Question 1: Elevator Pitch

This project aims to develop a precise and interpretable deep learning-based diagnostic system to detect Monkeypox using skin lesion images. Utilizing pre-trained models such as ResNet50, VGG19, and MobileNetV2, enhanced with Dense Dropout and Global Average Pooling layers, the system achieves high accuracy. By combining MobileNetV2 with Random Forest, the hybrid approach delivers superior prediction outcomes, supported by feature interpretation methods like LIME and SHAP for clinical reliability.

Question 2: Dataset Details

1) Collector(s):
Citation:
@article{bala2023monkeynet,
title={MonkeyNet: A robust deep convolutional neural network for monkeypox disease detection and classification},
author={Bala, Diponkor and Hossain, Md Shamim and Hossain, Mohammad Alamgir and Abdullah, Md Ibrahim and Rahman, Md Mizanur and Manavalan, Balachandran and Gu, Naijie and Islam, Mohammad S and Huang, Zhangjin},
journal={Neural Networks},
volume={161},
pages={757--775},
year={2023},
publisher={Elsevier} }

2) Year:
2023

3) Title of Dataset:
Kaggle Monkeypox Dataset

4) Version Number (if any):
Not explicitly mentioned, assumed initial version.

5) Publisher:
MonkeyNet: A robust deep convolutional neural network for monkeypox disease detection and classification. https://doi.org/10.1016/j.neunet.2023.02.022

6) DOI or URL:
https://www.kaggle.com/datasets/dipuiucse/monkeypoxskinimagedataset

7) Study/Paper/Reason:
The dataset was created to train and test models for detecting Monkeypox infections from skin lesion images, aiding medical diagnosis and outbreak management.

Question 3: Language and Libraries

Language:

- Python 3.13.1

Libraries:

1. **Data Preprocessing:** NumPy, Pandas, OpenCV
2. **Model Building:** TensorFlow/Keras, PyTorch
3. **Visualization:** Matplotlib, Seaborn
4. **Feature Interpretability:** LIME, SHAP
5. **Evaluation:** Scikit-learn

Question 4: we write our own code

1. **Data Augmentation:** Custom scripts for expanding the dataset through resizing, rotation, and flipping.
2. **Model Training:** Implementing ResNet50, VGG19, and MobileNetV2 with enhancements like Dropout layers and Global Average Pooling.
3. **Hybrid Model:** Merging MobileNetV2 with Random Forest for improved predictions.
4. **Interpretability Scripts:** Using LIME and SHAP for feature analysis and visualizations.
5. **Evaluation:** Custom evaluation scripts to compute metrics like accuracy, precision, recall, and F1-score.

Question 5: Best Choice of Model

Model Choice:

- MobileNetV2 enhanced with Random Forest.

Why:
MobileNetV2 offers lightweight and efficient feature extraction, while Random Forest provides robust decision-making capabilities, ensuring higher accuracy and interpretability.

Question 6: Hyperparameters and Optimization

Key Hyperparameters:

1. Learning Rate
2. Dropout Rate
3. Number of Dense Units
4. Batch Size
5. Number of Estimators (for Random Forest)

Optimization Strategy:

- Use grid search or random search for tuning hyperparameters.

- Implement learning rate schedulers for dynamic adjustments during training.
- Conduct cross-validation to prevent overfitting.

Question 7: Performance Evaluation

Metrics:

1. **Accuracy:** Overall correctness of predictions.
2. **Precision:** Proportion of true Monkeypox detections among all positive detections.
3. **Recall:** Ability to identify all actual Monkeypox cases.
4. **F1-Score:** Balances precision and recall.

Techniques:

- Use confusion matrices to analyze false positives and negatives.
- Visualize results with LIME and SHAP for interpretability.
- Compare hybrid model performance with standalone models to validate improvements.

Question 8:

https://github.com/saroja64/Bhupathi-B00116458-fall-2025/tree/main