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Midterm Object Detection Challenge

ITIA – 1378

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Midterm Object Detection Challenge : CIFAR – 10 Dataset

The CIFAR-10 dataset was chosen for this project because it is excellent for beginners learning about object detection. It contains a small, simple collection of images with easily recognizable objects, making it ideal for practicing techniques and building a foundation in object detection. While not suitable for very complex tasks, it serves as a great starting point for understanding the basics of identifying and working with objects in images.

The first step involved importing necessary libraries, which are the tools and frameworks needed to work with image data, build neural networks, and train models using CIFAR-10. Next, the dataset was loaded, and the images were normalized, labels formatted, and a smaller subset created to focus on specific tasks. To improve the dataset's quality, images of the "cat" class were removed, leaving only the other classes for training.

Data augmentation came next, where the images were modified in various ways, like flipping or rotating, to create a more diverse training dataset. This step helps the model generalize better to new images. Then, the team addressed class imbalances by calculating weights for each class to ensure the model trained fairly across all categories.

For the model-building phase, the EfficientNetB0 architecture was used as the baseline. Layers were added to the network to prepare it for classification tasks. The model was trained for 10 epochs using augmented data and class weights to handle imbalances, improving its performance. The team also created a lightweight model using MobileNetV2. This model, designed for efficiency, was trained similarly with the augmented data and evaluated for accuracy.

After training, the models were compared based on their test accuracy. EfficientNetB0 achieved about 10% test accuracy with a loss of 2.7619, processing 313 steps in 12 seconds. MobileNetV2 had a slightly lower test accuracy of 9.97% with a loss of 2.7715, completing the steps in 8 seconds. The team analyzed these results to explore improvements, such as better data preparation, tuning hyperparameters, or exploring other architectures.

While working on this project, the team reflected on many learning experiences. Technically, they gained a deeper understanding of how object-detection models process images and the challenges of preparing clean, labeled data. We also attempted to learn how to balance model accuracy and speed while addressing issues like overfitting or underfitting.

Using Jupyter Notebooks helped us connect theory with practice. Experimenting with different models and tweaking parameters provided valuable hands-on learning. We also grew more skilled with tools like TensorFlow and PyTorch and had key insights into how these technologies work.

Collaboration was another essential part of the process. The team reflected on how they communicated, shared tasks, and supported each other in solving problems. We found teamwork helpful. Finally, we discussed broader issues, such as data privacy and bias, and considered how object-detection models could be applied to real-world problems like healthcare or autonomous vehicles. Overall, working with Jupyter Notebooks made it easier to experiment and learn. Although there are some limitations with larger projects, documenting their reflections helped the team grow and improve for future endeavors.

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