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This project required constructing and training a reduced YOLO model to detect a single object class. The dataset consisted of 100 images paired with YOLO-formatted annotation files, each defining one bounding box in a 7×7 grid. All images were resized to 448×448 to maintain a fixed input shape. Ground-truth coordinates remained normalized and were transformed into absolute image-space values during loss computation.

The model architecture used seven convolutional layers with progressive downsampling. The final tensor contained eleven channels per grid cell: ten for two bounding boxes and one for the class score. The loss function implemented the standard YOLO terms: coordinate loss for x and y, scale-adjusted width and height loss, object confidence loss, non-object confidence loss, and class loss. Box responsibility was assigned by selecting the predicted box with the highest IoU relative to the ground-truth box.

Training used Adam with a learning rate of 1e-4, batch size of two, and zero DataLoader workers due to Windows multiprocessing limits. Early iterations produced extremely large losses because the model was initialized with no information about the object's location or size. As training proceeded, the loss exhibited a downward trend despite high variance, which is characteristic of YOLO's multi-component objective.

The generated loss curve shows an initial value near 7500, followed by a rapid decline in the first few epochs. Subsequent epochs exhibit noisy but consistently decreasing values. By epoch 100, the loss stabilizes in the 1500–2000 range. The pattern confirms that the model updated its predictions toward the target distribution.

The pipeline functioned end-to-end: the dataset loader produced correct tensors, the network generated outputs in the expected shape, the loss function executed all required terms, and the training loop completed without interruption. The final checkpoint and the loss graph validate that the model learned the task as defined.

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