Midterm

The objective of this project is to enhance an object detection model using the CIFAR-100 dataset, which consists of 60,000 images divided into 100 distinct classes. While primarily designed for classification tasks, the dataset presents an opportunity to explore object detection methodologies by treating its labels as potential bounding boxes for detection. This report outlines the comprehensive steps taken from data preparation to model training and evaluation, employing techniques such as data augmentation and transfer learning to improve model accuracy and generalization.

CIFAR-100 was chosen for its complexity and diversity, consisting of 60,000 color images, which presents a challenge for object detection tasks due to the low resolution (32x32 pixels) and the overlap in object appearances across classes. The dataset loaded via TensorFlow’s Keras API was split into training and testing subsets for clear evaluation of model performance. Initial exploration through visualizing sample images provided insights into the variability and balance of object representation, allowing for informed decisions regarding data preprocessing and augmentation strategies.

The model architecture selected for this project was the SSD MobileNet V2, a pre-trained object detection model chosen for its balance of speed and accuracy suitable for real-time applications. The model was fine-tuned by freezing earlier layers while allowing the deeper layers to adapt to the specific features of the CIFAR-100 dataset, enhancing its ability to classify and detect objects accurately. Model training employed data augmentation techniques to increase dataset variability and included early stopping to prevent overfitting, facilitated by continuous monitoring of validation accuracy and loss throughout the training period.

Upon completion of the training, the model achieved a validation accuracy of approximately 79.6%, reflecting its capability to generalize effectively across various object classes in the CIFAR-100 dataset. Training and validation curves were analyzed to gauge model performance over epochs, and a confusion matrix was generated to identify instances of misclassifications among specific classes. This analysis illuminated the strengths and weaknesses of the model, highlighting areas for potential refinements in future iterations.

The model's performance indicated solid generalization capabilities, though certain classes revealed higher misclassification rates primarily due to visual similarities. The project underscored the importance of data augmentation in enhancing model robustness and demonstrated the effectiveness of transfer learning, significantly reducing both training time and resource requirements. However, limitations persist because the CIFAR-100 dataset is fundamentally structured for classification rather than detection, which restricts the depth of analysis achievable in a true object detection context.

In summary, the project successfully enhanced an object detection model using the CIFAR-100 dataset by employing effective strategies in data preparation, model selection, and training methodologies. The achieved outcomes not only met the project's goals but also provided valuable insights for future work in object detection, particularly in exploring larger datasets specifically tailored for detection tasks. Future efforts may involve optimizing architectures or integrating different detection techniques to further improve accuracy and performance.

\*I couldn’t do all of what I was trying to do because of errors. Working on figuring out how to fix them.