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

Deliverables

1. **GitHub Repository**:

   o Create a GitHub repository named Deep Learning Lab.

   o Create separate folders for each lab (e.g., Experiment1, Experiment2, Experiment3).

   o Add all relevant files for this lab (code, weights, and documentation) into the Experiment3 folder.

   o Include a README.md file in the root of your repository, briefly explaining the purpose of each lab.

   o Share the GitHub repository link.

2. **Code Implementation**:

   o Clearly structured code with proper comments.

   o 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