My First Deep Neural Network

PyTorch

In this work, I gained experience training a small deep neural network with PyTorch that:

- Uses generator-based data loading to work directly with image file paths instead of loading all images into memory.
- Integrates the PIL library and its Image module into PyTorch workflows to handle images.
- Builds a transformation pipeline for preprocessing.
- Creates a DataLoader to load and batch data during training.
- Uses a training set to train the model, a validation set to guide improvements, and a test set to measure the model's performance.

The network stacks four convolutional blocks, each consisting of:

- **Conv2d** (3→32→64→128→256 channels).
- **ReLU** activation.
- **MaxPool2d** for spatial downsampling.
- **BatchNorm2d** for stable and faster training.

Daisy and Sunflowers classification

https://github.com/norquip/My_Deep_Learning_Labs/tree/main

Classifier:

- **AdaptiveAvgPool2d(1)** reduce feature maps to a 1×1 representation.
- **Flatten** converts the tensor to a feature vector.
- **Linear → ReLU → BatchNorm1d → Dropout(0.4)** adds regularization and nonlinear mapping
- **Final Linear layer** outputs the class scores

My insights:

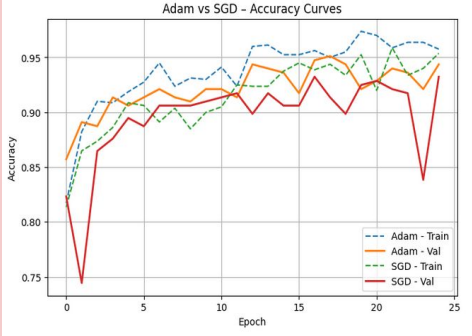
- ❑ Some data transformation can help to reduce misclassifications.
- ❑ Learning rates too high can produce spikes on the training-validation plots & epochs.
- ❑ Adam optimization performs better than SGD.
- ❑ The complete dataset of 5 flower classes is significantly imbalanced, which introduces additional challenges during training.

```
Evaluation metrics for the model:
Accuracy: 97.75%
ROC-AUC: 0.998
Log Loss: 0.8100

Classification report:
              precision    recall  f1-score   support

       daisy       0.98      0.97      0.98       134
  sunflowers       0.97      0.98      0.98       133

    accuracy                           0.98       267
   macro avg       0.98      0.98      0.98       267
weighted avg       0.98      0.98      0.98       267
```



★ I used the sets daisy and sunflowers from the complete flowers dataset available at: https://storage.googleapis.com/download.tensorflow.org/example_images/flower_photos.tgz. The images here presente were taken from the archive under the Creative Commons By-Attribution License, available at: https://creativecommons.org/licenses/by/2.0/. Thanks to all photographers that make this dataset available.

★ This work was inspired by the IBM Courses: Deep Learning with Pytorch and AI Capstone Project with Deep Learning.