Report of Magnet Loss Implementation and Incremental Learning on CIFAR-10 Dataset

Introduction

This report summaries the steps and results taken for the given tasks 1) Reproducing the method of Magnet Loss Implementation on CIFAR 10 dataset 2) Modifying the approach for Continual learning.

Task-1: Magnet Loss Implementation on CIFAR 10

The magnet loss method described in this paper "Metric Learning with Adaptive Density Discrimination" was implemented on CIFAR 10 dataset using PyTorch. We employed pre-trained weights of GoogleNet, with its modified final layer to classify 10-object classes of CIFAR 10.

Moreover, we followed the standard data augmentation and normalization techniques to pre-process the dataset. The magnet loss was implemented to cluster embeddings, figure out the distance between them and improve inter-cluster separation using a parameter alpha α.

Key Settings

- To speed up the training process, we used a subset of 5000 images.
- The model was trained on 50 epochs.

Results

We obtained 3.62% accuracy for Softmax Similarity and 0.32 score of Mean Attribute Concentration.

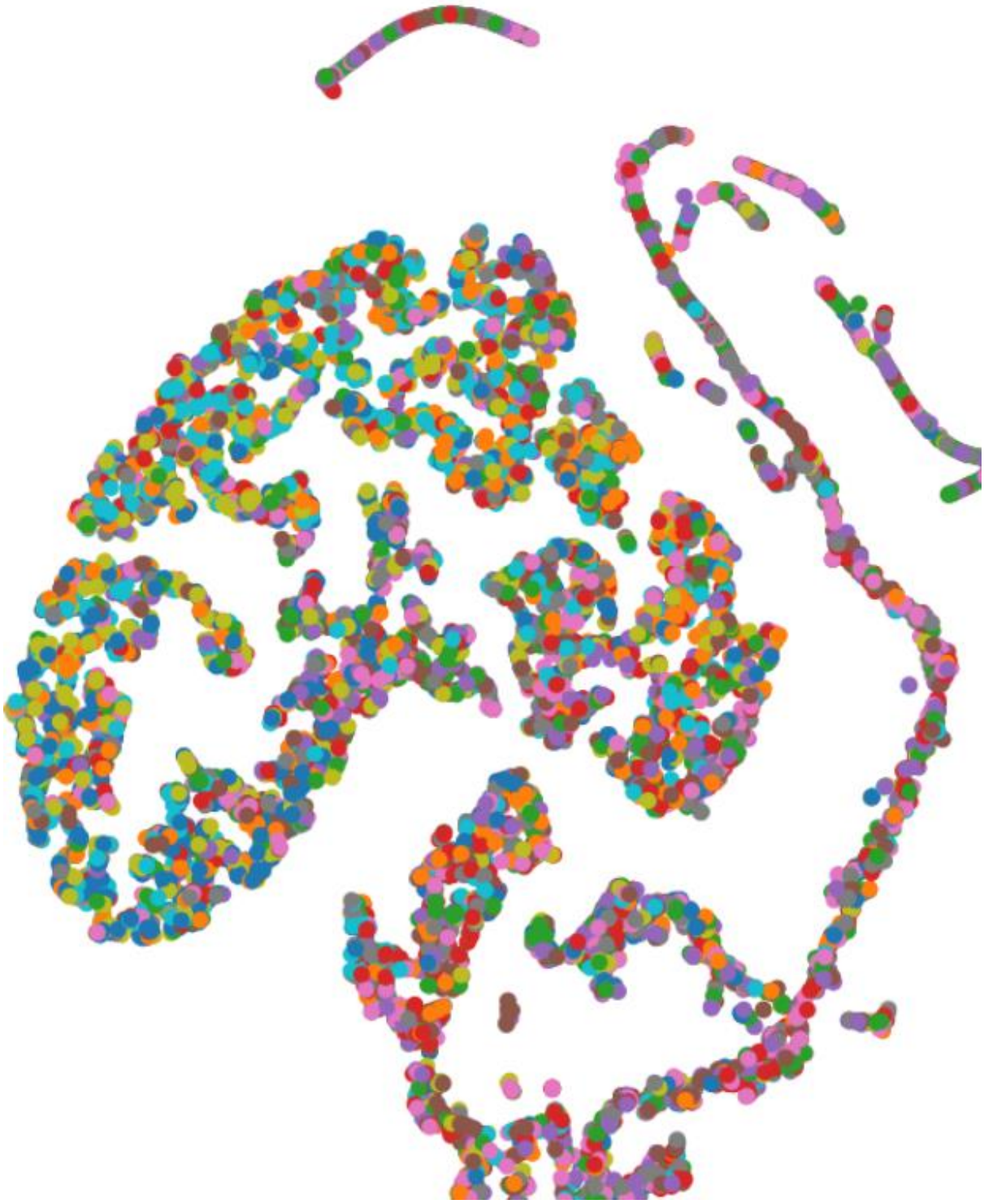

Fig.1 t-SNE Visualization of Embeddings

Task-2 Continual Learning on CIFA-10

Methodology

We incremented the model for continual learning by dividing the CIFAR-10 into 5-subsets, each consist of data of 2 classes. After data splitting, we trained the model incrementally over 5 phases, employing only the training data from the current increment at each phase, while being tested on the test data of all seen classes up to that point.

Results

The obtained results are deprecated in the table.

Increment	Classes	Accuracy
1	0-1	98.95%
2	2-3	44.62%
3	4-5	31.03%
4	6-7	24.51%
5	8-9	19.29%

Key Insights

We observed that the accuracy is been significantly dropped after 1st increment reflecting the issue of catastrophic forgetting. Based on my knowledge, the proposed solutions are Adding memory augmented networks, Rehearsal techniques (Buffer of Past Data), Regularization practices.

References

1. https://github.com/vithursant/MagnetLoss-PyTorch/blob/master/magnet_loss/magnet_loss.py
2. https://medium.com/@navarai/understanding-and-mitigating-catastrophic-forgetting-in-machine-learning-d5caa93d375e
3. https://stats.stackexchange.com/questions/314508/how-to-avoid-catastrophic-forgetting
4.