Experiment-4

CNN IMPLEMENTATION

Objective

The objective of this lab is to implement Convolutional Neural Networks (CNNs) to classify images in the Cats vs. Dogs dataset and the CIFAR-10 dataset. You will explore different configurations by experimenting with:

- **3 Activation Functions**
- **3 Weight Initialization Techniques**
- **3 Optimizers**

Additionally, you will compare your best CNN model for both datasets with a pretrained ResNet-18 model.

Steps to Complete the Task

1.CNN Implementation

- **Define a CNN architecture**:
  - Experiment with different numbers of convolutional layers and filter sizes.
  - Include pooling layers and fully connected layers as needed.
  - Add dropout and batch normalization for better regularization and stability.
- **Experiment with configurations**:
  - Implement 3 different activation functions:
    - ReLU
    - Tanh
    - Leaky ReLU
  - Implement 3 different weight initialization techniques:
    - Xavier Initialization
    - Kaiming Initialization
    - Random Initialization
  - Experiment with 3 optimizers:
    - SGD

▪ Adam

▪ RMSprop

2.Training and Evaluation

- Train your CNN on each dataset using all combinations of activations, weight initializations, and optimizers.

- Save the best-performing model for each dataset.

- Save the weights of your best-performing models and upload them to a GitHub repository along with your code.

- Use accuracy and loss metrics to evaluate performance.

3.Transfer Learning with ResNet-18

- Fine-tune ResNet-18 on both datasets.

- Compare its performance with your best CNN model.

Deliverables

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1. **GitHub Repository**:
   - Create a GitHub repository named Deep Learning Lab.
   - Create separate folders for each lab (e.g., Experiment1, Experiment2, Experiment3).
   - Add all relevant files for this lab (code, weights, and documentation) into the Experiment3 folder.
   - Include a README.md file in the root of your repository, briefly explaining the purpose of each lab.
   - Share the GitHub repository link.

2. **Code Implementation**:
   - Clearly structured code with proper comments.
   - Include separate sections for data preprocessing, model definition, training, and evaluation.

Resources

Cats vs Dogs : https://www.kaggle.com/competitions/dogs-vs-cats

CIFAR-10 : https://www.cs.toronto.edu/~kriz/cifar.html

CNN : https://youtu.be/NmLK_WQBxB4?feature=shared

https://www.digitalocean.com/community/tutorials/writing-cnns-from-scratch-in-pytorch

ResNet18 : https://youtu.be/o_3mboe1jYI?si=Zzyl-boXvFrFQZ44