Progress Report 3: Cross-Architectural Knowledge Distillation in Medical Imaging: Multi-Scale Geometric Feature Fusion for MRI Scan Classification

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I. Trained EfficientNetB0

The EfficientNetB0 model was trained on its own without any knowledge distillation techniques applied. MRI images stored in MATLAB (`.mat`) files were used. Grayscale images were converted to 3-channel format and normalized. The data is split into 80% training and 20% validation, with augmentations like random horizontal flips applied to the training set. It is trained using cross-entropy loss and Adam optimizer (lr = 1e-4) for 10 epochs on a GPU.

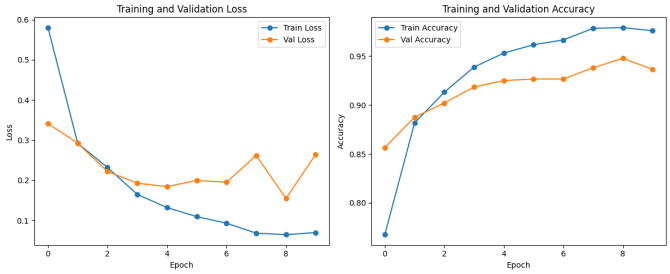

Fig. 1. EfficientNetB0 Loss and Accuracy Curve

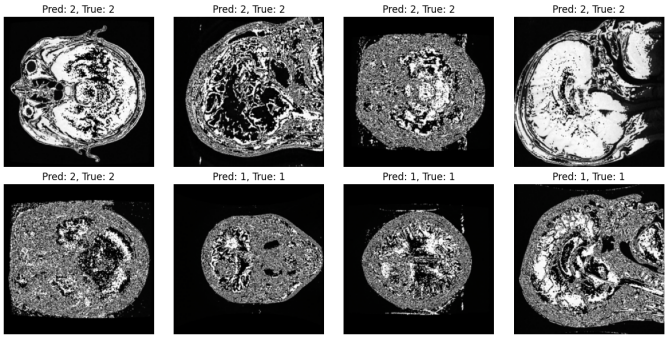

Fig. 2. EfficientNetB0 Prediction Results

II. Trained Hybrid VGG19 Teacher Model

The Figshare Brain Tumor Dataset stored in MATLAB (`.mat`) files were used to train a Hybrid VGG19 Teacher Model. It loads the dataset using `h5py`, extracts MRI images and labels, normalizes grayscale images to 3-channel format, and applies data augmentation (resizing, normalization, horizontal flips). The dataset is split into 80% training and 20% validation. A Hybrid VGG19 Teacher Model is defined with two VGG19 branches, each fine-tuned separately before their outputs are combined via a classifier. The model is trained using cross-entropy loss and an Adam optimizer (lr = 1e-4) for 10 epochs on a GPU.

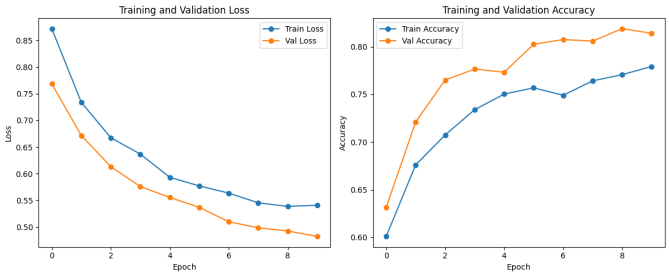

Fig. 3. Hybrid VGG19 Model Loss and Accuracy Curve

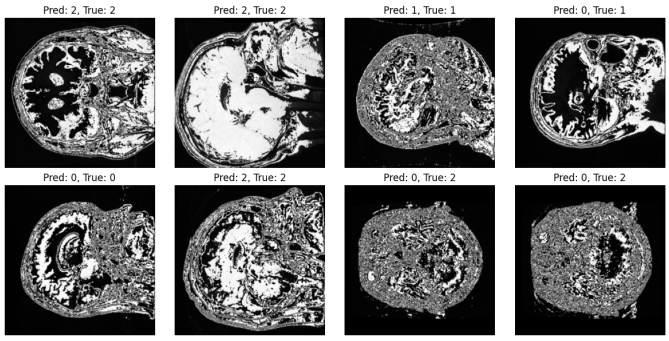

Fig. 4. Hybrid VGG19 Model Prediction Resutls

III. Model Peformance after Knowledge Distillation

Finally the code was re-implemented with knowledge distillation applied as before.

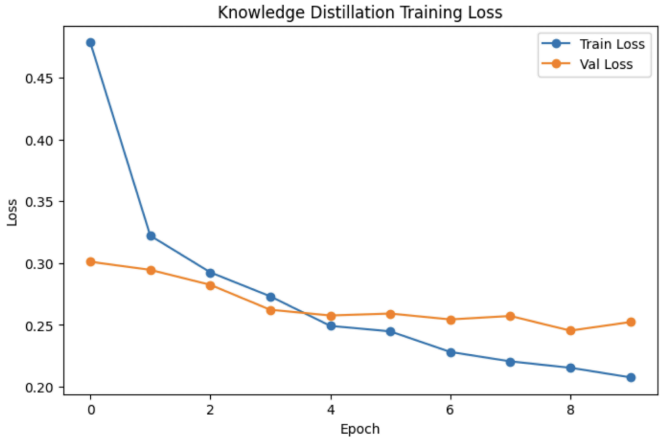

Fig. 5. Knowledge Distillation Training Loss

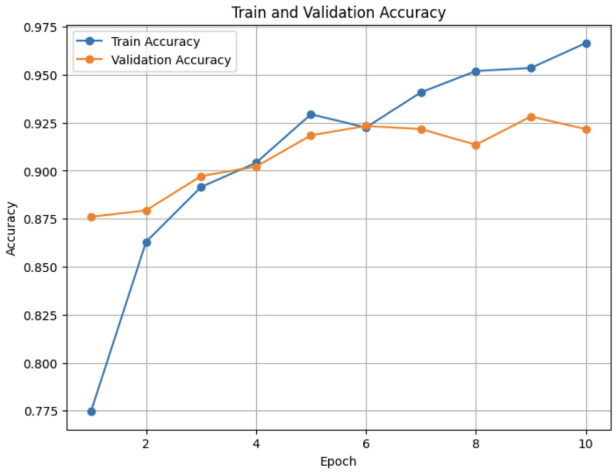

Fig. 6. Knowledge Distillation Accuracy Curve

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