2) Transfer Learning Application

Task:

Apply transfer learning using a pre-trained CNN model (e.g., VGG, ResNet) to build a small drone detection system. Fine-tune the pre-trained model on a small dataset of drone images, adjusting the final layers for binary classification (drone vs. non-drone). Evaluate the performance of the fine-tuned model on a separate test dataset and compare it with training from scratch. Provide detailed documentation explaining your design choices and algorithm architecture.

Model Architecture:

1) **ResNet Model**: The model architecture consists of a pre-trained ResNet50 base with added layers for classification. The final layer employs a sigmoid activation function for binary classification.
2) **Model from Scratch**: The model architecture consists of a simple CNN with two convolutional layers followed by max-pooling layers for feature extraction. The flattened output is fed into two fully connected (dense) layers for classification, with a sigmoid activation function in the output layer for binary classification.

Hyper parameters:

	ResNet Model	**Model from Scratch**
1) Base Model	ResNet50	None
2) Target size of Image	(224, 224)	(224, 224)
3) Batch Size	32	32
4) epochs	25	25
5) Optimizer	Adam	Adam
6) Loss function	Binary crossentropy	Binary crossentropy
7) Metrics	Accuracy	Accuracy

Data Source:

Data was obtained from web through freely available websites, such as:

i) https://unsplash.com/
ii) https://pixelied.com/
iii) https://www.istockphoto.com/ , etc.

Data Pre-processing:

Data was pre-processed by tensorflow's ImageDataGenerator. Following are the processes performed:

i) Image size: (224, 224)
ii) Rescale: 1/255, etc.

Model Performance:

	ResNet50	Model from Scratch
1) Accuracy (during training)	67%	91%
2) Loss (during training)	59%	17%
3) Accuracy (during testing)	63%	72%
4) Loss (during testing)	72%	118%

Conclusion/Inference:

1) Both the model performed exceptionally as we consider the quantity and quality of data, but there is room for improvement.
2) Resnet model performed very we as we compare it to model from scratch.
3) Resnet model kept its accuracy and loss in similar range during training as well as testing.
4) Model from scratch seems to be over fitted as during testing it has very high accuracy and very low loss but during testing its accuracy decreased and loss jumped significantly.
5) If we have similar kind of data available, we should consider resnet as it performed uniformly throughout the training and testing, unlike model from scratch whose accuracy changes significantly.

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