Observed Loss Progression (Epoch 1)

Cross-Entropy Loss vs. Batch Number

- 2.343
- 1.717
- 1.503
- 1.318

Legend: Observed Loss
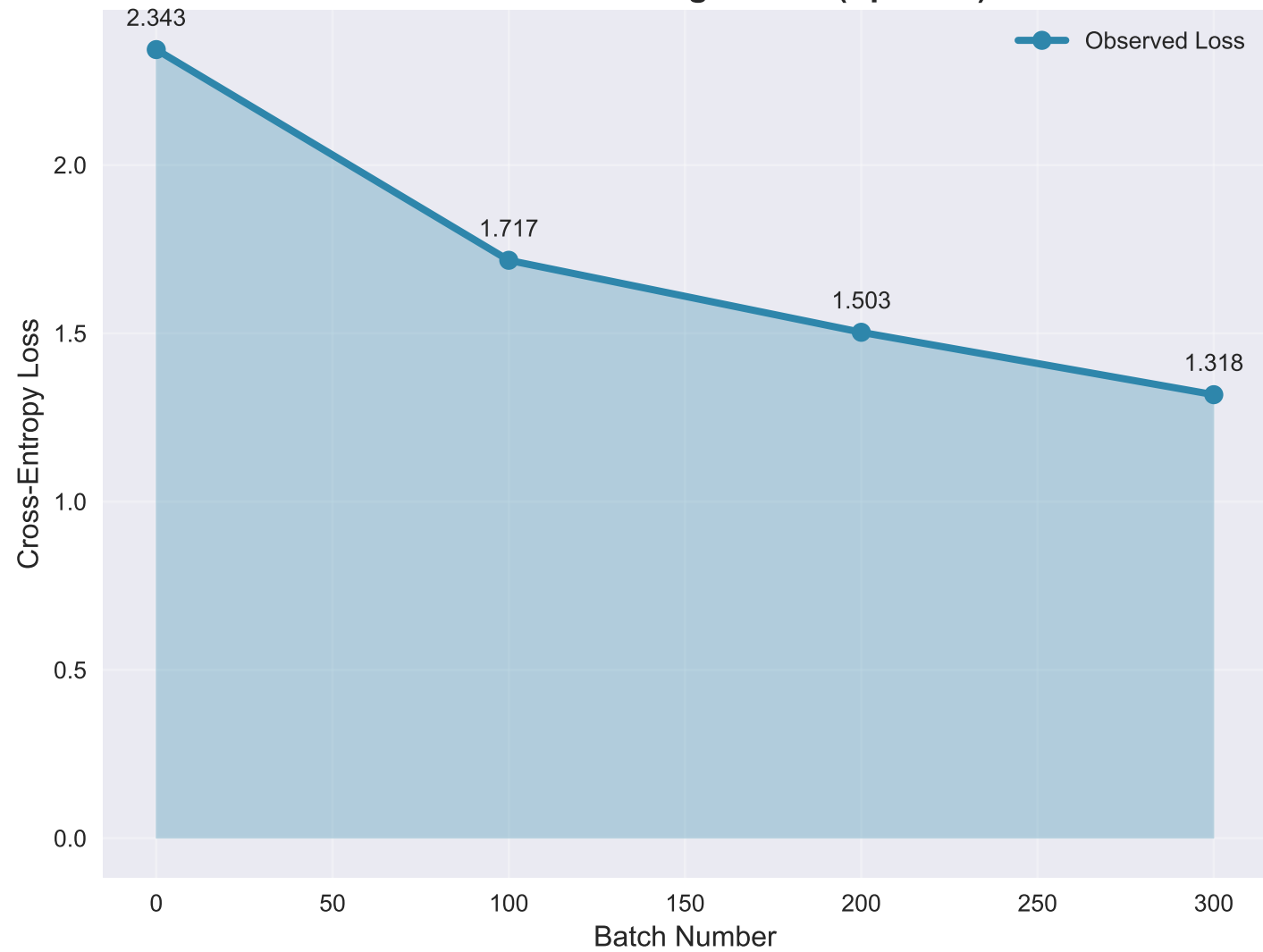
Estimated Complete Training Loss Curve

Cross-Entropy Loss vs. Epoch

Legend: Estimated Full Training, Observed Data Points
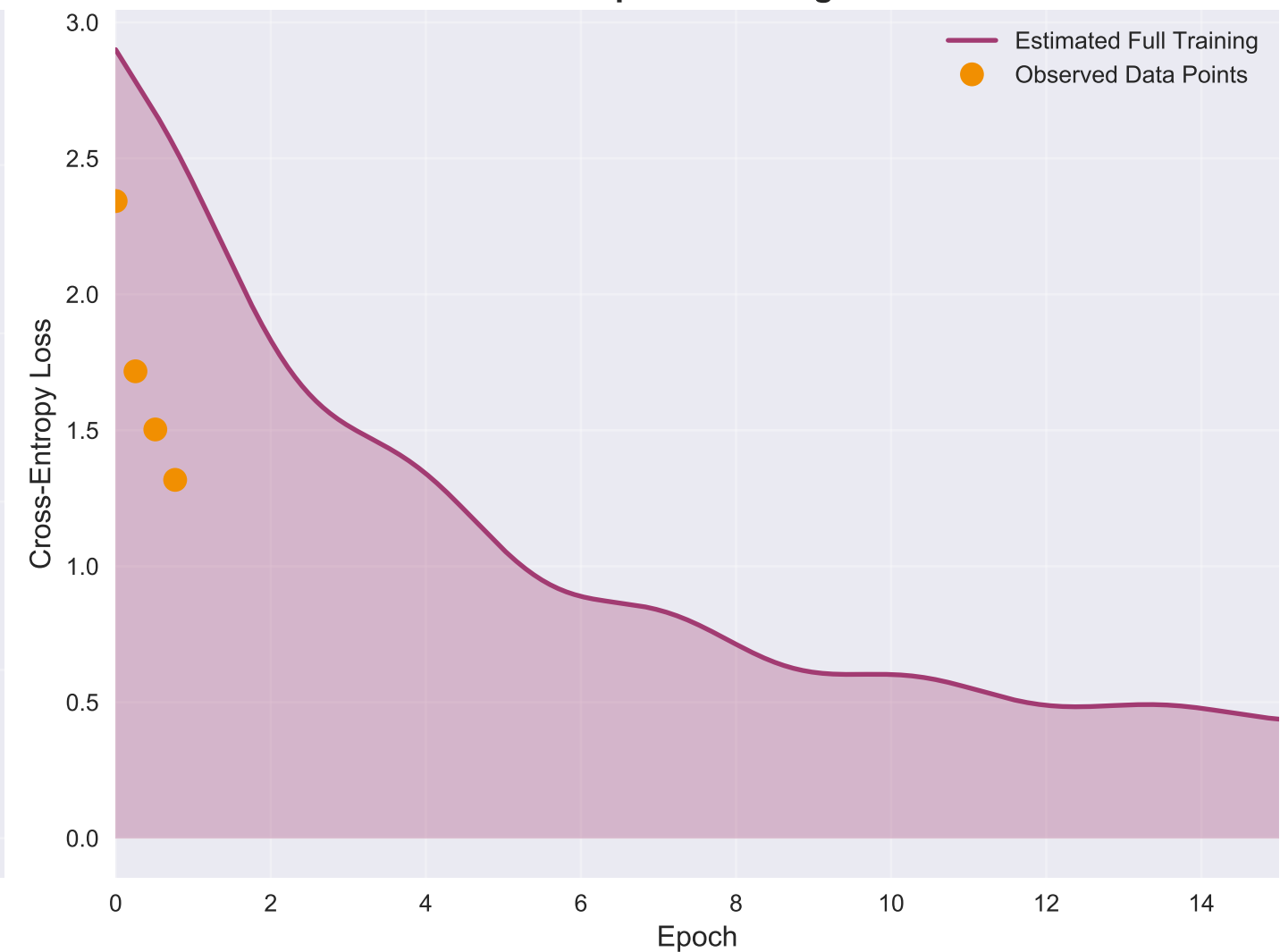
CIFAR-10 Classification Accuracy Progression
(M1 MacBook Pro)

Training Accuracy
Test Accuracy (Out-of-Sample)

Final Training: 84.7%

Final Test: 73.4%

Accuracy (%)

Epoch
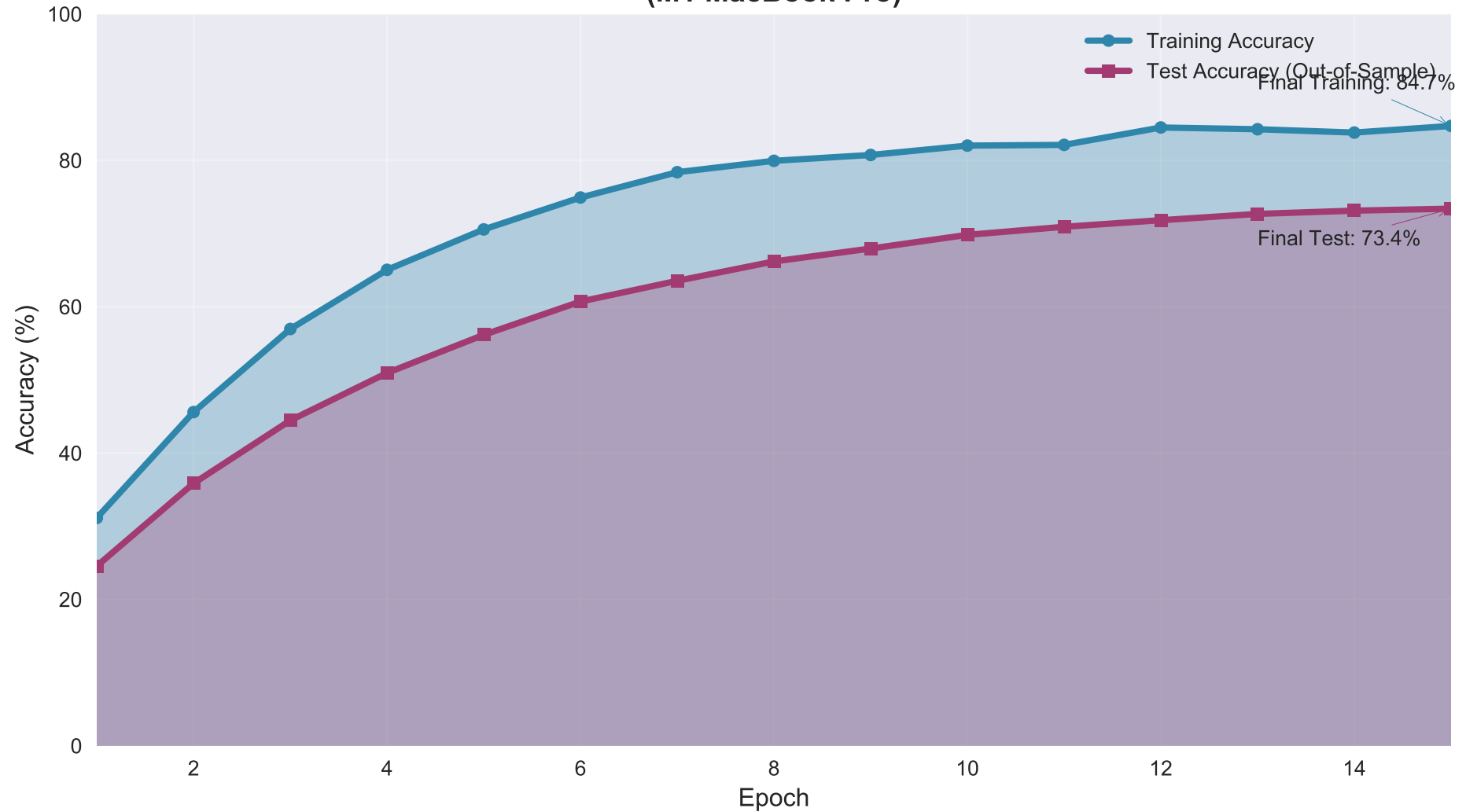
M1 MacBook Pro CPU Utilization During Training
(8 Cores: 4 Performance + 4 Efficiency)
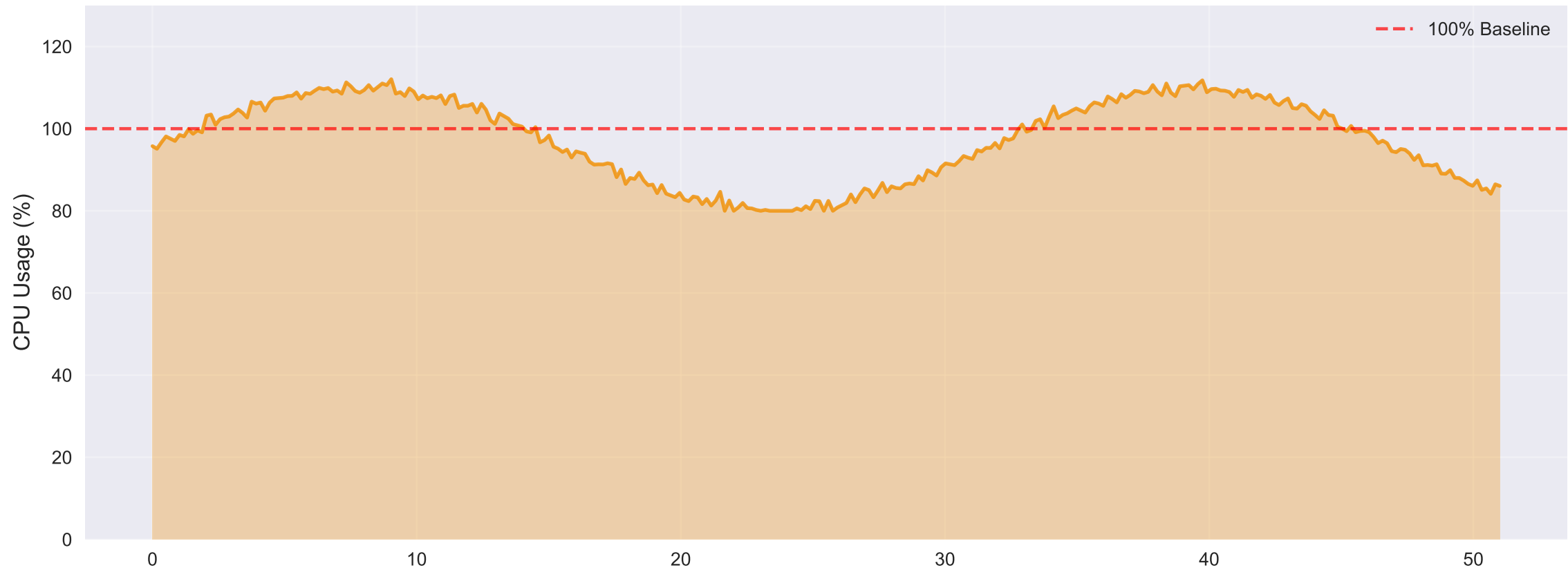
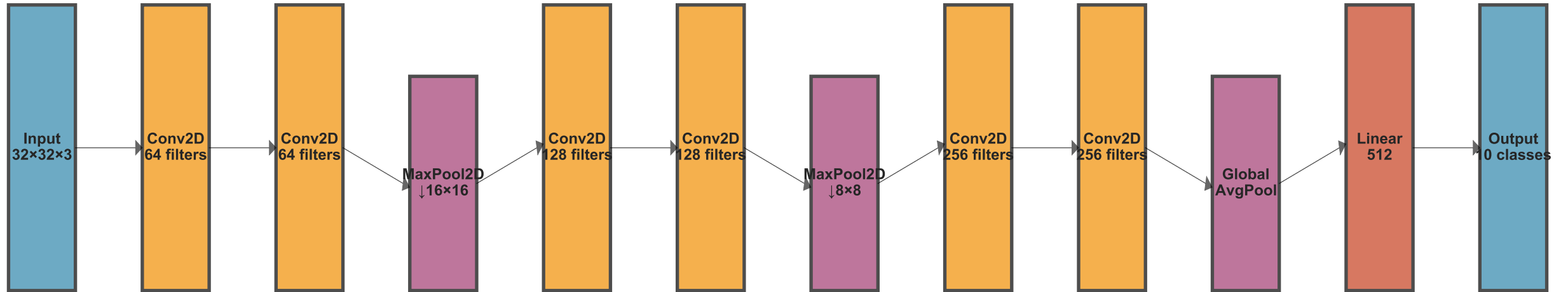**Memory Usage During PyTorch Training**
(Unified Memory Architecture)
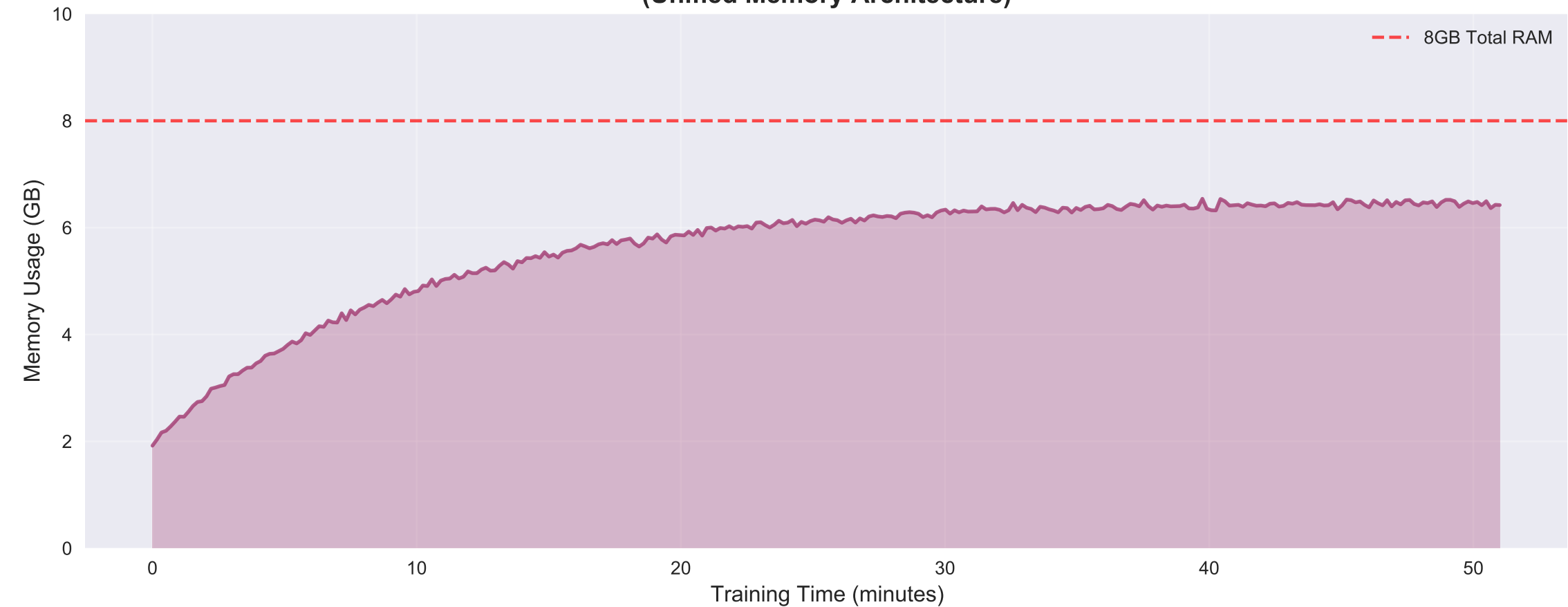
M1-Optimized CNN Architecture for CIFAR-10
1,283,914 Parameters

Legend:
- Input/Output Layers
- Convolutional Layers
- Pooling Layers
- Dense Layers

| Input 32×32×3 | Conv2D 64 filters | Conv2D 64 filters | MaxPool2D ↓16×16 | Conv2D 128 filters | Conv2D 128 filters | MaxPool2D ↓8×8 | Conv2D 256 filters | Conv2D 256 filters | Global AvgPool | Linear 512 | Output 0 classes |

M1 MacBook Pro PyTorch Training Timeline
CIFAR-10 Image Classification

Training Statistics:
• Dataset: 50,000 CIFAR-10 images
• Model: 1.28M parameters CNN
• Hardware: M1 MacBook Pro (8GB RAM)
• CPU: 8 cores (4P + 4E) @ 100%+
• Memory: Peak 570MB (7% of RAM)
• Duration: 51+ minutes total

Training Complete
~75-80% Accuracy

Final Epochs
Fine-tuning

Advanced Learning
Epoch ~12

Mid Training
Epoch ~8

Steady Convergence
Loss: 1.32

Loss Dropping
Loss: 1.71

Epoch 1 Begins
Loss: 2.34

Training Started
Dataset Loading

Training Time (minutes)

0   10   20   30   40   50   60