Project 1: Deep Learning-Image Classification with CNN

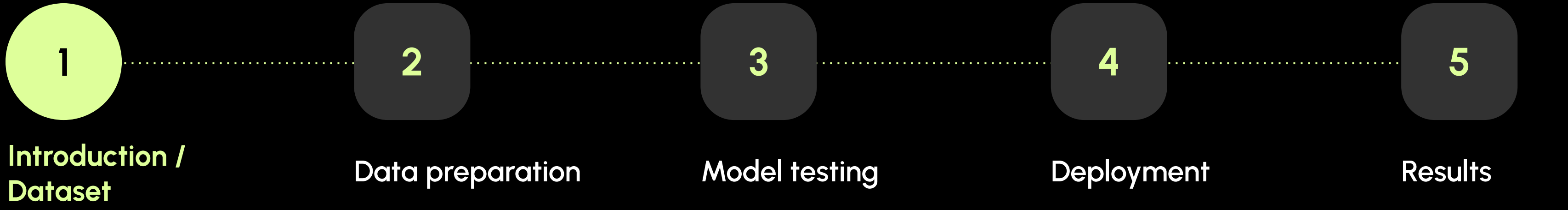
Group 3

Presented by

Mauricio

Nicolas

How the partnership will work



1 Introduction / Dataset

2 Data preparation

3 Model testing

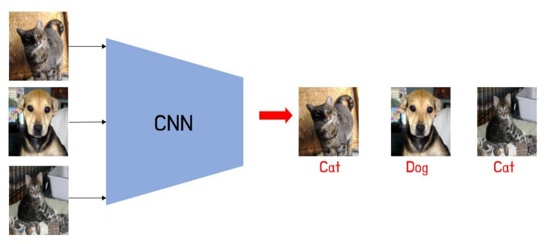
4 Deployment

5 Results

Our successful partnerships

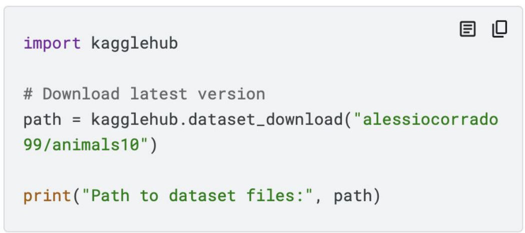
Introduction

The main goal of this project is to develop an image classification model capable of correctly identifying 10 different animal species,



Data set

The Animals-10 dataset used in this project contains approximately 28,000 images distributed across 10 different animal classes: dog, cat, horse, elephant, butterfly, chicken, cow, sheep, spider, and squirrel.

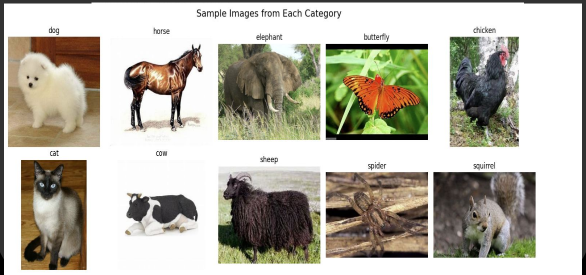


```python
import kagglehub

# Download latest version
path = kagglehub.dataset_download("alessiocorrado99/animals10")

print("Path to dataset files:", path)
```

Our successful partnerships

Visualization / Analysis

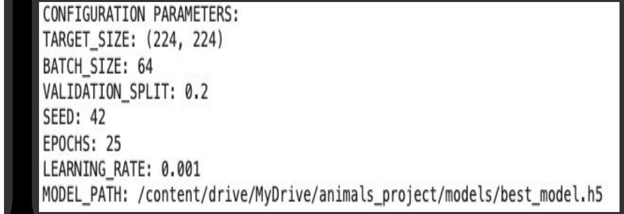
1



Sample Images from Each Category

Preprocessing

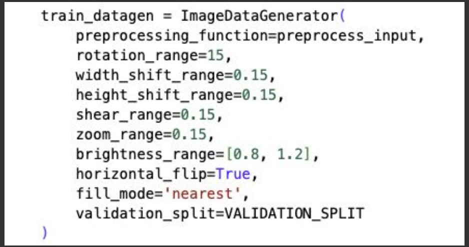
2



```
CONFIGURATION PARAMETERS:
TARGET_SIZE: (224, 224)
BATCH_SIZE: 64
VALIDATION_SPLIT: 0.2
SEED: 42
EPOCHS: 25
LEARNING_RATE: 0.001
MODEL_PATH: /content/drive/MyDrive/animals_project/models/best_model.h5
```

Augmentation

3



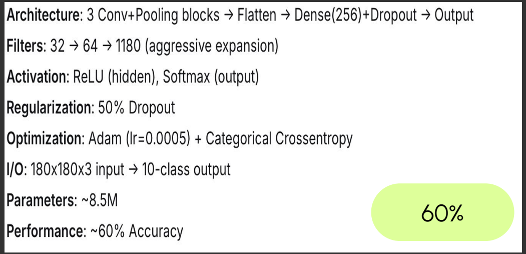
```
train_datagen = ImageDataGenerator(
    preprocessing_function=preprocess_input,
    rotation_range=15,
    width_shift_range=0.15,
    height_shift_range=0.15,
    shear_range=0.15,
    zoom_range=0.15,
    brightness_range=[0.8, 1.2],
    horizontal_flip=True,
    fill_mode='nearest',
    validation_split=VALIDATION_SPLIT
)
```

Validation Split

4

- 80% for training
- 20% for testing

MODELS AND TESTING



Architecture: 3 Conv+Pooling blocks → Flatten → Dense(256)+Dropout → Output

Filters: 32 → 64 → 1180 (aggressive expansion)

Activation: ReLU (hidden), Softmax (output)

Regularization: 50% Dropout

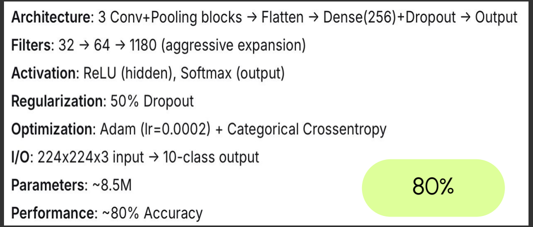
Optimization: Adam (lr=0.0005) + Categorical Crossentropy

I/O: 180x180x3 input → 10-class output

Parameters: ~8.5M

Performance: ~60% Accuracy

60%



Architecture: 3 Conv+Pooling blocks → Flatten → Dense(256)+Dropout → Output

Filters: 32 → 64 → 1180 (aggressive expansion)

Activation: ReLU (hidden), Softmax (output)

Regularization: 50% Dropout

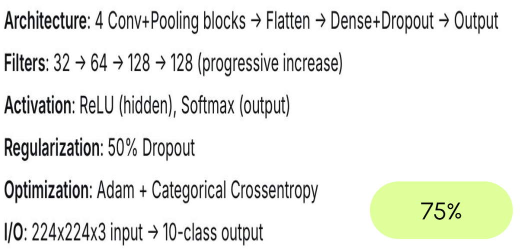
Optimization: Adam (lr=0.0002) + Categorical Crossentropy

I/O: 224x224x3 input → 10-class output

Parameters: ~8.5M

Performance: ~80% Accuracy

80%



Architecture: 4 Conv+Pooling blocks → Flatten → Dense+Dropout → Output

Filters: 32 → 64 → 128 → 128 (progressive increase)

Activation: ReLU (hidden), Softmax (output)

Regularization: 50% Dropout

Optimization: Adam + Categorical Crossentropy

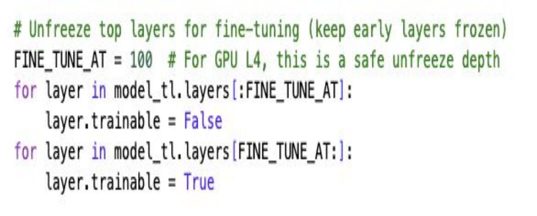
I/O: 224x224x3 input → 10-class output

75%

Transfer Learning

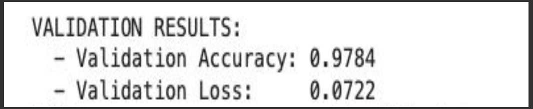
- 🟦 EfficientNetB0
- 🟨 Resnet50
- 🟩 MobileNetV2

Fine - Tuning



```
# Unfreeze top layers for fine-tuning (keep early layers frozen)
FINE_TUNE_AT = 100  # For GPU L4, this is a safe unfreeze depth
for layer in model_tl.layers[:FINE_TUNE_AT]:
    layer.trainable = False
for layer in model_tl.layers[FINE_TUNE_AT:]:
    layer.trainable = True
```

98%

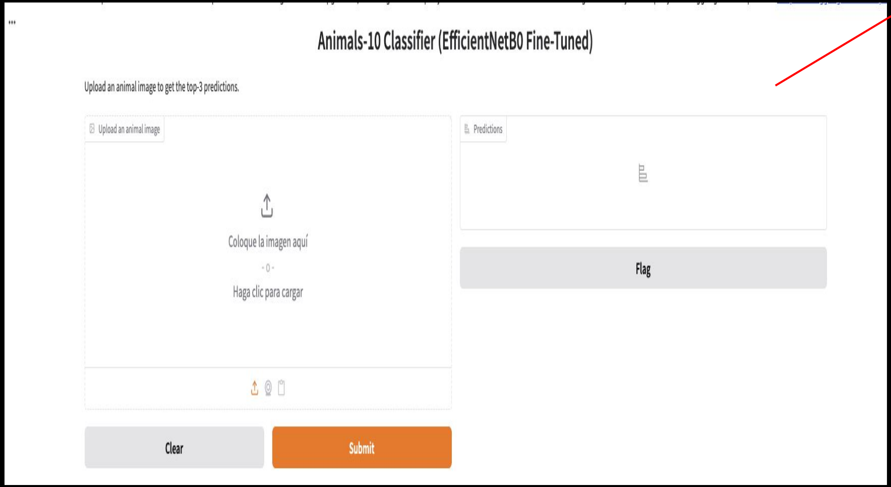


```
 VALIDATION RESULTS:
   - Validation Accuracy: 0.9784
   - Validation Loss:     0.0722
```

Let's work together

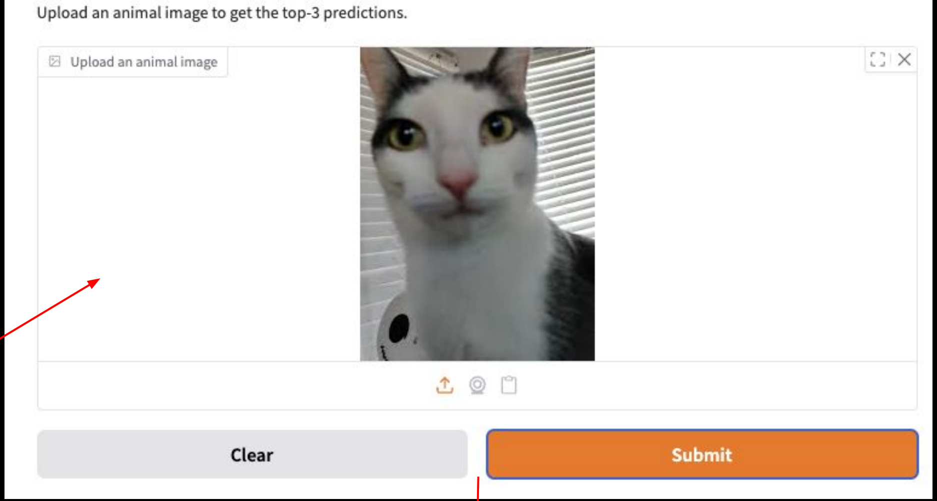
Deployment

- We use Gradio for the deployment.

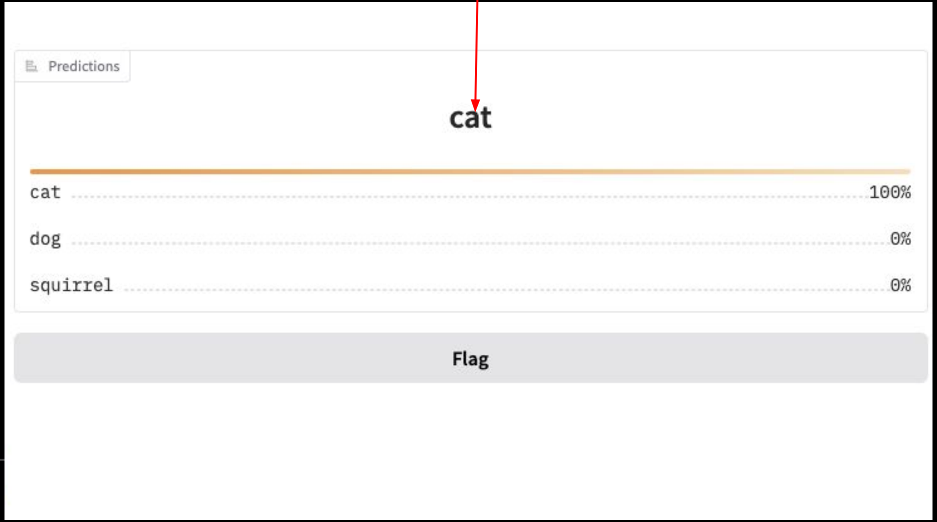


Animals-10 Classifier (EfficientNetB0 Fine-Tuned)

Upload an animal image to get the top-3 predictions.



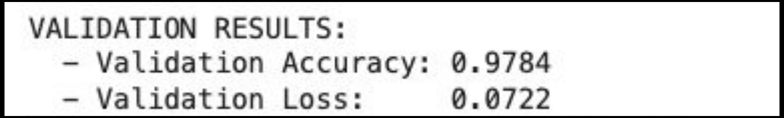
Upload an animal image to get the top-3 predictions.



cat

```
cat ........................................ 100%
dog .......................................... 0%
squirrel ..................................... 0%
```

RESULTS



```
VALIDATION RESULTS:
  - Validation Accuracy: 0.9784
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```
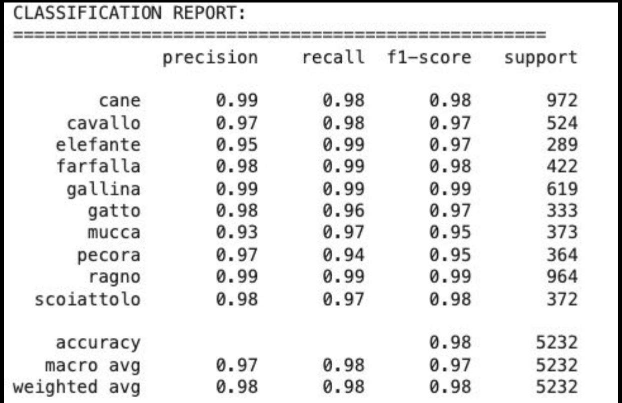
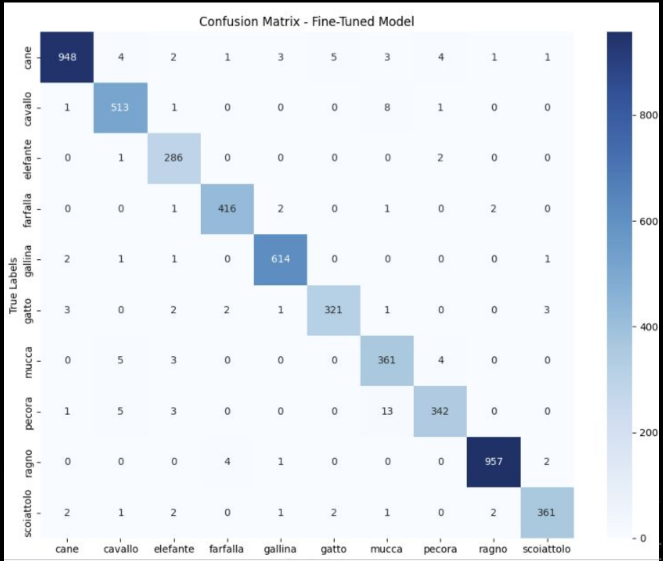
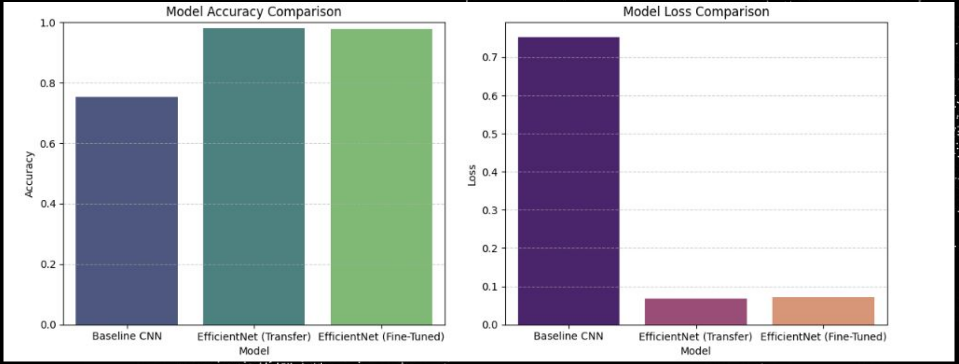



```
CLASSIFICATION REPORT:
==================================================
              precision    recall  f1-score   support

        cane       0.99      0.98      0.98       972
     cavallo       0.97      0.98      0.97       524
    elefante       0.95      0.99      0.97       289
    farfalla       0.98      0.99      0.98       422
     gallina       0.99      0.99      0.99       619
       gatto       0.98      0.96      0.97       333
       mucca       0.93      0.97      0.95       373
      pecora       0.97      0.94      0.95       364
       ragno       0.99      0.99      0.99       964
  scoiattolo       0.98      0.97      0.98       372

    accuracy                           0.98      5232
   macro avg       0.97      0.98      0.97      5232
weighted avg       0.98      0.98      0.98      5232
```



Confusion Matrix - Fine-Tuned Model

	cane	cavallo	elefante	farfalla	gallina	gatto	mucca	pecora	ragno	scoiattolo
cane	948	4	2	1	3	5	3	4	1	1
cavallo	1	513	1	0	0	0	8	1	0	0
elefante	0	1	286	0	0	0	0	2	0	0
farfalla	0	0	1	416	2	0	1	0	2	0
gallina	2	1	1	0	614	0	0	0	0	1
gatto	3	0	2	2	1	321	1	0	0	3
mucca	0	5	3	0	0	0	361	4	0	0
pecora	1	5	3	0	0	0	13	342	0	0
ragno	0	0	0	4	1	0	0	0	957	2
scoiattolo	2	1	2	0	1	2	1	0	2	361



Model Accuracy Comparison

Model Loss Comparison