**Comparing Some Convolutional Neural Network**

**Architectures (CNN) for Brain Tumor Classification**

**Abstract**

In neuroscience, brain tumors are one of the most important topics of study done by neuroscientists. Brain tumors can be malignant or benign. Malignant tumors are tumors that can spread to other parts of the body and can be a threat to life. The benign tumors are not life-threatening but they do have an impact on the brain. The most common types of brain tumors are glioma, meningioma, and pituitary. According to research by Preston A. Wells Jt. Center for Brain Tumor, 2.4 % of cancer-related deaths are caused due to brain tumors. So early detection localization and classification of brain tumors are important in the field of neuroscience.

Deep learning based techniques have been used in brain tumor detection and classification in last decade. More successful results were obtained when the most popular deep leaning method of Convolutional Neural Network(CNN) is applied .In this study some reputed CNN architectures are used as a basis for developing the deep learning networks. In the experiment, the architectures are investigates by comparing the performance of the CNN architectures.

**Keywords:** Deep learning , Convolutional Neural Network, Brain Tumor Classification, Neuroimaging, Transfer Learning

**Introduction**

**Literature Review**

Brain tumor classification using MRI scans is a critical area of research due to its significant impact on patient management. Traditional methods relying on manually extracted features have been largely superseded by the integration of deep learning techniques, particularly Convolutional Neural Networks (CNNs). These models excel at extracting informative features directly from image data, enhancing classification accuracy. However, their performance is often hindered by the requirement of large, labeled datasets and substantial computational resources [1].

Transfer learning has emerged as a promising solution to address these limitations. By leveraging pre-trained models from large-scale image datasets, researchers have successfully adapted them for brain tumor classification, reducing training time and improving performance with limited data [2].

Several studies have explored different deep-learning architectures for brain tumor classification. Hossain et al. (2019) proposed a CNN-based method that achieved high accuracy and robust feature extraction but required large datasets and computational resources [1].

Sajjad et al. (2019) utilized transfer learning with pre-trained models like AlexNet and GoogleNet, demonstrating reduced training time and improved performance with limited data, although fine-tuning these models can be complex [2].

Other studies have focused on specific aspects of brain tumor classification. Pereira et al. (2016) developed a deep learning model with small kernels for improved tumor segmentation in MRI images, achieving better localization and segmentation accuracy, but requiring significant computational power [3]. R

Reza et al. (2018) proposed a deep neural network combining CNNs and Long Short-Term Memory (LSTM) networks to capture both spatial and temporal features, potentially enhancing classification but with increased complexity and longer training times [4].

Afshar et al. (2018) introduced Capsule Networks for brain tumor classification, offering advantages in handling spatial relationships, but with a more complex architecture and slower training compared to traditional CNNs [5].

Ensemble models combining multiple CNN architectures have also been explored. Zhao et al. (2020) developed such a model for improved accuracy, but at the cost of increased computational complexity [6].

Hybrid deep learning models have been proposed as well, such as the one by Zhang et al. (2019) that combined CNNs and autoencoders for effective feature learning and improved classification accuracy, although careful parameter tuning is needed [7].

Mohsen et al. (2018) applied deep belief networks (DBNs) for brain tumor classification, achieving high accuracy, but with a complex training process and significant computational demands [8].

Additionally, Sajjad et al. (2020) proposed an improved CNN architecture with additional layers for enhanced feature refinement, leading to better classification accuracy but with increased model complexity and longer training times [9].

Islam et al. (2019) developed a deep learning model with transfer learning and data augmentation for brain tumor classification, achieving improved accuracy with limited data and reduced overfitting, but with a dependence on the choice of pre-trained models and data augmentation techniques [10].

Methodology Proposed

Experiment and Analysis

Evaluation Metrics

Conclusion and Future Work

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