



CERTIFICATE NO : **ICRESMH /2025/C0425461**

A Study on Multimodal Deep Learning Approach for Automatic Benign Classification

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ABSTRACT

A multimodal deep learning approach for automatic benign classification focuses on accurately identifying non-cancerous tumors or lesions by integrating multiple sources of medical data. Traditional classification techniques often rely on a single modality, such as imaging data, which may not provide sufficient information for precise diagnosis. Multimodal deep learning addresses this limitation by combining various data types, including medical images (such as MRI, CT scans, ultrasound, or histopathological images), clinical records, and sometimes genomic or laboratory data. Advanced deep learning architectures, particularly convolutional neural networks (CNNs) and hybrid neural network models, are used to extract meaningful features from each modality and fuse them into a unified representation. This integrated learning process enables the model to capture both structural and contextual characteristics associated with benign tumors. As a result, the system can automatically distinguish benign conditions from other abnormalities with higher accuracy and reliability. Automatic benign classification systems also reduce the workload of medical professionals by assisting in preliminary diagnosis and screening processes. Moreover, such systems help minimize unnecessary biopsies or invasive procedures by improving diagnostic confidence. With the continuous advancement of artificial intelligence in healthcare, multimodal deep learning models are becoming increasingly important tools for supporting clinicians in medical decision-making and promoting efficient, accurate, and early detection of benign conditions.