PROJECT 1 ON COMPUTER VISION		
Student's Code	AIMS African Institute for Mathematical Sciences SENEGAL	Deadline
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Contents

1 Introduction

Early diagnosis of brain tumors is a major challenge in medicine. This project aims to design an automated system capable of classifying brain tumors from MRI images using deep learning models.

2 Project Objectives

- Preprocess an MRI dataset for classification.
- Build and train classification models using PyTorch and TensorFlow.
- Compare the performance of the models on a test set.
- Implement a web interface for prediction.

3 Dataset and Preprocessing

The dataset contains MRI images of four classes: *Glioma*, *Meningioma*, *No Tumor*, and *Pituitary*.

Preprocessing steps:

- Resize images to 224×224 pixels.
- Normalize images using ImageNet statistics.

4 Methodology

4.1 Model Architectures

- **PyTorch**: ResNet18 pretrained on ImageNet, fine-tuned on the tumor dataset.
- **TensorFlow**: ResNet50 model with the final layers adapted for 4 classes.

4.2 Training

- Loss function: Cross-Entropy Loss.
- Optimizer: Adam.
- Learning rate: 0.001.

- Number of epochs: 5 and 10.
- Batch size: 32.

4.3 Evaluation

- Accuracy on the test set.
- Loss and accuracy curves.

5 Results

5.1 PyTorch Model

- Final Loss: 0.0201
- Test Accuracy: 87.46%

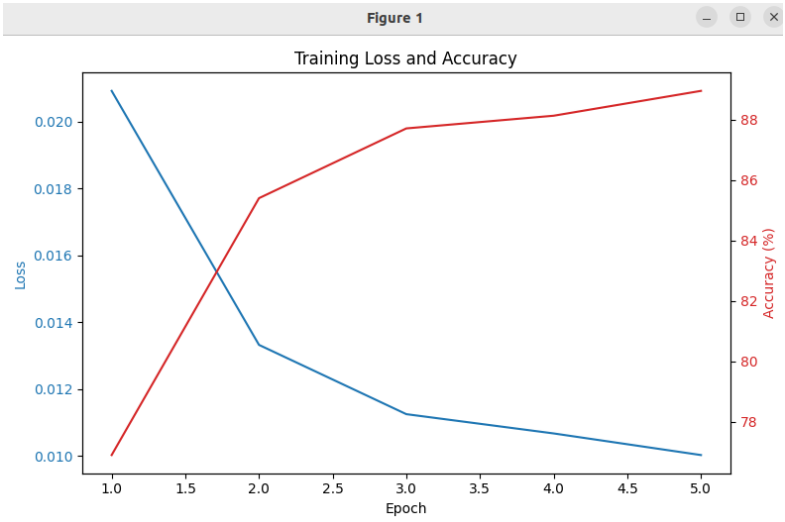

Figure 1: Training Loss and Accuracy (PyTorch) over 5 epochs.

5.2 TensorFlow Model

- Final Loss: 0.02498
- Test Accuracy: 98.57%

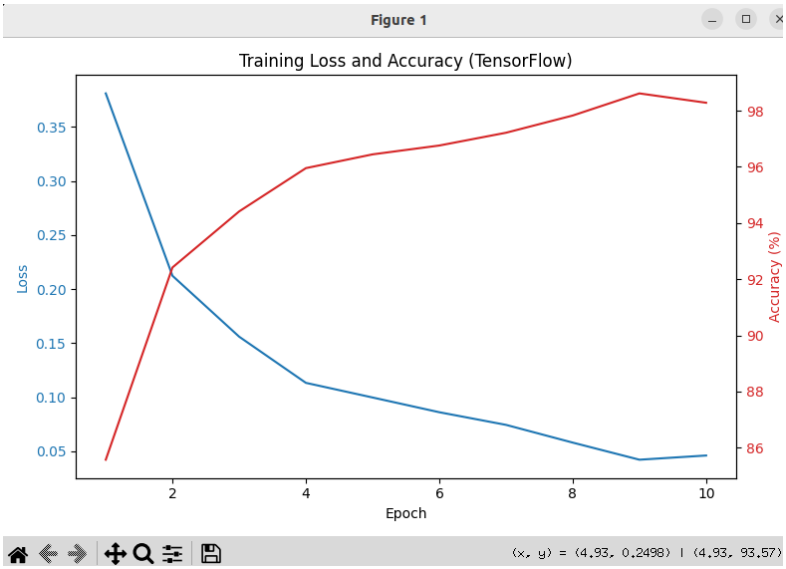

Figure 2: Training Loss and Accuracy (TensorFlow) over 10 epochs.

6 Discussion

The PyTorch model achieved strong performance, with a final loss of 0.0201 and a test accuracy of 87.46%, as shown in Figure 1. The TensorFlow model outperformed it, reaching a final loss of 0.02498 and a test accuracy of 98.57%, as depicted in Figure 2. The TensorFlow model's higher accuracy may be attributed to the ResNet50 architecture and additional epochs. However, improvements are possible, such as adding data augmentation techniques and better regularization to address potential overfitting, especially for the PyTorch model.

6.1 User Interface

Figure 3: Detailed web interface layout with prediction options.

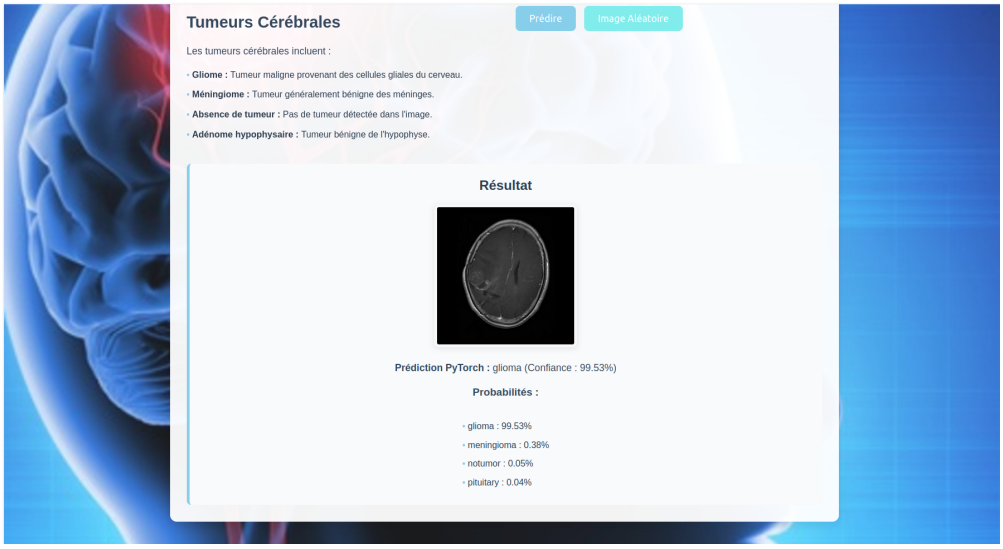

Figure 4: Prediction result for glioma with 99.53% confidence.

These screenshots demonstrate the web application's functionality, showcasing a successful glioma prediction with high confidence and the overall interface design, including description, prediction options, and result display.

7 Conclusion and Perspectives

This project successfully developed a brain tumor classification system using deep learning. The results are promising, with the TensorFlow model achieving 98.57% accuracy and the PyTorch model reaching 87.46%. Further improvements could include:

- Data augmentation techniques.
- Integration of multimodal data.
- Deployment of an interactive web service.

8 References

- `https://pytorch.org`
- `https://www.tensorflow.org`
- `https://keras.io`
- `https://github.com/HalemoGPA/BrainMRI-Tumor-Classifier-Pytorch`

9 Appendix

9.1 Source Code

The source code is available at: `https://github.com/AmyColledIop/project_cv_amy` And the app is available at : `http://127.0.0.1:5001`