

Using CUDA GPU: NVIDIA GeForce RTX 3050

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Training resnet50 for Chest X-Ray Classification

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Loading data...

Loading data from:

Train: data/raw/chest\_xray/train

Val: data/raw/chest\_xray/val

Test: data/raw/chest\_xray/test

/home/user/miniconda3/envs/dl\_env/lib/python3.10/site-packages/albumen

tations/core/validation.py:114: UserWarning: ShiftScaleRotate is a special case of Affine transform. Please use Affine transform instead.

original\_init(self, \*\*validated\_kwargs)

Train samples: 5216

Validation samples: 16

Test samples: 624

Train distribution - Normal: 1341, Pneumonia: 3875

Imbalance ratio: 2.89:1

Creating resnet50 model...

model.safetensors: 100% [██████████]

102M/102M [00:10<00:00, 9.45MB/s]

Model parameters: 24,558,146

Trainable parameters: 24,558,146

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STAGE 1: Baseline Training (Frozen Backbone)

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Trainable parameters: 1,050,114

Training stage: baseline

Epochs: 15, Learning rate: 0.001

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Epoch 1/15

Training: 100% [██████████] 163/163 [00:26<00:00,  
6.10it/s, loss=0.189]

Evaluating:

100%|██████████| 1/1

[00:00<00:00, 2.52it/s]

Train Loss: 0.3100, Train Acc: 0.8760

Val Loss: 1.9708, Val Acc: 0.5000, Val AUC: 0.8594

Epoch 2/15

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Training: 100%|██████████| 163/163 [00:27<00:00,  
5.98it/s, loss=0.488]

Evaluating:

100%|██████████| 1/1

[00:00<00:00, 2.66it/s]

Train Loss: 0.2341, Train Acc: 0.9093

Val Loss: 1.8152, Val Acc: 0.5000, Val AUC: 0.8594

Epoch 3/15

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Training: 100%|██████████| 163/163 [00:26<00:00,  
6.06it/s, loss=0.139]

Evaluating:

100%|██████████| 1/1

[00:00<00:00, 2.66it/s]

Train Loss: 0.2279, Train Acc: 0.9089

Val Loss: 1.1969, Val Acc: 0.6250, Val AUC: 0.9062

Epoch 4/15

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Training: 100%|██████████| 163/163 [00:26<00:00,  
6.08it/s, loss=0.158]

Evaluating:

100%|██████████| 1/1

[00:00<00:00, 2.65it/s]

Train Loss: 0.2262, Train Acc: 0.9089

Val Loss: 1.6458, Val Acc: 0.5000, Val AUC: 0.9062

Epoch 5/15

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Training: 100%|██████████| 163/163  
[00:26<00:00, 6.06it/s, loss=0.15]

Evaluating:

100%|██████████| 1/1

[00:00<00:00, 2.65it/s]

Train Loss: 0.2207, Train Acc: 0.9109  
Val Loss: 1.3981, Val Acc: 0.6250, Val AUC: 0.9375

Epoch 6/15

Training: 100%|██████████| 163/163 [00:27<00:00,

5.92it/s, loss=0.249]

Evaluating:

100%|██████████| 1/1

[00:00<00:00, 2.65it/s]

Train Loss: 0.2073, Train Acc: 0.9166

Val Loss: 2.0710, Val Acc: 0.5000, Val AUC: 0.8438

Epoch 7/15

Training: 100%|██████████| 163/163 [00:26<00:00,

6.09it/s, loss=0.321]

Evaluating:

100%|██████████| 1/1

[00:00<00:00, 2.66it/s]

Train Loss: 0.1978, Train Acc: 0.9179

Val Loss: 2.4053, Val Acc: 0.5000, Val AUC: 0.8438

Epoch 8/15

Training: 100%|██████████| 163/163 [00:26<00:00,

6.04it/s, loss=0.276]

Evaluating:

100%|██████████| 1/1

[00:00<00:00, 2.65it/s]

Train Loss: 0.1960, Train Acc: 0.9218

Val Loss: 1.8553, Val Acc: 0.5625, Val AUC: 0.8906

Early stopping triggered at epoch 8

Best Validation AUC: 0.9375

Baseline model saved to models/resnet50\_baseline.pth

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STAGE 2: Progressive Unfreezing - Stage 1

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Unfrozen last 20 layers  
Trainable parameters: 9,979,394

Training stage: stage\_1  
Epochs: 15, Learning rate: 0.0001

Epoch 1/15

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Training: 100%|██████████| 163/163 [00:27<00:00,  
6.01it/s, loss=0.165]

Evaluating:

100%|██████████| 1/1  
[00:00<00:00, 2.53it/s]

Train Loss: 0.1752, Train Acc: 0.9317

Val Loss: 2.1222, Val Acc: 0.5625, Val AUC: 0.9062

Epoch 2/15

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Training: 100%|██████████| 163/163 [00:26<00:00,  
6.14it/s, loss=0.179]

Evaluating:

100%|██████████| 1/1  
[00:00<00:00, 2.52it/s]

Train Loss: 0.1877, Train Acc: 0.9271

Val Loss: 1.8448, Val Acc: 0.5625, Val AUC: 0.8906

Epoch 3/15

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Training: 100%|██████████| 163/163 [00:26<00:00,  
6.14it/s, loss=0.114]

Evaluating:

100%|██████████| 1/1  
[00:00<00:00, 2.53it/s]

Train Loss: 0.1607, Train Acc: 0.9377

Val Loss: 2.2626, Val Acc: 0.5625, Val AUC: 0.9219

Epoch 4/15

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Training: 100%|██████████| 163/163 [00:27<00:00,  
5.94it/s, loss=0.164]

Evaluating:

100%|██████████| 1/1  
[00:00<00:00, 2.52it/s]

Train Loss: 0.1554, Train Acc: 0.9404  
Val Loss: 2.1609, Val Acc: 0.5000, Val AUC: 0.9219

Epoch 5/15

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Training: 100%|██████████| 163/163 [00:26<00:00,  
6.08it/s, loss=0.0551]  
Evaluating:  
100%|██████████| 1/1

[00:00<00:00, 2.52it/s]  
Train Loss: 0.1521, Train Acc: 0.9450  
Val Loss: 1.8661, Val Acc: 0.5625, Val AUC: 0.9531

Epoch 6/15

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Training: 100%|██████████| 163/163 [00:27<00:00,  
6.03it/s, loss=0.343]  
Evaluating:  
100%|██████████| 1/1

[00:00<00:00, 2.54it/s]  
Train Loss: 0.1484, Train Acc: 0.9417  
Val Loss: 2.3928, Val Acc: 0.5000, Val AUC: 0.9375

Epoch 7/15

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Training: 100%|██████████| 163/163 [00:27<00:00,  
6.02it/s, loss=0.0423]  
Evaluating:  
100%|██████████| 1/1

[00:00<00:00, 2.52it/s]  
Train Loss: 0.1404, Train Acc: 0.9450  
Val Loss: 2.4182, Val Acc: 0.5000, Val AUC: 0.9062  
Early stopping triggered at epoch 7

Best Validation AUC: 0.9531

Stage 1 model saved to models/resnet50\_stage1.pth

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STAGE 3: Progressive Unfreezing - Stage 2

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Unfrozen last 50 layers  
Trainable parameters: 18,251,266

Training stage: stage\_2  
Epochs: 15, Learning rate: 1e-05

Epoch 1/15

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Training: 100%|██████████| 163/163 [00:26<00:00,  
6.06it/s, loss=0.117]

Evaluating:

100%|██████████| 1/1  
[00:00<00:00, 2.60it/s]

Train Loss: 0.1252, Train Acc: 0.9486

Val Loss: 2.6821, Val Acc: 0.5000, Val AUC: 0.9219

Epoch 2/15

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Training: 100%|██████████| 163/163 [00:26<00:00,  
6.16it/s, loss=0.145]

Evaluating:

100%|██████████| 1/1  
[00:00<00:00, 2.59it/s]

Train Loss: 0.1293, Train Acc: 0.9509

Val Loss: 2.4331, Val Acc: 0.5000, Val AUC: 0.9062

Epoch 3/15

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Training: 100%|██████████| 163/163 [00:26<00:00,  
6.14it/s, loss=0.223]

Evaluating:

100%|██████████| 1/1  
[00:00<00:00, 2.59it/s]

Train Loss: 0.1375, Train Acc: 0.9507

Val Loss: 2.4886, Val Acc: 0.5000, Val AUC: 0.9219

Epoch 4/15

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Training: 100%|██████████| 163/163 [00:26<00:00,  
6.12it/s, loss=0.349]

Evaluating:

100%|██████████| 1/1  
[00:00<00:00, 2.59it/s]

Train Loss: 0.1282, Train Acc: 0.9475  
Val Loss: 2.6990, Val Acc: 0.5000, Val AUC: 0.9219

Epoch 5/15

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Training: 100%|██████████| 163/163 [00:26<00:00,  
6.04it/s, loss=0.0757]  
Evaluating:  
100%|██████████| 1/1

[00:00<00:00, 2.59it/s]  
Train Loss: 0.1224, Train Acc: 0.9521  
Val Loss: 2.8557, Val Acc: 0.5000, Val AUC: 0.9219

Epoch 6/15

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Training: 100%|██████████| 163/163 [00:27<00:00,  
6.01it/s, loss=0.264]  
Evaluating:  
100%|██████████| 1/1

[00:00<00:00, 2.59it/s]  
Train Loss: 0.1255, Train Acc: 0.9490  
Val Loss: 2.8795, Val Acc: 0.5000, Val AUC: 0.9219

Epoch 7/15

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Training: 100%|██████████| 163/163 [00:26<00:00,  
6.05it/s, loss=0.129]  
Evaluating:  
100%|██████████| 1/1

[00:00<00:00, 2.59it/s]  
Train Loss: 0.1219, Train Acc: 0.9538  
Val Loss: 2.6783, Val Acc: 0.5000, Val AUC: 0.9062  
Early stopping triggered at epoch 7

Best Validation AUC: 0.9219

Final model saved to models/resnet50\_final.pth

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FINAL EVALUATION ON TEST SET

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Evaluating: 100%|██████████|  
20/20 [00:03<00:00, 5.95it/s]

Test Metrics:

loss: 1.1768  
accuracy: 0.6715  
auc: 0.9230  
f1\_score: 0.7915  
precision: 0.6560  
recall: 0.9974  
sensitivity: 0.9974  
specificity: 0.1282

Results saved to results/resnet50\_test\_results.txt

Training completed successfully!