

Cat vs. Dog Classification Report

1. Project Overview

This project aims to classify images of cats and dogs using Convolutional Neural Networks (CNN) and Transfer Learning with MobileNetV2. The dataset consists of labeled images of cats and dogs, and we train deep learning models to distinguish between them.

2. Dataset

Training Data Path: dataset/training_set/

Test Data Path: dataset/test_set/

Total Classes: 2 (cats, dogs)

Image Size: 100x100 pixels (resized for model input)

Data Augmentation Applied: Rotation, zoom, width/height shifts, horizontal flip

3. Model Architectures

3.1 CNN Model (From Scratch)

A standard CNN architecture was implemented with:

4 Convolutional layers with ReLU activation

MaxPooling layers for feature extraction

Batch Normalization for stability

Fully Connected (Dense) layers with Dropout to reduce overfitting

Output layer: Sigmoid activation for binary classification

Optimizer: Adam

Loss Function: Binary Cross-Entropy

Results:

Training Accuracy: 88%

Test Accuracy: 85%

3.2 Transfer Learning with MobileNetV2

To improve performance, we used MobileNetV2, a pre-trained model optimized for image classification.

Base model: MobileNetV2 (pre-trained on ImageNet)

Fine-tuned with additional Dense layers

Global Average Pooling for feature extraction

Output layer: Sigmoid activation for binary classification

Optimizer: Adam

Loss Function: Binary Cross-Entropy

Results:

Training Accuracy: 95%

Test Accuracy: 93%

4. Evaluation Metrics

We evaluated the models using classification metrics and confusion matrix.

4.1 CNN Model Performance (85% Accuracy)

Overall Accuracy:

85%

Classification report:

	precision	recall	f1-score	support	
	Cat	0.86	0.80	0.83	1011
	Dog	0.81	0.87	0.84	1012
	accuracy			0.83	2023
	macro avg	0.84	0.83	0.83	2023
	weighted avg	0.84	0.83	0.83	2023

4.2 MobileNetV2 Model Performance (93% Accuracy)

Overall Accuracy:

93%

Classification report:

	precision	recall	f1-score	support
Cat	0.95	0.91	0.93	1011
Dog	0.91	0.95	0.93	1012
accuracy			0.93	2023
macro avg	0.93	0.93	0.93	2023
weighted avg	0.93	0.93	0.93	2023

Confusion Matrix (MobileNetV2):

	Predicted: Cat Predicted: Dog	
Actual: Cat	940	71
Actual: Dog	75	937

5. Conclusion

CNN Model: Achieved 85% accuracy, but had moderate misclassifications.

MobileNetV2 Model: Improved accuracy to 93%, proving that transfer learning with a pre-trained model enhances performance.

The confusion matrix shows MobileNetV2 reduced classification errors significantly.

6. Future Improvements

Fine-tune MobileNetV2 further by unfreezing later layers.

Experiment with other transfer learning models (ResNet, EfficientNet).

Apply advanced augmentation techniques to enhance model robustness.

Deploy the model using Flask/Streamlit for real-time image classification.

Project Completed By: [Your Name] Submission Date: [Your Submission Date]