INTRODUCTION TO DEEP LEARNING

REPORT: FINAL PROJECT

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Final Project: Bird Species Classification with CNN

1) Dataset:

1. Source: CUB-200-2011 dataset (Caltech-UCSD Birds 200, 2011)
2. Description:
   The dataset consists of images belonging to 200 bird species. Both train and test splits are used.
3. Preprocessing Steps:
   a. Downloaded and extracted the dataset.
   b. Split images into train (5994 images) and test (5794 images) folders leveraging train_test_split.txt provided with the dataset.
   c. Used Keras `ImageDataGenerator` for resizing, augmentation (rescale, rotation, shifts, horizontal flip), and normalization.
4. Image Size: Images were resized to 224x224 pixels, matching MobileNetV2 input.
5. Number of Classes: 200

2) Preprocessing:

1. Library Used: TensorFlow / Keras
2. Techniques:
   a. Rescaling: All images are normalized to `1` by dividing by 255.
   b. Augmentation: On training data, random rotation (20°), width/height shifts, and horizontal flipping.
   c. Test Data: Only rescaling.
3. Batch Size: 32

3) Model Architecture:

1. Base Model: MobileNetV2 (pre-trained on ImageNet)
2. Input Shape: (224, 224, 3)
3. Top Layers:
   a. Global Average Pooling 2D
   b. Dropout (0.3)

    c. Dense Layer with ‘softmax’ activation
4. Frozen Weights: The weights of MobileNetV2 are frozen during training.
5. Total Parameters: ~2.5 Million
    a. Trainable: 256,200
    b. Non-Trainable: 2,257,984

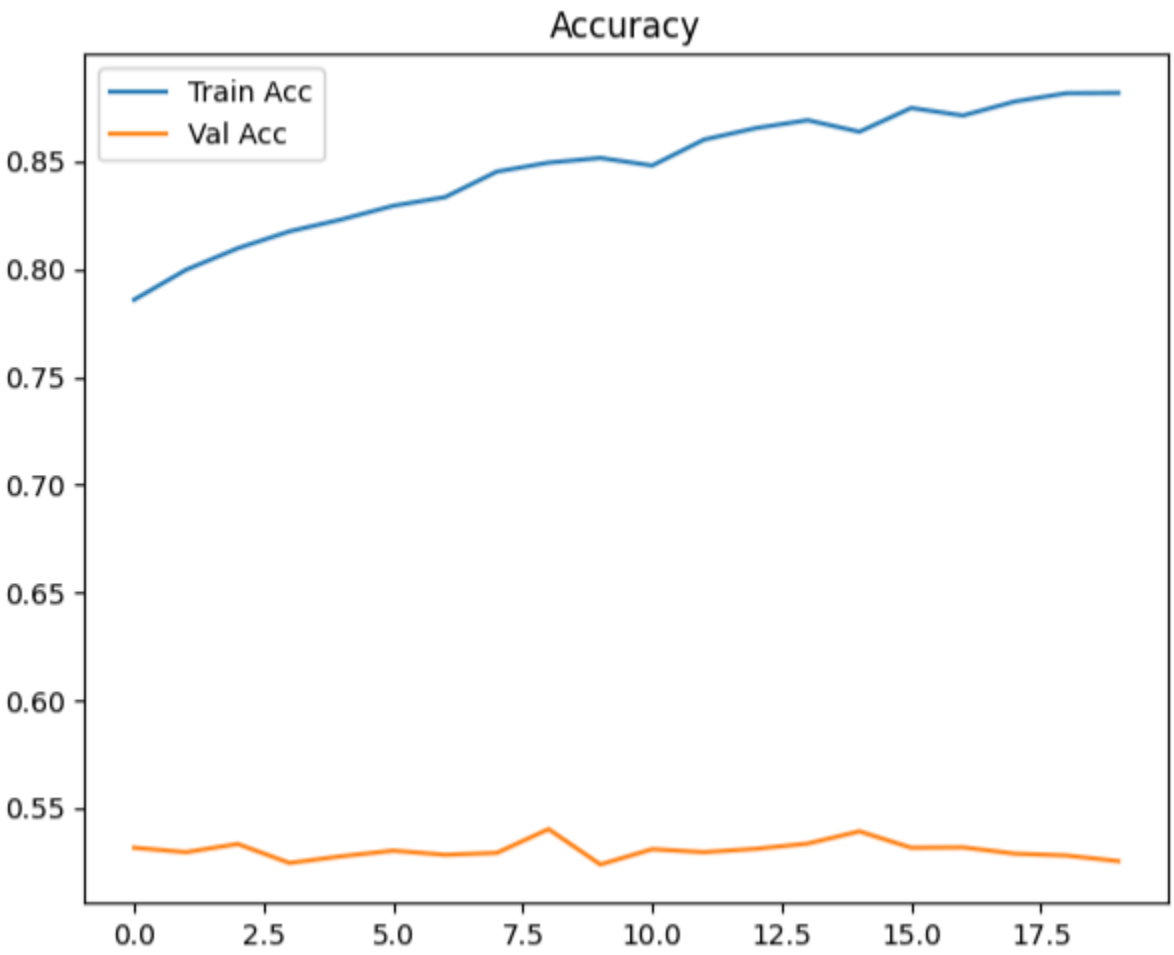
4) Device Specifications:

1. Processor: Intel core i5
2. GPU: NVIDIA GeForce RTX 3060 Laptop GPU
3. RAM: 16 GB

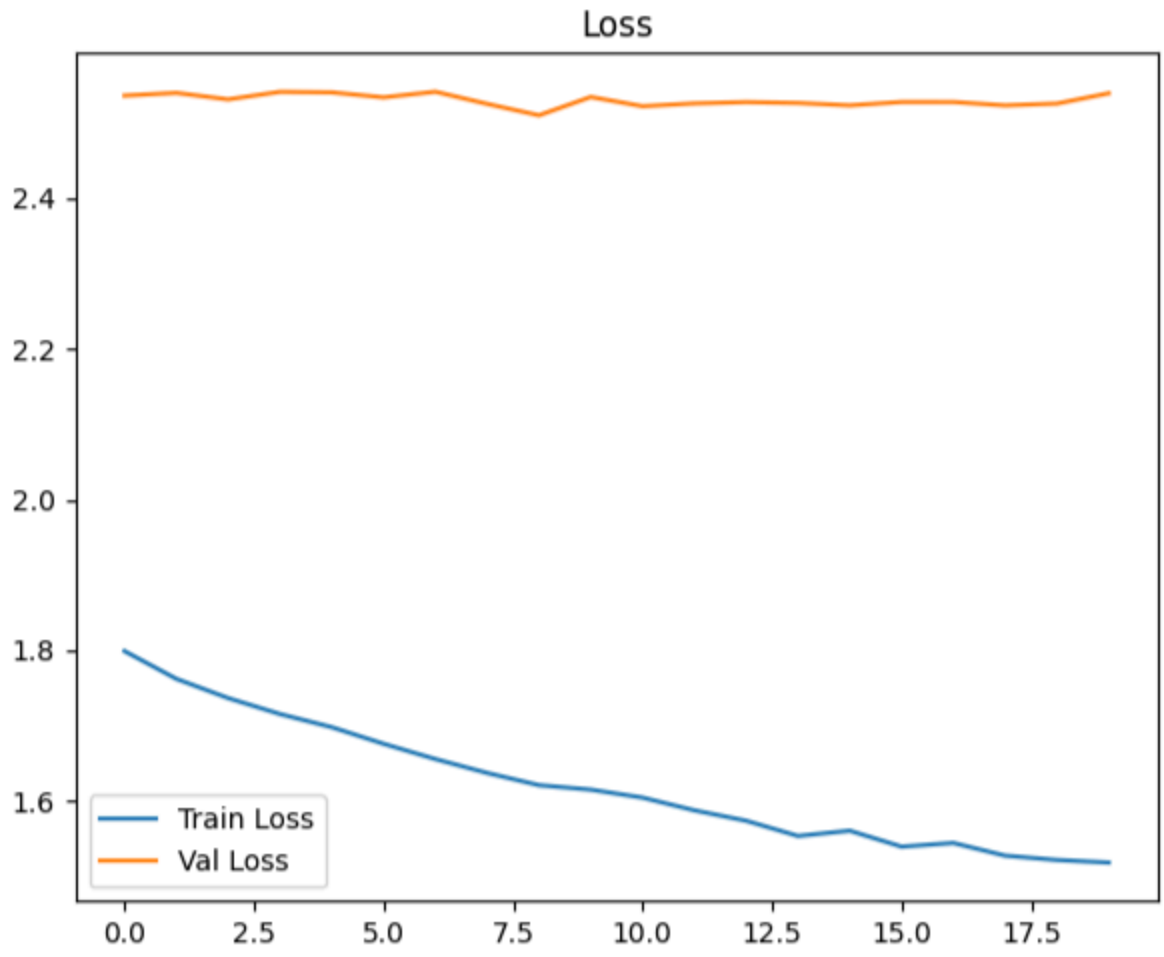
5) Training details:

- Criterion Used: Categorical Crossentropy with label smoothing (0.1)
- Optimizer: Adam (learning rate=0.0005)
- Epochs Trained: 20
- Batch Size: 32
- Train/Val Split: Original
    - Train: 5994 images
    - Test: 5794 images
- Total Time Taken: 30 mins roughly

6) Result:



TRAINING VS VALIDATION ACCURACY PLOT



TRAINING VS VALIDATION LOSS PLOT

- Final Validation Accuracy: ~53.5%
- Final Training Accuracy: ~88.8%
- Validation Loss: ~2.5
- Training Loss: ~1.5