SOC Final Project Report

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Project Name: Fine-grained classification on CUB-200-2011 dataset with CNN

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1. Introduction

This report presents the work done for the fine-grained image classification task using a Convolutional Neural Network (CNN) model. The task involves classifying images from the CUB-200-2011 dataset into 200 bird species classes. The CNN model was designed with a parameter limit of 10 million to achieve efficient parameter utilization while maintaining high accuracy.

2. Dataset

2.1 Dataset Description

The CUB-200-2011 dataset contains 11788 images of 200 bird species with a diverse range of poses and backgrounds. The dataset is available for download here.

2.2 Data Split

The dataset was used with its default train-test split given in the dataset.Created train and test directories according to the 'train_test_split.txt' file. Around half of the data is in the training set and the other half in test.The training set contains images for model training, while the test set is used for evaluating model performance.

3. Model Architecture

3.1 Base Model

The EfficientNet-B0 architecture was selected as the base model for this task. EfficientNet-B0 is known for its efficient use of parameters and high accuracy, making it the best choice for this classification task within the 10 million parameter constraint.

3.2 Model Details

- **Base Model:** EfficientNet-B0
- **Input Shape:** (224, 224, 3)
- **Output Layer:** Dense layer with 200 units and softmax activation for multi-class classification
- **Total Parameters:** 4,305,771

For total architecture refer to [Full Model Architecture](#)

# 4. Training Details

4.1 Training Parameters

- **Optimizer:** Adam
- **Loss Function:** Sparse Categorical Crossentropy
- **Batch Size:** 32
- **Epochs:** 10

4.2 Training Process

The model was trained using the training dataset with validation performed on the test dataset.

4.3 Training Loss and Accuracy

The following plots show the training and validation loss and accuracy over epochs:
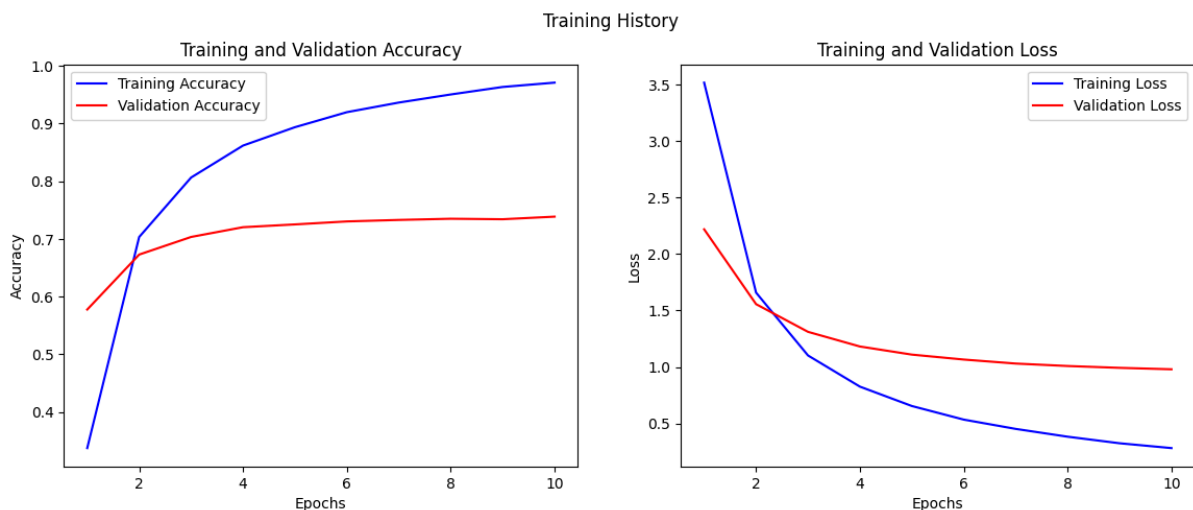
5. Final Results

5.1 Model Evaluation

The model was evaluated on the test dataset, achieving a final accuracy of :
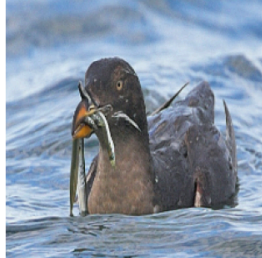73.83500337600708 %

5.2 Some Predictions on Model

Notebook of predictions : Some Predictions
Here are some predictions made by our model :

True: 012.Yellow_headed_Blackbird
Pred: 012.Yellow_headed_Blackbird

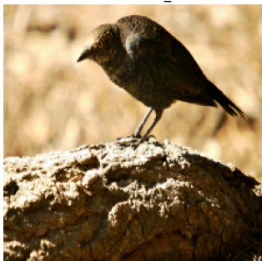True: 008.Rhinoceros_Auklet
Pred: 008.Rhinoceros_Auklet

True: 011.Rusty_Blackbird
Pred: 009.Brewer_Blackbird

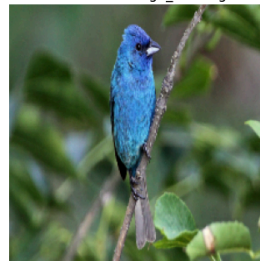True: 003.Sooty_Albatross
Pred: 003.Sooty_Albatross

True: 011.Rusty_Blackbird
Pred: 198.Rock_Wren

True: 003.Sooty_Albatross
Pred: 003.Sooty_Albatross

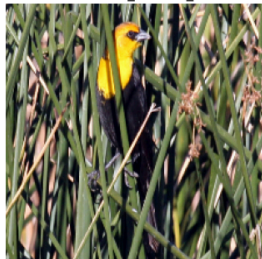True: 014.Indigo_Bunting
Pred: 014.Indigo_Bunting

True: 011.Rusty_Blackbird
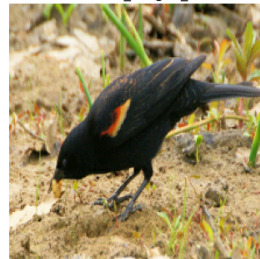Pred: 026.Bronzed_Cowbird

True: 006.Least_Auklet
Pred: 006.Least_Auklet

True: 012.Yellow_headed_Blackbird
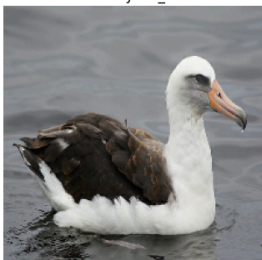Pred: 012.Yellow_headed_Blackbird

True: 010.Red_winged_Blackbird
Pred: 010.Red_winged_Blackbird

True: 004.Groove_billed_Ani
Pred: 004.Groove_billed_Ani

True: 002.Laysan_Albatross
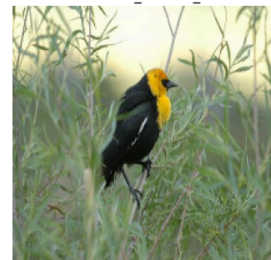Pred: 002.Laysan_Albatross

True: 002.Laysan_Albatross
Pred: 002.Laysan_Albatross

True: 009.Brewer_Blackbird
Pred: 027.Shiny_Cowbird

True: 012.Yellow_headed_Blackbird
Pred: 012.Yellow_headed_Blackbird

6. Model Checkpoint

The final model checkpoint has been saved as 'bird_detector.keras' : Model Checkpoint

Colab Notebook and Model file containing folder: SOC FINAL PROJECT

Summary

- **Dataset:** [CUB_200_2011](#) (11788 images of birds of 200 classes)
- **Model:** EfficientNet-B0 with added output softmax layer of 200 units.
- **Total Parameters:** 4,305,771
- **Epochs:** 10
- **EpochsFinal Training Accuracy:** 97.06%
- **Final Test Accuracy:** 73.84%