# Comparative Analysis of Custom Scratch CNN and EfficientNetB0 for Brain Tumor Classification in MRI

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| **ABSTRACT**  This paper discusses the classification of brain tumours in magnetic resonance imaging (MRI) images using two approaches: a custom scratch Convolutional Neural Network (CNN) and a pre-trained EfficientNetB0 model. The dataset includes four classes: glioma, meningioma, pituitary, and non-tumour, representing a wide range of brain abnormalities [1].  The initial network is employed a scratch CNN architecture that has been carefully designed to fit the intricacies of the brain tumour classification task. This model was created from scratch, taking into consideration the specific features and complexities associated with brain imaging data [2]. The rationale behind the custom architecture is to investigate the potential advantages of a tailored solution for this particular classification problem. The second network utilises transfer learning by employing the EfficientNetB0 model, which is a state-of-the-art architecture pre-trained on various datasets [3]. Transfer learning aims to apply the knowledge gained from training on extensive datasets to a specific task, potentially enhancing performance and reducing the need for large amounts of task-specific labelled data [4].  Rigorous experiments and evaluations were conducted on a carefully selected dataset using standard metrics, including accuracy, precision, recall, and F1-score, to assess the performance of both models. The results indicate that the EfficientNetB0 model consistently outperforms the scratch CNN on all metrics, demonstrating its superior ability to accurately classify brain tumour images.  This study examines the effectiveness of transfer learning in brain tumour classification and highlights the advantages of using a pre-trained model, such as EfficientNetB0. The results presented in this paper contribute to the ongoing debate on the optimal approach for deep learning-based medical image classification tasks. These findings have the potential to improve diagnostic accuracy and reduce the burden of data annotation efforts.  **References:**  [1] N. Ullah et al., "An effective approach to detect and identify brain tumors using transfer learning," Applied Sciences, vol. 12, no. 11, p. 5645, 2022.  [2] W. Ayadi, W. Elhamzi, I. Charfi, and M. Atri, "Deep CNN for brain tumor classification," Neural processing letters, vol. 53, pp. 671-700, 2021.  [3] H. A. Shah, F. Saeed, S. Yun, J.-H. Park, A. Paul, and J.-M. Kang, "A robust approach for brain tumor detection in magnetic resonance images using finetuned efficientnet," IEEE Access, vol. 10, pp. 65426-65438, 2022.  [4] R. Mehrotra, M. Ansari, R. Agrawal, and R. Anand, "A transfer learning approach for AI-based classification of brain tumors," Machine Learning with Applications, vol. 2, p. 100003, 2020. |

# Keywords: Brain Tumor Classification, Convolutional Neural Network (CNN), Transfer Learning, EfficientNetB0, Medical Image Analysis