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THE FIRST INTERNATIONAL CONGRESS ON HEALTH SERVICES TRANSFORMATION

اولین کنگره بین المللی تحول خدمات سلامت

۲۷ و ۲۸ مهر ماه

Code: 1261

Early Diagnosis of Multiple Sclerosis Using Magnetic Resonance Imaging Based on LASSO Feature Selection and Convolutional Neural Networks

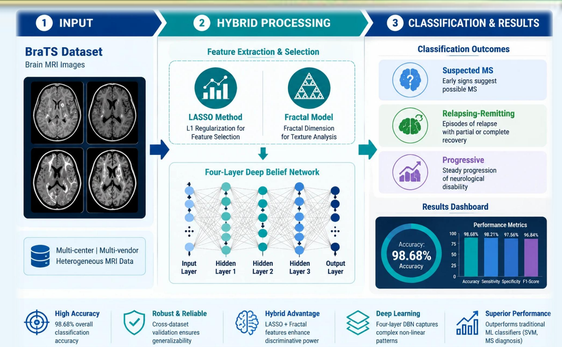




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Backgrounds

Clinical Need:

Multiple Sclerosis (MS) is a progressive autoimmune disorder of the central nervous system. Early and precise diagnosis is crucial for disease modification and effective therapeutic interventions, as neurodegeneration is often irreversible once established.

Current Bottlenecks:

Current clinical workflows rely heavily on manual lesion segmentation in MRI scans by radiologists. This process is inherently:

Time-consuming: High volume of imaging data.

Subjective: Prone to inter-observer variability.

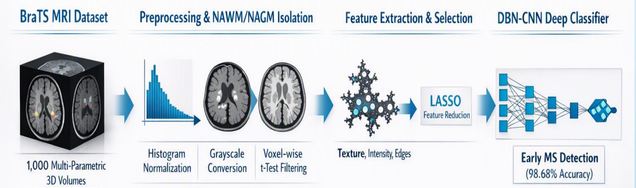
Error-prone: Risk of missing subtle, early-stage pathology.

Research Gap:

Neuroimaging data presents high dimensionality with significant redundant features, which often hinders the performance and convergence of standard deep learning models.

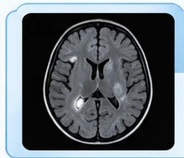
Methods

Proposed End-to-End Methodology & Architecture



Findings

MULTI-STAGE IMAGE PROCESSING PIPELINE & LESION ISOLATION



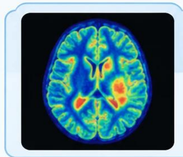
1 Stage 1: Raw MRI (FLAIR / T2)

Original MRI scan (FLAIR / T2) with native intensity and background including skull and artifacts.



2 Stage 2: Skull Stripping & Artifact Filtering

Remove skull and non-brain tissue, reduce noise and artifacts, and normalize the brain image.



3 Stage 3: Fractal Texture Mapping

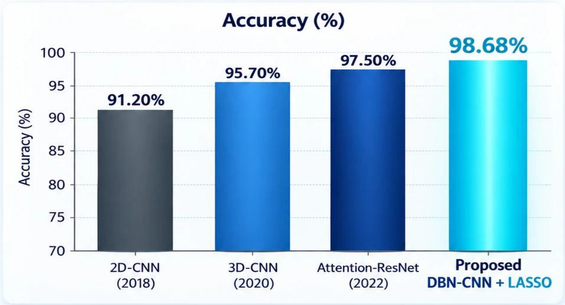
Extract fractal texture features and generate a texture anomaly heatmap for lesion detection.



4 Stage 4: Automated Lesion Isolation Mask

Generate a binary lesion mask by isolating abnormal regions from the processed image.

Quantitative Benchmarking & Diagnostic Performance



Sensitivity
>94.5%

Specificity
>94.2%

MSE Error
0.8598
Fast Convergence

Conclusion

Clinical Translation & Conclusion

Clinical Impact

Early diagnosis of MS with our system enables timely and proactive patient management, improving outcomes for individuals with multiple sclerosis.

CAD System Advantage

Reduces human diagnostic errors and enhances radiologist workflow efficiency, **supporting accurate** and *swift decision-making.*

Key Takeaways

Our **DBN-CNN+LASSO** model demonstrates **robustness** and **strong potential** for *future application in clinical practice.*

References

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