Progress Report 2: Cross-Architectural Knowledge Distillation in Medical Imaging: Multi-Scale Geometric Feature Fusion for MRI Scan Classification

Mahiyat Nawar Mantaqa
2122455042

MD. Shafat Islam Khan
2121517642

I. Figshare Brain Tumor Dataset

The Figshare Brain Tumor Dataset contains 2064 contrast-inhanced images from 233 patients with 3 kinds of brain tumor: meningioma (708 slices), glioma (1426 slices), and pituitary tumor (930 slices) into a .zip file: https://www.kaggle.com/datasets/ashkhagan/figshare-brain-tumor-dataset

II. Training and Validation Loss, Accuracy

- Training & Validation Loss: The loss decreases steadily over epochs, indicating the model is learning effectively without major overfitting.
- Training & Validation Accuracy: Both training and validation accuracy improve consistently, with validation accuracy reaching approximately **85%**. This suggests a well-generalizing model.
- The predictions in Figure 2 are generally accurate, with at least one case of misclassification (Pred: 2, True: 0 in the bottom-right corner), indicating some room for improvement.

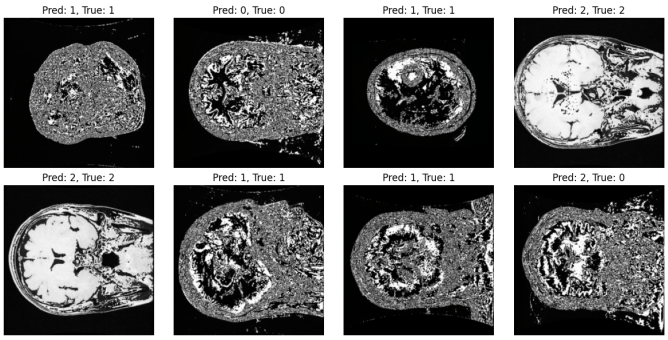

Fig. 2. Prediction Results

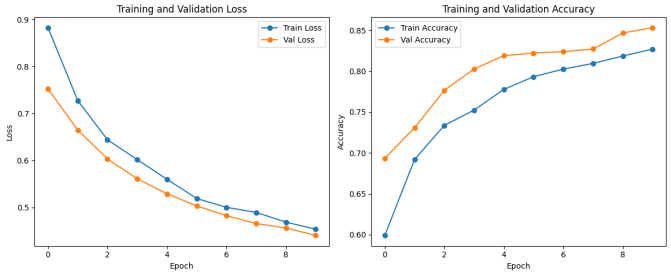

Fig. 1. Loss and Accuracy Trends

III. Model Peformance after Knowledge Distillation

1) Accuracy Improvement: The KD model achieves 97% training accuracy and 91% validation accuracy, compared to 85% validation accuracy in the previous model.
2) Faster Convergence: The KD model reaches high accuracy in fewer epochs, reducing training time.
3) Overfitting Consideration: The training accuracy is higher than validation accuracy, suggesting potential overfitting.
4) Better Generalization: Validation accuracy is consistently high, indicating improved knowledge transfer from the teacher model.

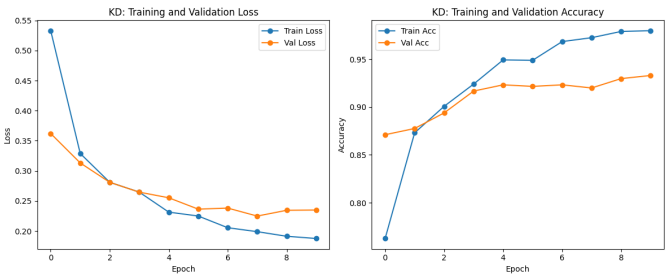

Fig. 3. Loss and Accuracy after Knowledge Distillation

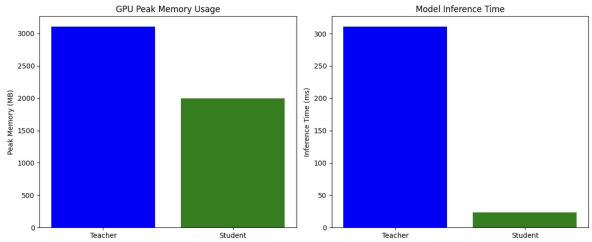

Fig. 4. Teacher-Student Model Performance Comparison

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