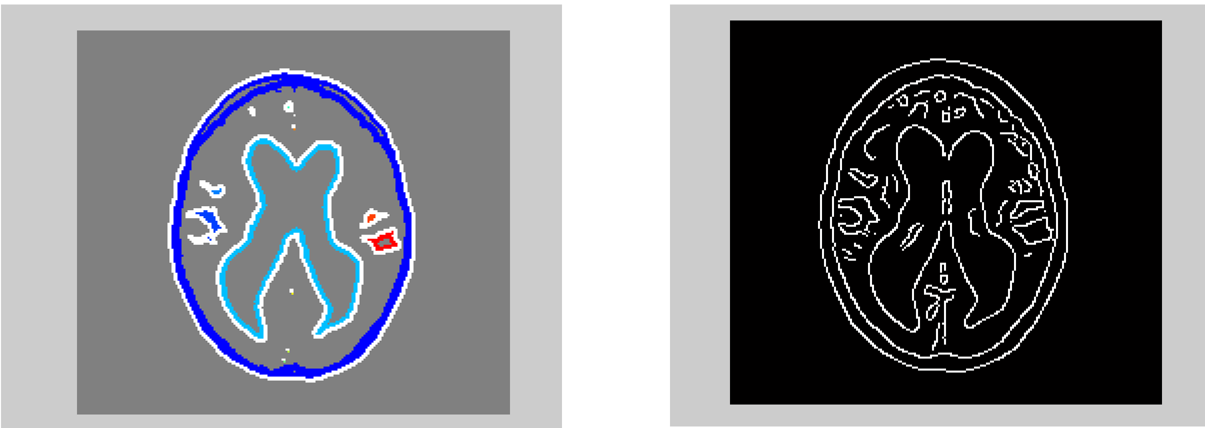

Figure.6 Black pixel images

ISSN 2454-9940
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```
chronic =

     1.0444


dementia =

     1.0259
```

Figure.7 Chronic values

## ADVANTAGES

- Enables early pharmacological and non-pharmacological therapies.
- Provides timely access to support networks and care agencies.
- Increases chances of preventing behavioral and psychological symptoms of dementia (BPSD).
- Helps detect and treat reversible conditions like normal pressure hydrocephalus.
- Allows intervention in lifestyle-related diseases to slow cognitive decline.
- Detecting Mild Cognitive Impairment (MCI) can help delay dementia progression.

## APPLICATIONS

- **Early Diagnosis & Intervention –** Helps in detecting Alzheimer's at an early stage, enabling timely medical intervention to slow disease progression.
- **Automated Screening –** AI-based image processing enables automated and accurate screening of MRI or PET scans, reducing manual diagnostic errors.
- **Personalized Treatment Plans –** Early detection allows doctors to tailor treatment and lifestyle modifications to individual patients, improving quality of life.
- **Monitoring Disease Progression –** Image processing techniques help track brain atrophy and other changes over time, aiding in disease management.
- **Clinical Research & Drug Development –** Assists in testing new drugs and therapies by identifying early biomarkers of Alzheimer's in clinical trials.
- **Remote Diagnosis & Telemedicine –** Enables AI-driven remote analysis of brain scans, improving access to Alzheimer's detection in underserved areas.
- **Cognitive Rehabilitation –** Helps in planning cognitive therapies and exercises to maintain brain function for as long as possible.
- **Neuroscience Advancements –** Enhances understanding of Alzheimer's pathology through deep learning and neuroimaging analysis.
- **Cost-Effective Diagnosis –** Reduces reliance on invasive tests and extensive medical evaluations, making early detection more affordable and accessible.
- **Enhanced Caregiver Support –** Enables caregivers to plan better for the patient's needs by understanding the severity and progression of the disease.

## CONCLUSION

The purpose of early detection of Alzheimer's disease is achieved. Enlarged Vascular and Brain atrophy. The implementation is done using image segmentation for the identification of enlarged Vascular. The amount of enlargement will classify the patient as Healthy patient, 1st stage AD, 2nd Stage AD, Mild Cognitive impairment cases. Another important factor for the detection of the AD is Brain atrophy. Watershed algorithm for image segmentation is used to detect Brain atrophy. Gradient of image is used to check the Cavity in Brain atrophy. This automated method is having simple methodology and low time complexity of the image. This overcomes the problem of earlier detection with no damage cause to brain. This will boost the research in the area of medical imaging.

## FUTURE SCOPE

This research is focused on designing effective feature selection and ensemble modeling techniques. The feature selection technique based on an efficient fusion of feature ranking techniques and greedy searching can find out a sub-optimal minimal feature set for a ML task. In short, the application of the proposed feature selection algorithm on the AD domain can assist the physician in finding out the important features for distinguishing AD and MCI. Moreover, the application of DES algorithms can also improve the AD classification performance. The improvement in the classification results will help the physician in making the correct decision about the AD diagnosis status.

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