Brain Tumor Classification with CNNs & Transfer Learning

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Dataset introduction

Brain MRI Images for Brain Tumor Detection”

- **1.Contents**: Approximately 98 image files, but the dataset description does not specify a train/validation split

2. Generic Classification Dataset (~7,023 images)

- A commonly used brain tumor classification dataset on Kaggle includes 7,023 images divided into four categories: Glioma, Meningioma, Pituitary tumor, and No tumor

Dataset

- MRI images with 4 tumor classes:

Glioma, meningioma, no tumor, pituitary

- Training, Testing set, No Validation dataset

- Representative sample images

Introduction & Motivation

• Brain tumor detection is critical for diagnosis

• CNNs can automate feature extraction

• Goal: Compare baseline CNN vs transfer learning (ResNet-50)

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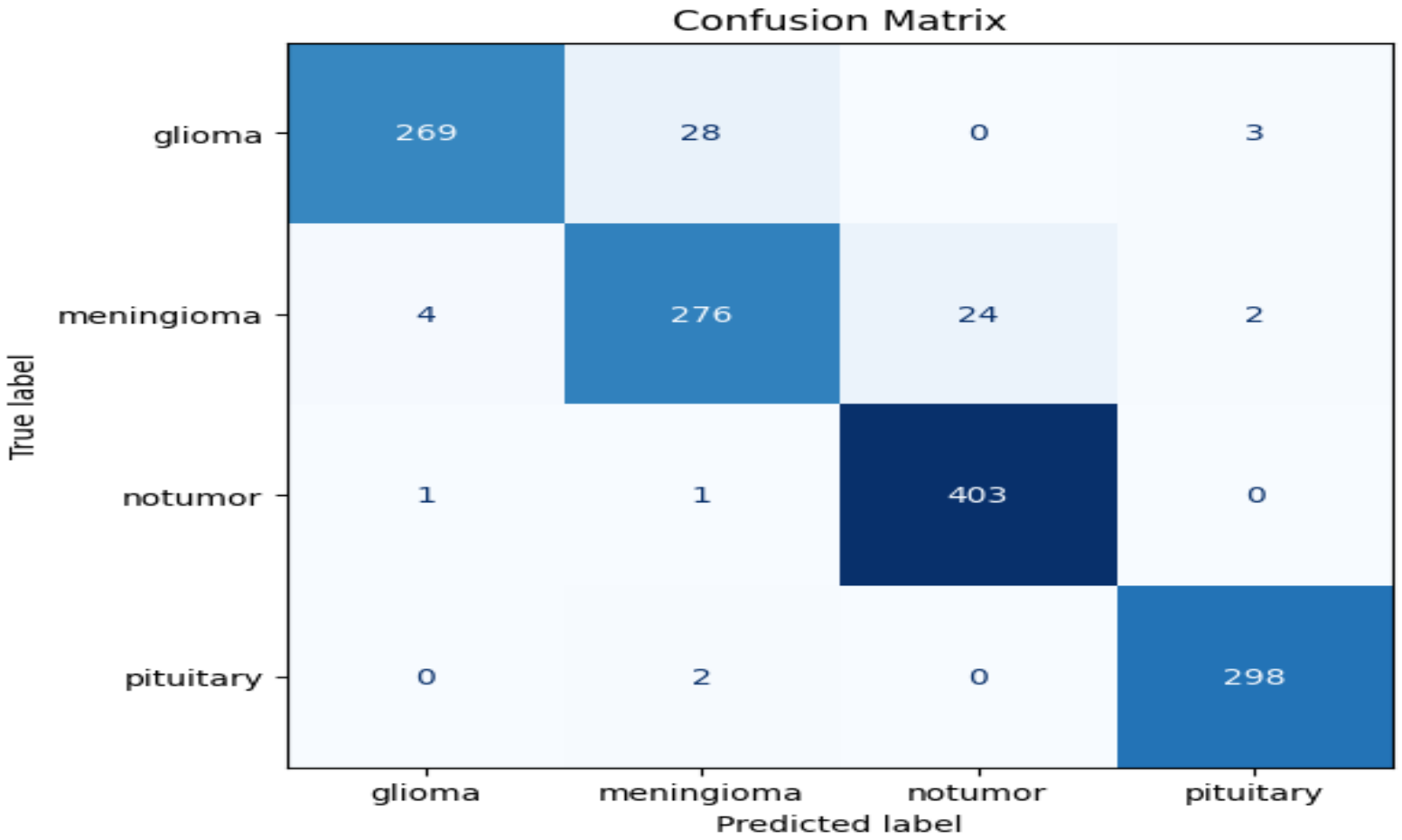
Baseline Model: Simple CNN

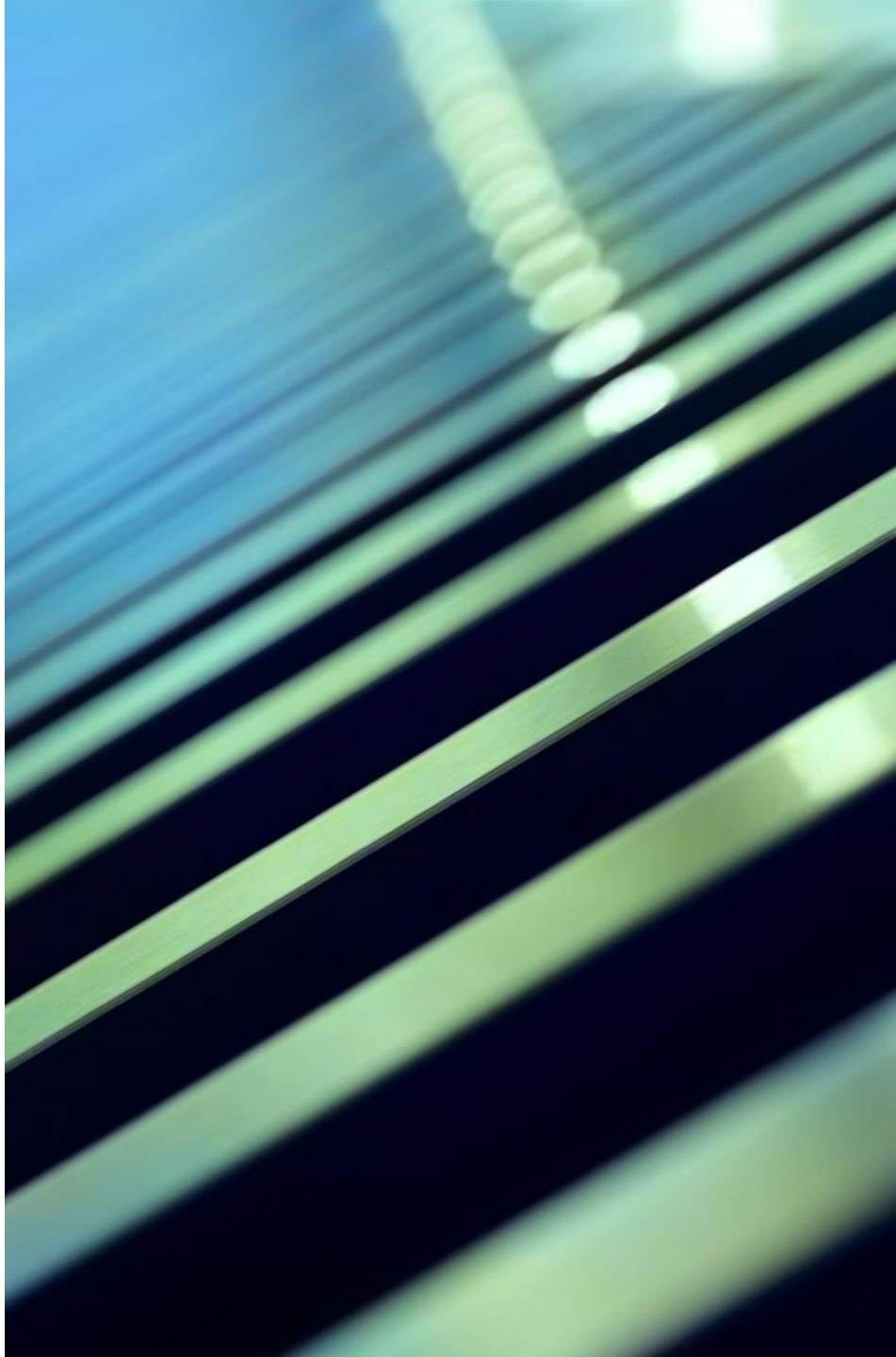
- 3 convolutional layers + fully connected classifier
- Accuracy: ~95%
- Shows dataset is learnable even with a small CNN

Confusion matrix for baseline CNN

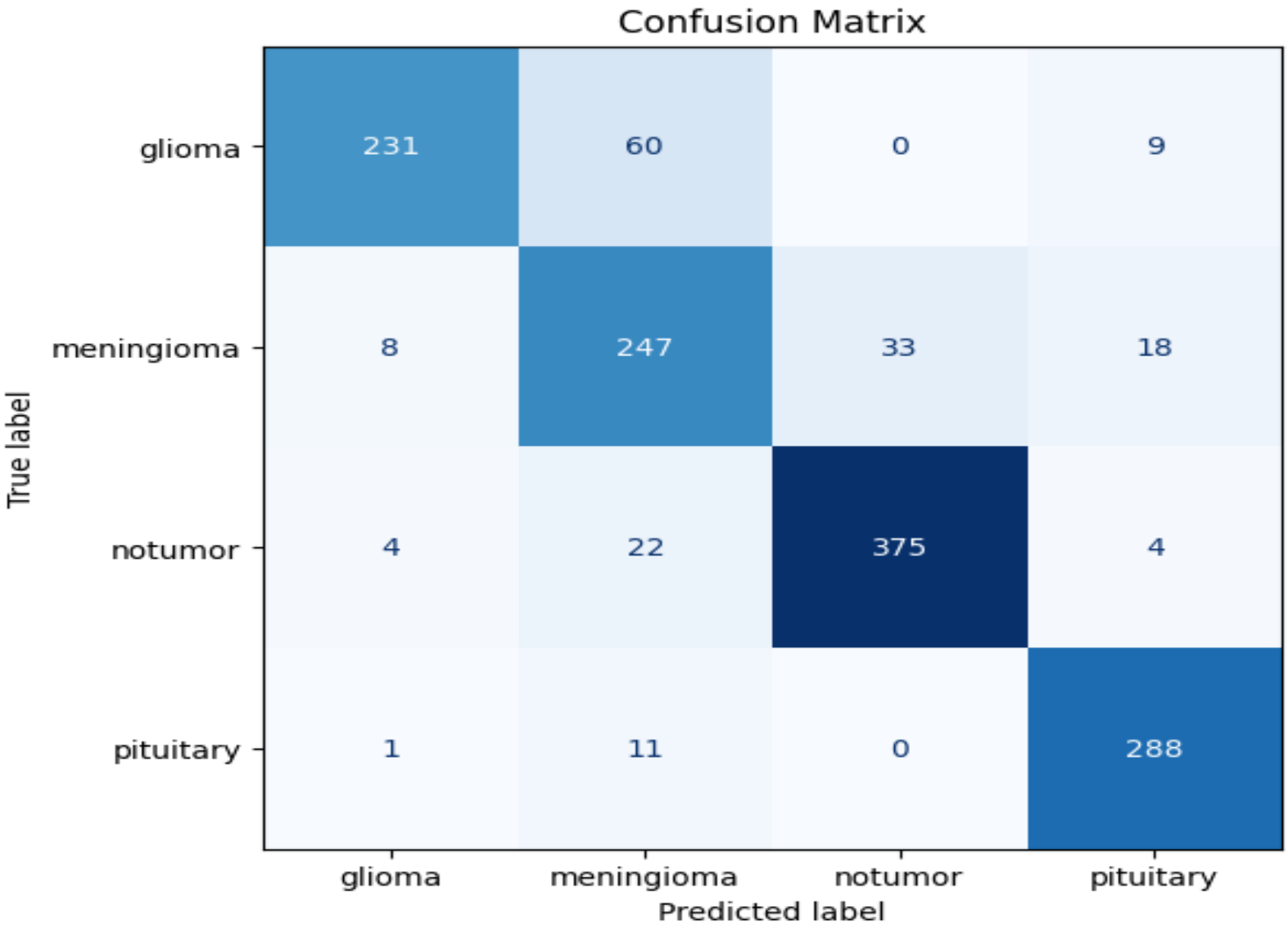


Pretrained ResNet-50 (Frozen)

- Used ImageNet pretrained ResNet-50 with frozen layers
- Accuracy: ~87%
- Likely cause: domain mismatch (ImageNet vs MRI)
- Model could not adapt to medical images

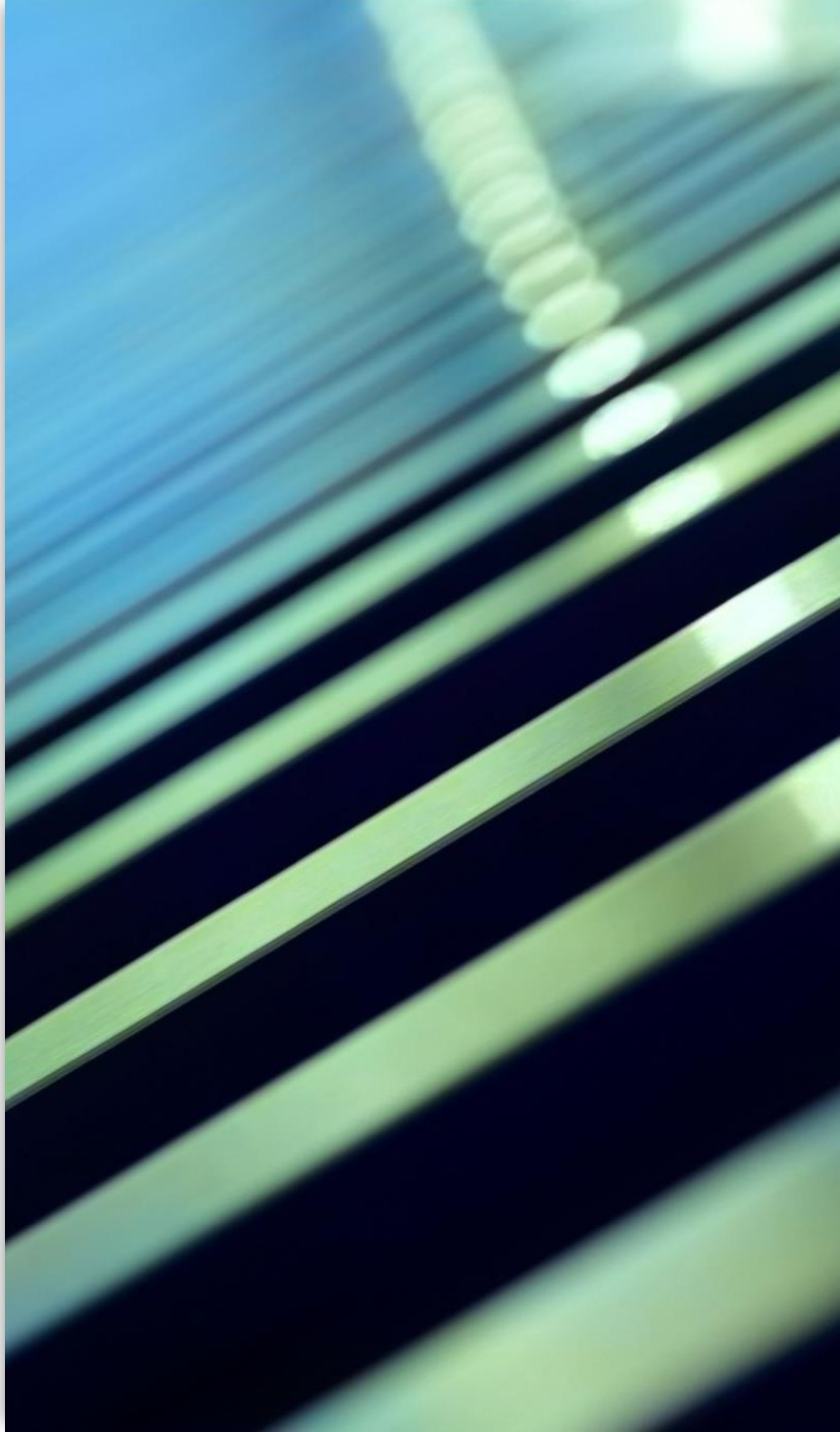


Confusion matrixResNet50 without Finetunning

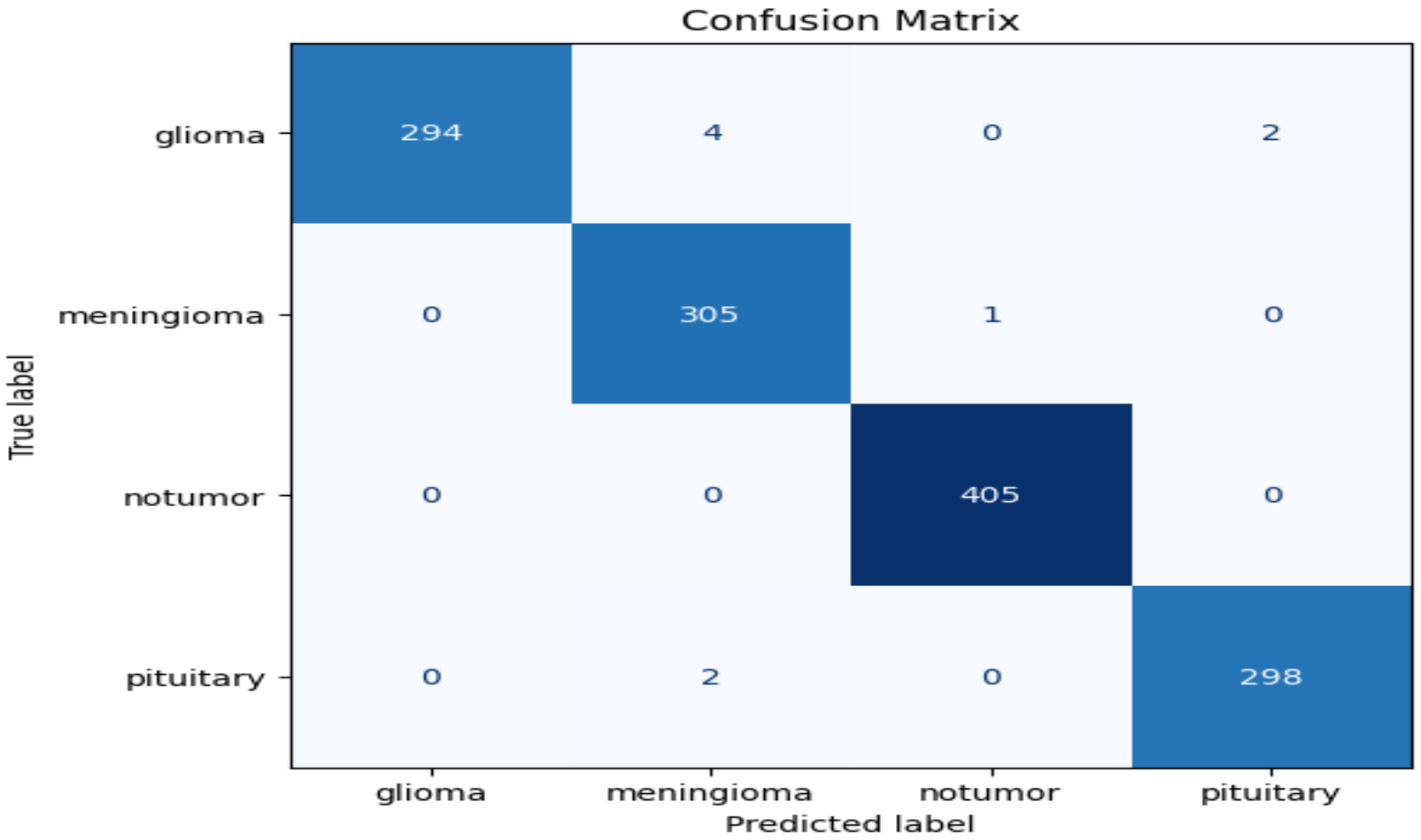


Fine-Tuned ResNet-50 without validation split

- Unfroze deeper layers and trained with lower LR
- Accuracy: ~98%
- Matches baseline but leverages pretrained weights
- Demonstrates power of fine-tuning

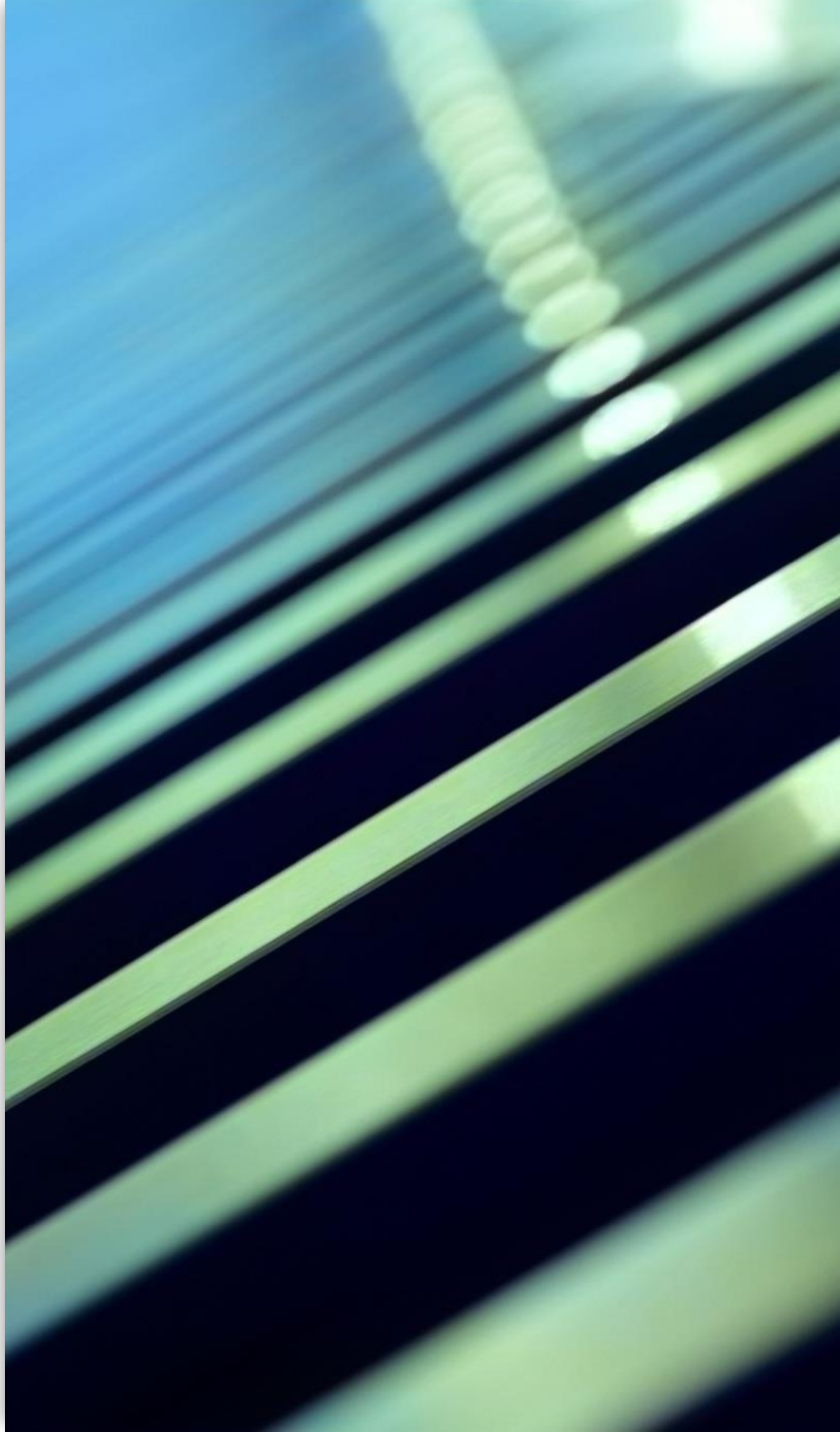


Fine-Tuned ResNet 50 without validation split



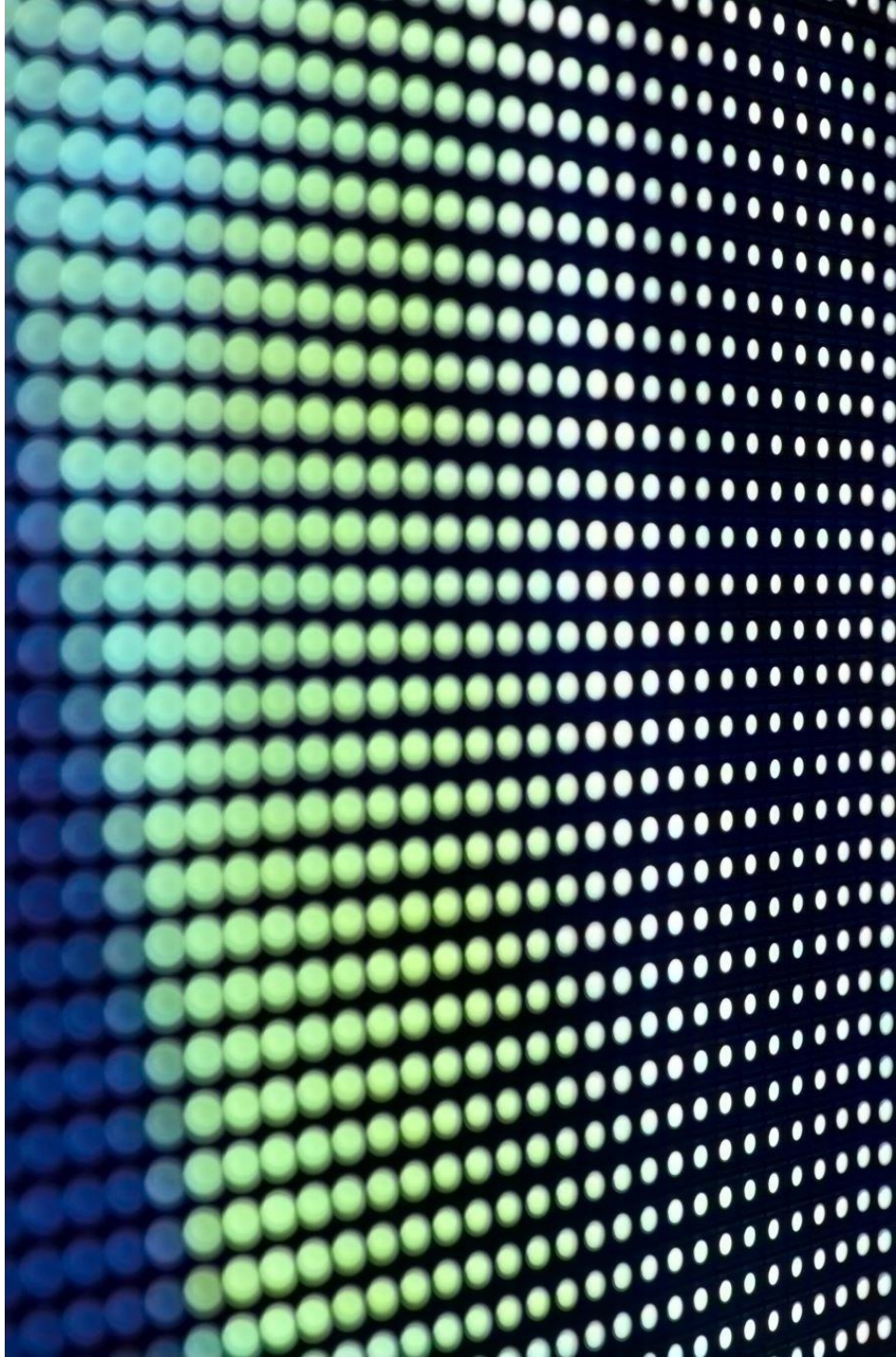
Fine-Tuned ResNet-50 with train/validation split

- Unfroze deeper layers and trained with lower LR
- Accuracy: ~99%
- Matches baseline but leverages pretrained weights
- Demonstrates power of fine-tuning



Results Comparison

- Baseline CNN: 95%
- Pretrained ResNet-50 (frozen): 87%
- Fine-Tuned ResNet-50 without validation split: 98%
- Fine-Tuned ResNet-50 with validation split: 99%



Key Takeaways

- Baseline CNN is strong
- Pretrained ImageNet features don’t always transfer directly
- Fine-tuning unlocks pretrained models’ power
- Always compare baseline vs transfer learning

Future Work

- Explore other pretrained models (EfficientNet, ViTs,Resnet24, Resnet18)
- Add data augmentation
- Apply Grad-CAM for explainability

Questions?

Thank you!