

Softmax Regression Comprehensive Demo Report

Multiclass classification with softmax function

Topics Covered:

- Decision boundary visualization
- Training convergence analysis
- Softmax function properties
- Temperature scaling effects
- Sklearn comparison and validation
 - Real-world dataset (Iris)

SEED = 42 for reproducibility

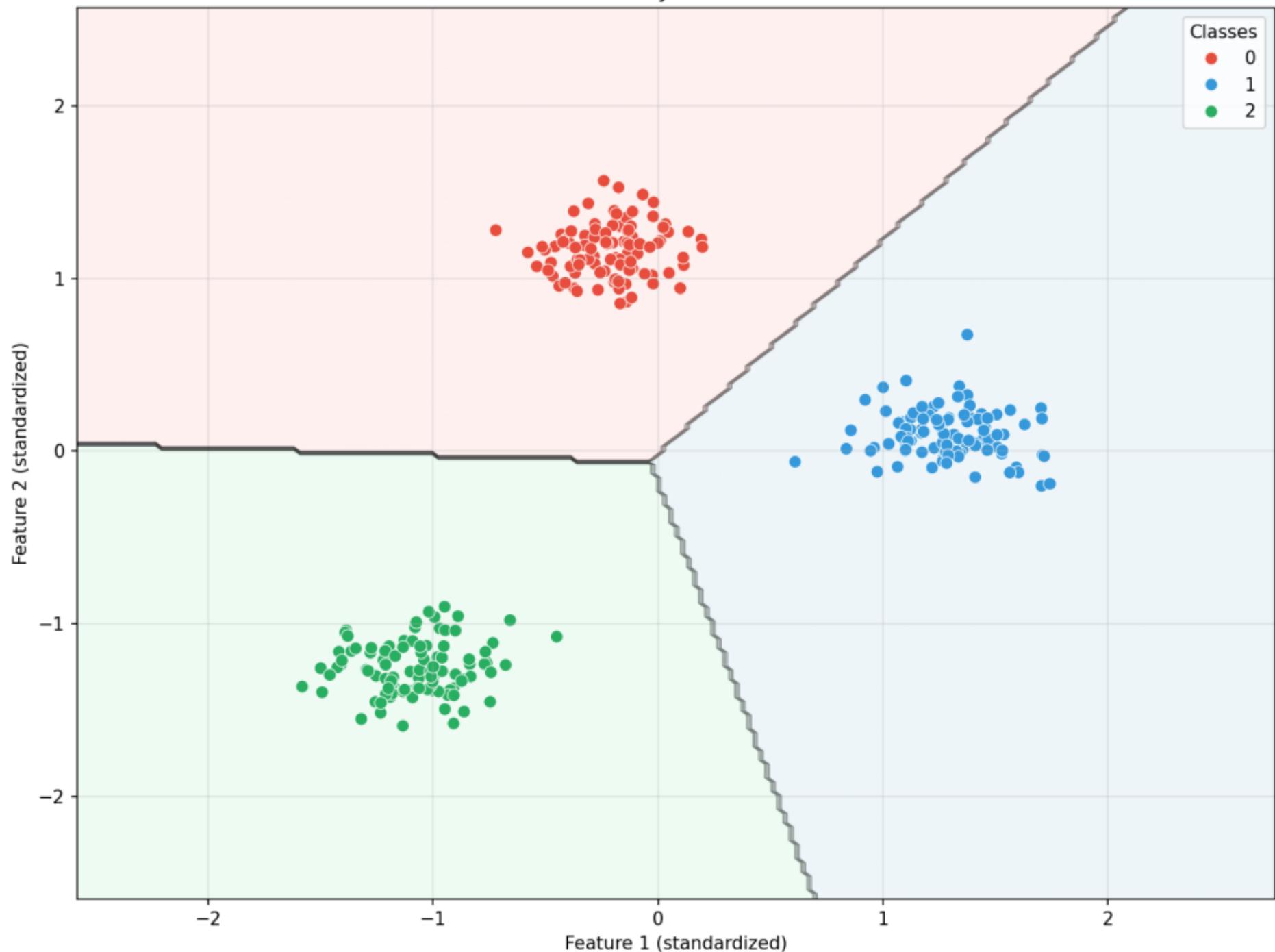
Summary of Results

1. 3-Class Decision Boundaries
 - Training Accuracy: 100.00%
 - Final Loss: 0.004791
2. Convergence Analysis
 - LR=0.01: Final Loss = 0.217224
 - LR=0.1: Final Loss = 0.024547
 - LR=0.5: Final Loss = 0.005564
 - LR=1.0: Final Loss = 0.002970
3. Temperature Scaling
 - Temperatures tested: [0.5, 1.0, 2.0, 5.0]
 - Lower T -> sharper distribution
 - Higher T -> softer distribution
4. Sklearn Comparison
 - Our Test Accuracy: 1.0000
 - Sklearn Test Accuracy: 1.0000
 - Mean Probability Difference: 0.004452
5. Iris Dataset
 - Train Accuracy: 0.9810
 - Test Accuracy: 0.9111

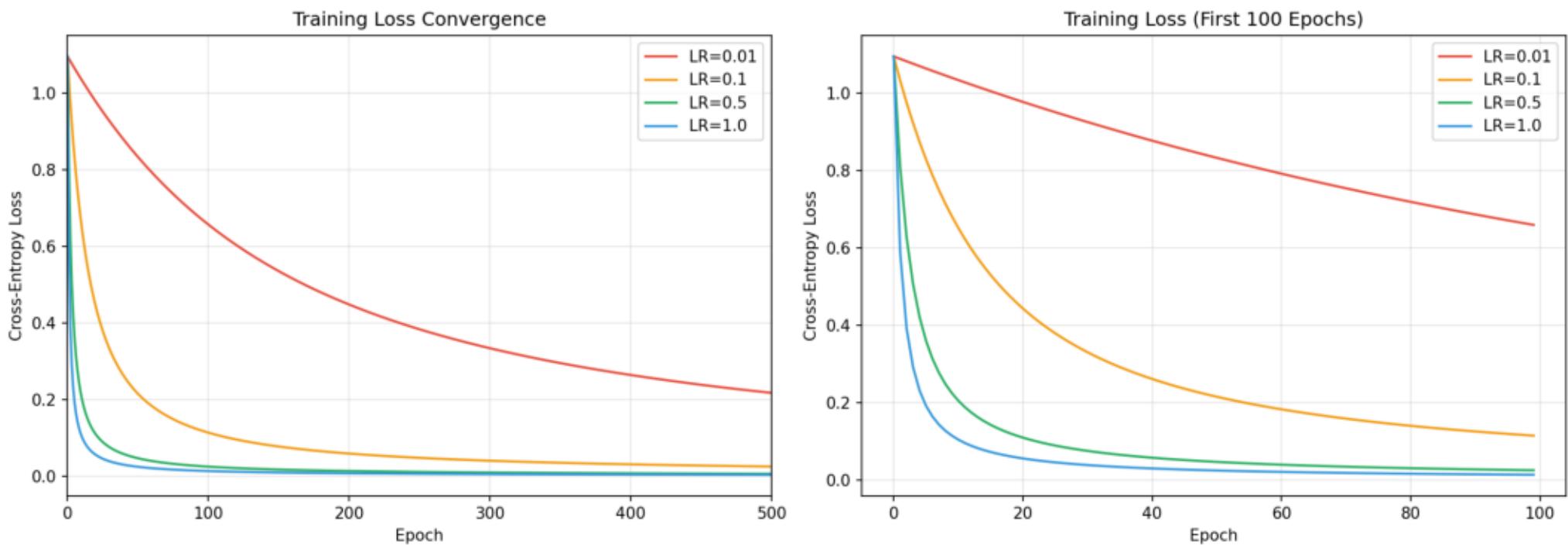
3-Class Decision Boundaries

3-Class Softmax Regression Decision Boundaries

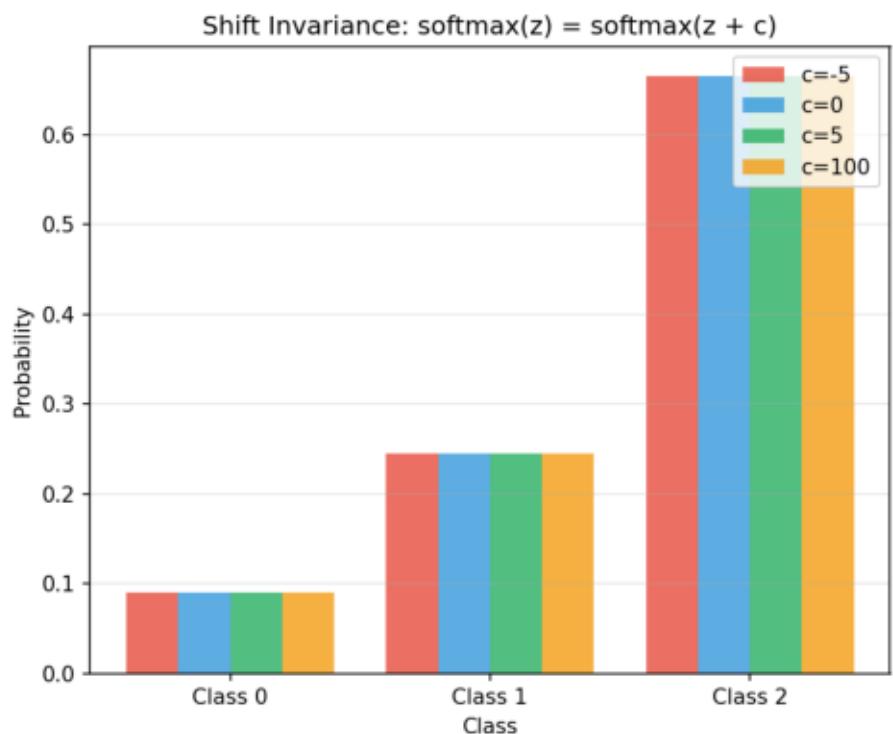
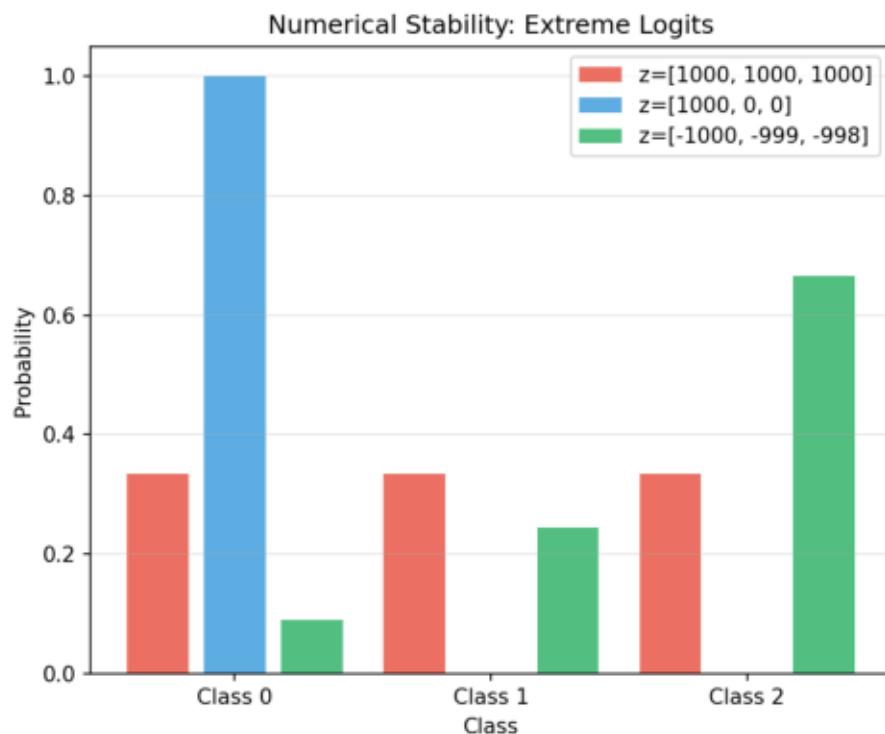
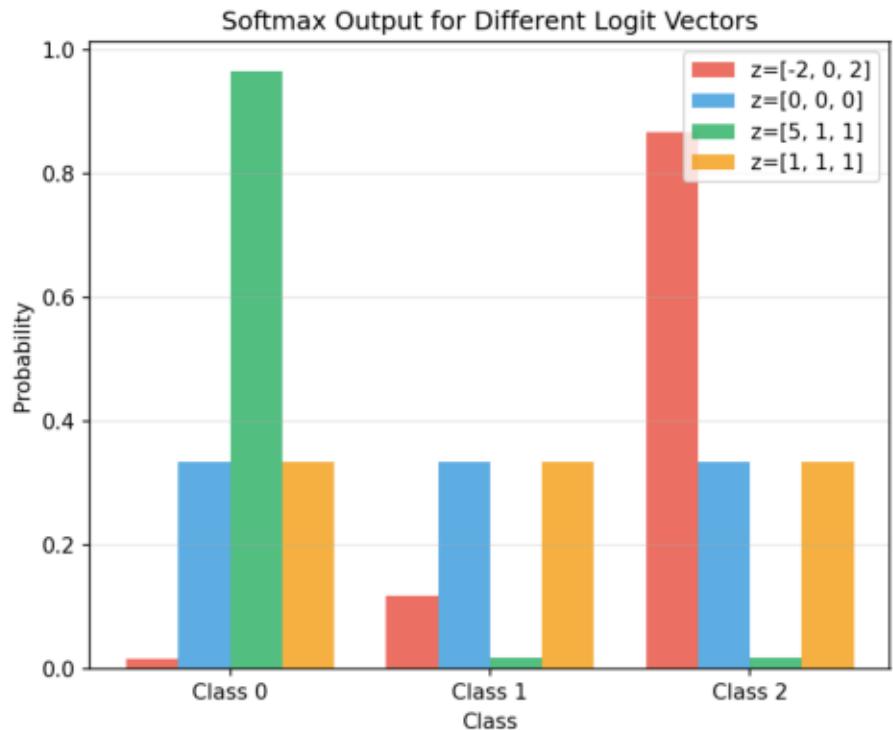
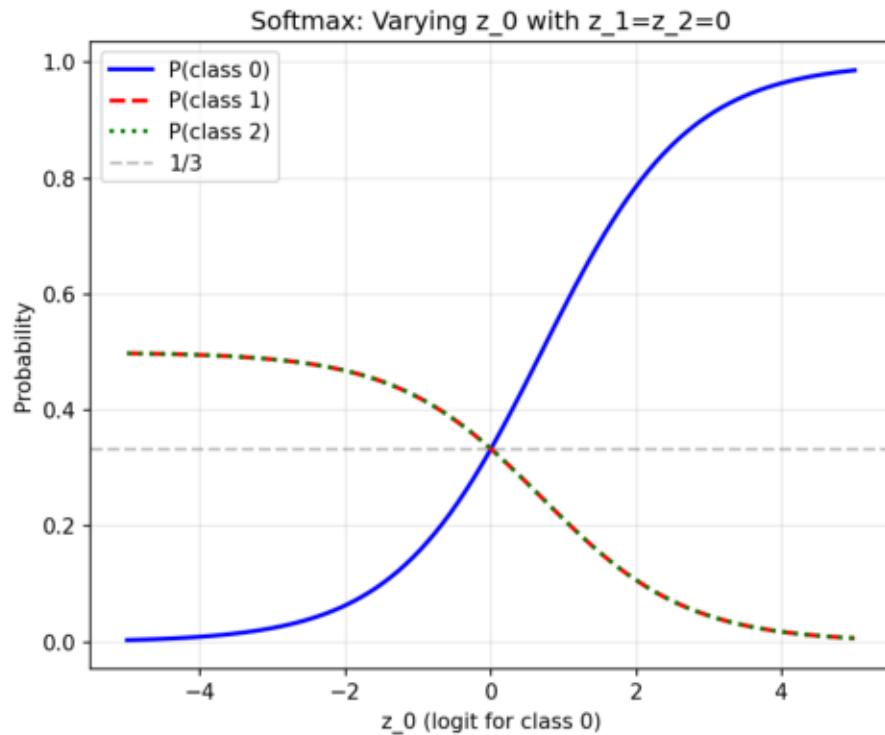
Accuracy: 100.00%



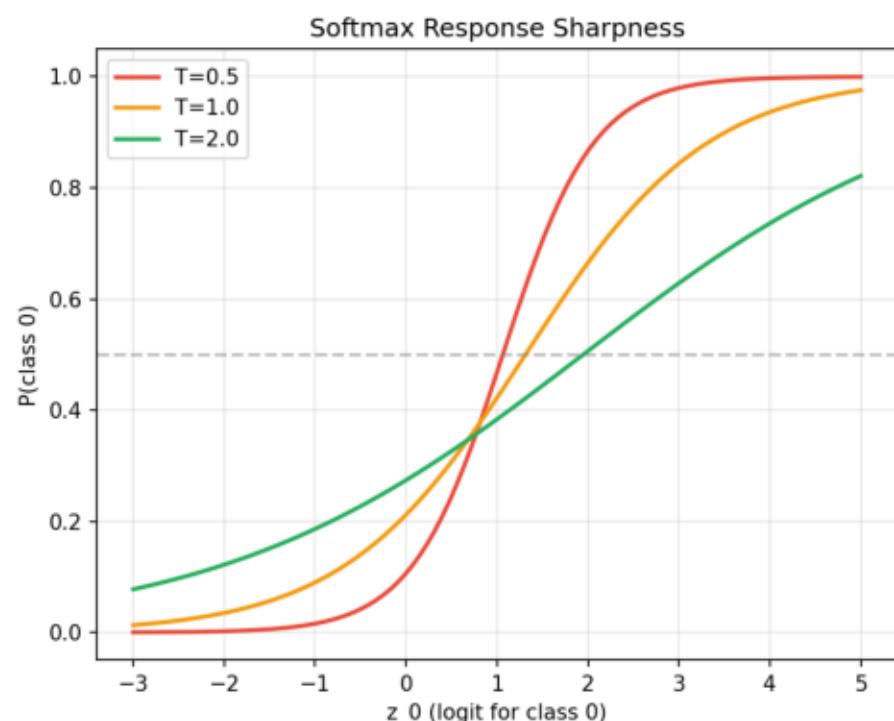
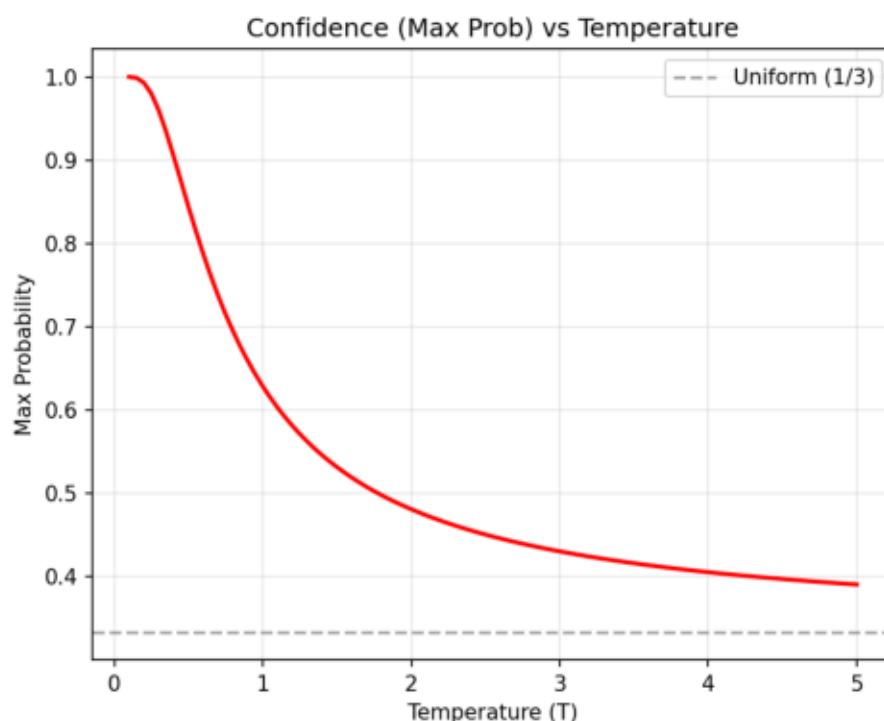
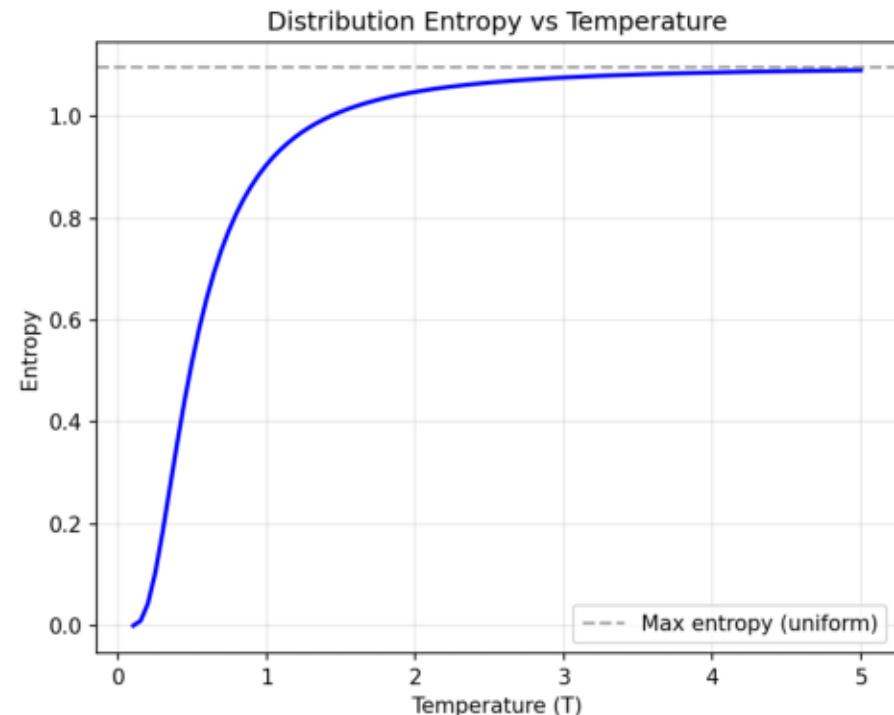
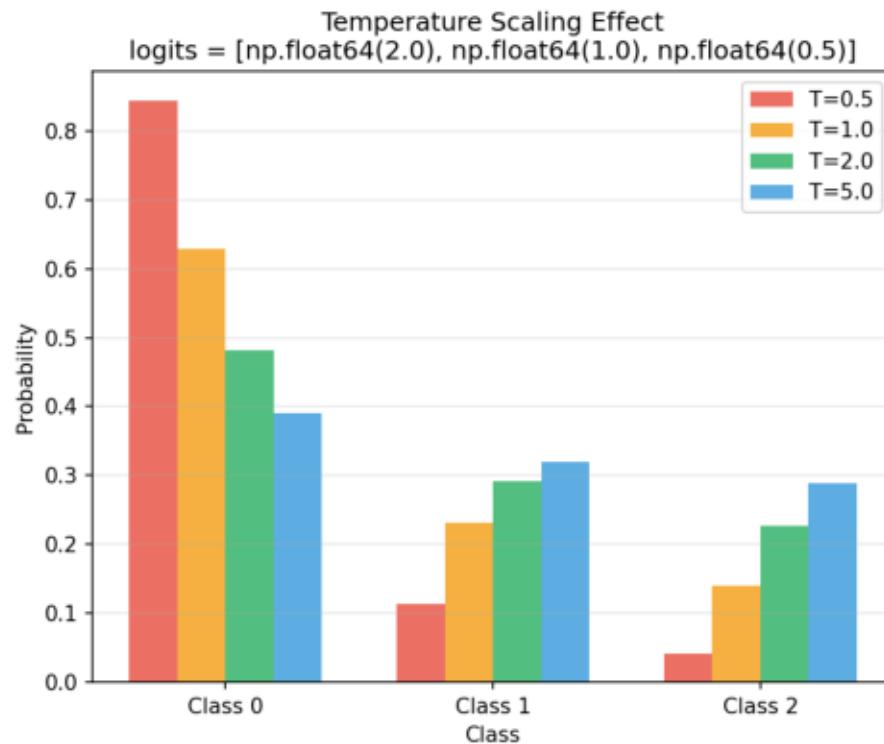
Training Convergence



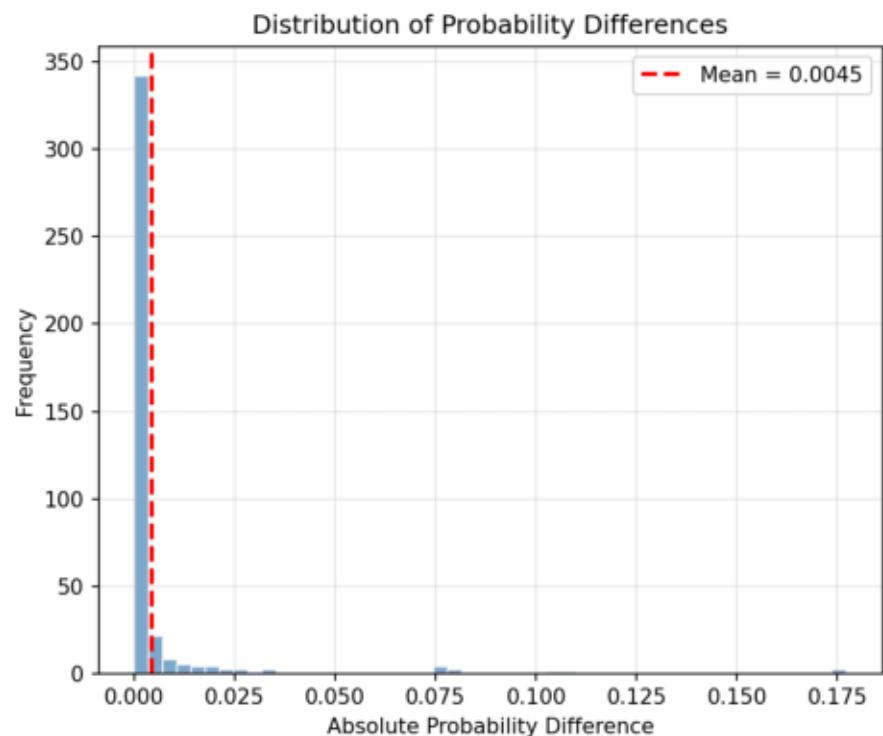
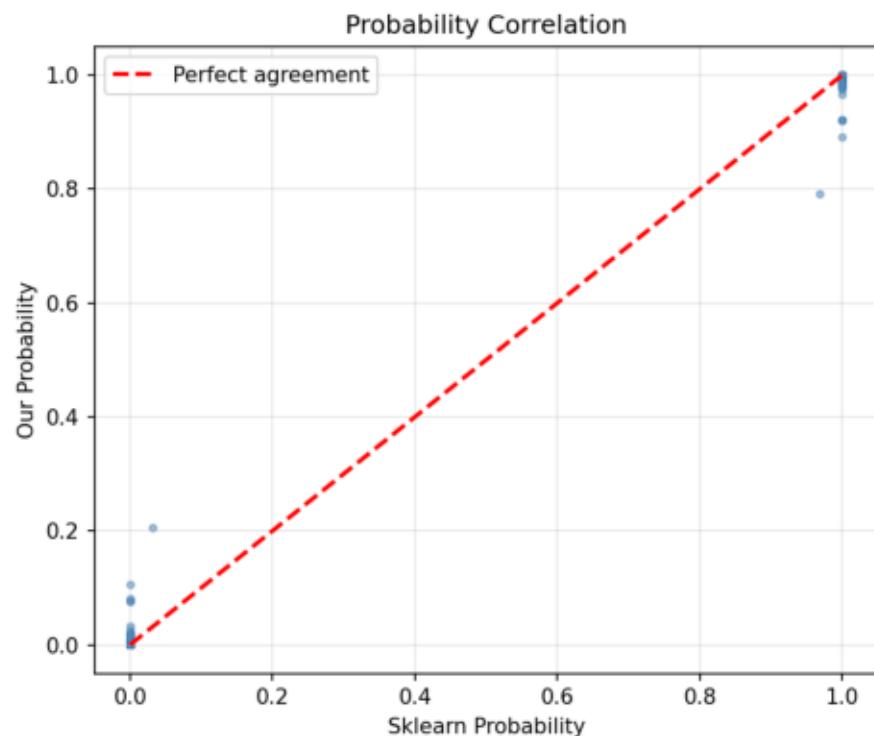
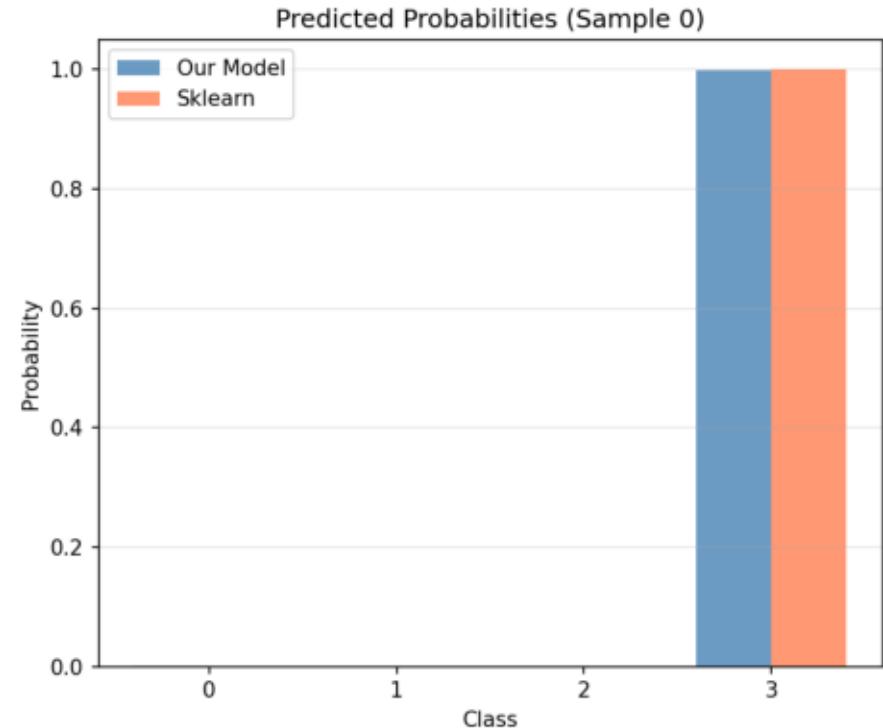
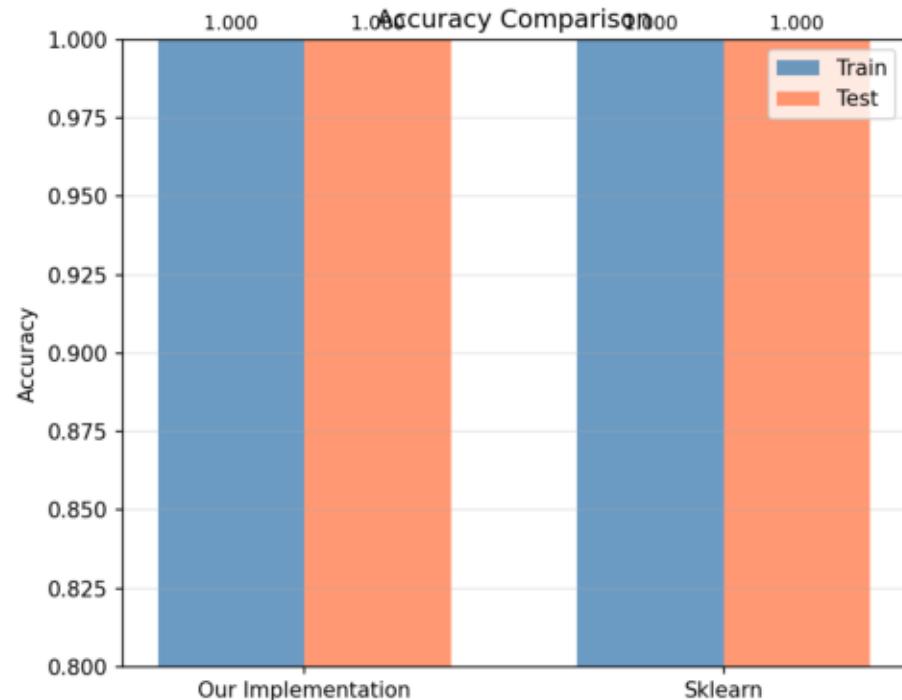
Softmax Function Visualization



Temperature Scaling



Sklearn Comparison



Iris Dataset

