Metric Learning: Triplet-Loss

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I. The Triplet-Loss Pipeline

In this supervised similarity or metric learning, the Triplet-Loss pipeline consists of

1) Retrieve images from CUB200_2011 dataset within `TripletCUBDataset` class
2) Transform images into tensors and apply additional augmentations to the training set only
3)
4)

II. Training Hyper-parameters

We conducted 4 experiments using two pre-trained models: ResNet18 and ResNet34
ResNet18 contains ... million parameters
ResNet34 contains approximately 21.5 million parameters

1) epochs: 20, learning rate: 0.001, batch size: 32
2) epochs: 20, learning rate: 0.002, batch size: 32
3) epochs: 20, learning rate: 0.001, batch size: 64
4) epochs: 20, learning rate: 0.002, batch size: 64

III. Training Curves

A. ResNet18

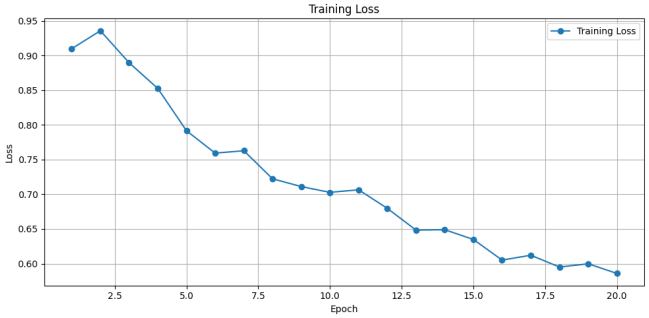

Fig. 1. Experiment 1 with ResNet18

B. ResNet34

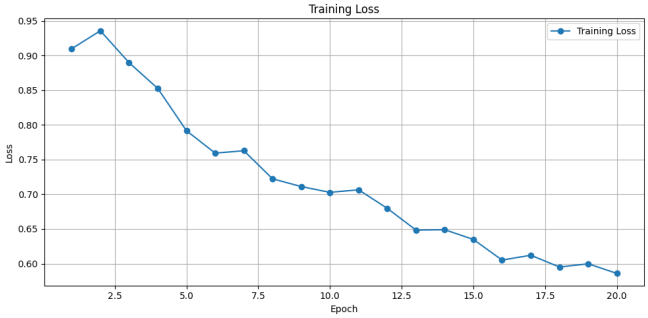

Fig. 2. Experiment 1 with ResNet34

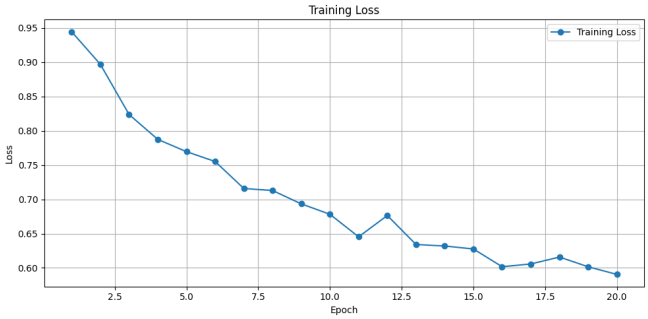

Fig. 3. Experiment 2 with ResNet34

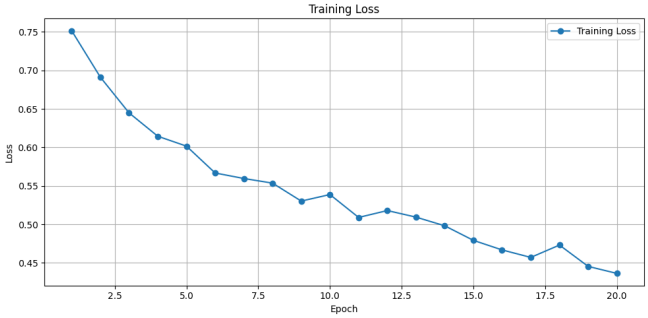

Fig. 4. Experiment 3 with ResNet34

IV. Embedding Visualizations

A. ResNet18

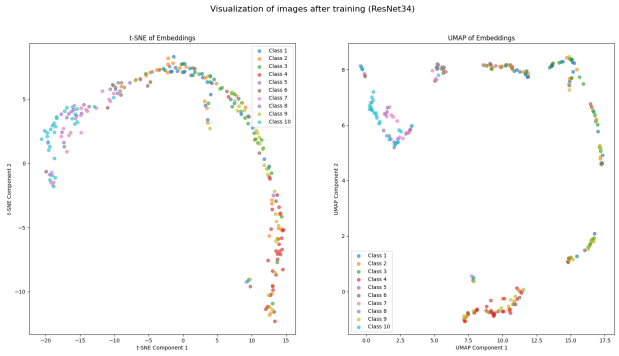

Fig. 5. Experiment 1 with ResNet18

B. ResNet34

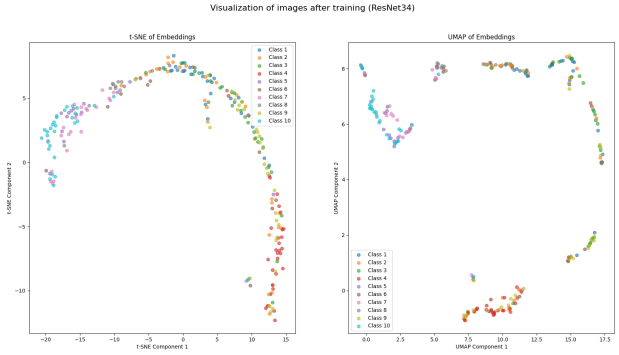

Fig. 6. Experiment 1 with ResNet34

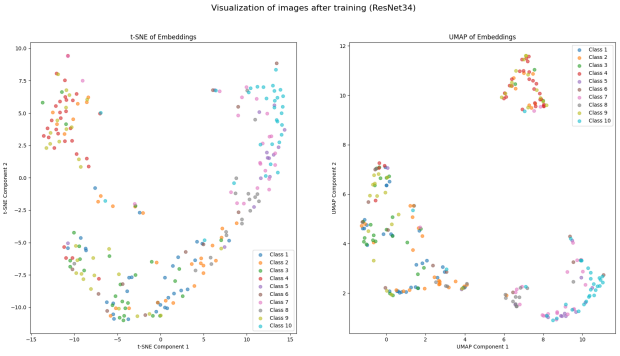

Fig. 7. Experiment 2 with ResNet34

V. Evaluation Results

A. ResNet18

TABLE I
Loss and Accuracy Metrics for Experiment 1

Metric	Value
Loss	
Top-1 Accuracy (%)	
Cosine Similarity Anchor-Positive	
Cosine Similarity Anchor-Negative	

TABLE II
Precision Metrics for Experiment 1

Metric	Value (%)
Precision@1	
Precision@5	
Precision@10	

B. ResNet34

TABLE III
Loss and Accuracy Metrics for Experiment 1

Metric	Value
Loss	0.5902
Top-1 Accuracy (%)	75.85
Cosine Similarity Anchor-Positive	0.6200
Cosine Similarity Anchor-Negative	0.0994

TABLE IV
Precision Metrics for Experiment 1

Metric	Value (%)
Precision@1	31.69
Precision@5	30.12
Precision@10	30.37

TABLE V
Loss and Accuracy Metrics for Experiment 2

Metric	Value
Loss	0.5829
Top-1 Accuracy (%)	75.63
Cosine Similarity Anchor-Positive	0.6727
Cosine Similarity Anchor-Negative	0.1282

TABLE VI
Precision Metrics for Experiment 2

Metric	Value (%)
Precision@1	26.34
Precision@5	29.14
Precision@10	29.42

TABLE VII
Loss and Accuracy Metrics for Experiment 3

Metric	Value
Loss	0.4440
Top-1 Accuracy (%)	83.28
Cosine Similarity Anchor-Positive	0.7201
Cosine Similarity Anchor-Negative	0.0272

TABLE VIII
PRECISION METRICS FOR EXPERIMENT 3

Metric	**Value (%)**
Precision@1	34.98
Precision@5	30.86
Precision@10	29.55