

EECS 545 Machine Learning

Homework #4

1 [34 points] CNNs for Multi-class Classification

- (a) Autograder.
- (b) Autograder.

CIFAR-10 results We get 41.40%, 44.24%, and 43.84% for train, val, and test accuracies respectively.

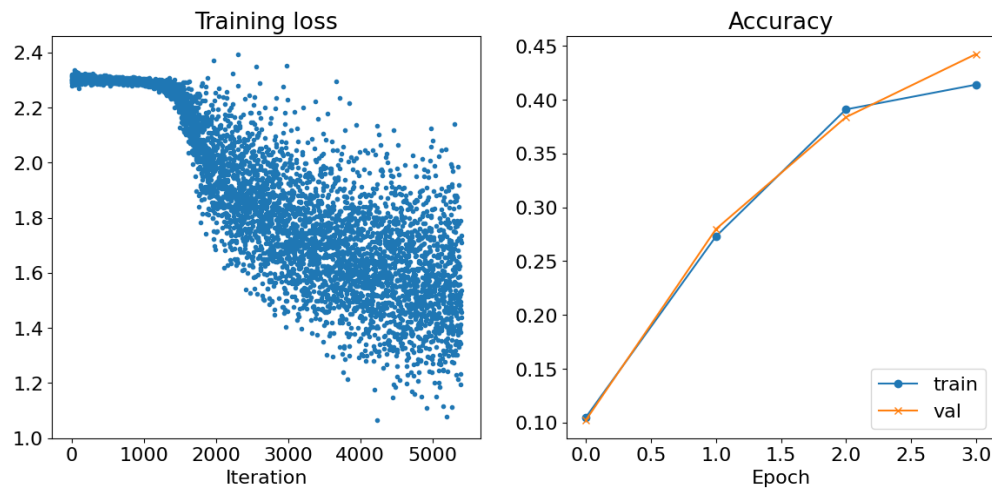


Figure 1: Training curves on CIFAR-10.

(Optional) MNIST results We get 98.60%, 98.42%, and 97.55% for train, val, and test accuracies respectively.

Learned filters in W1

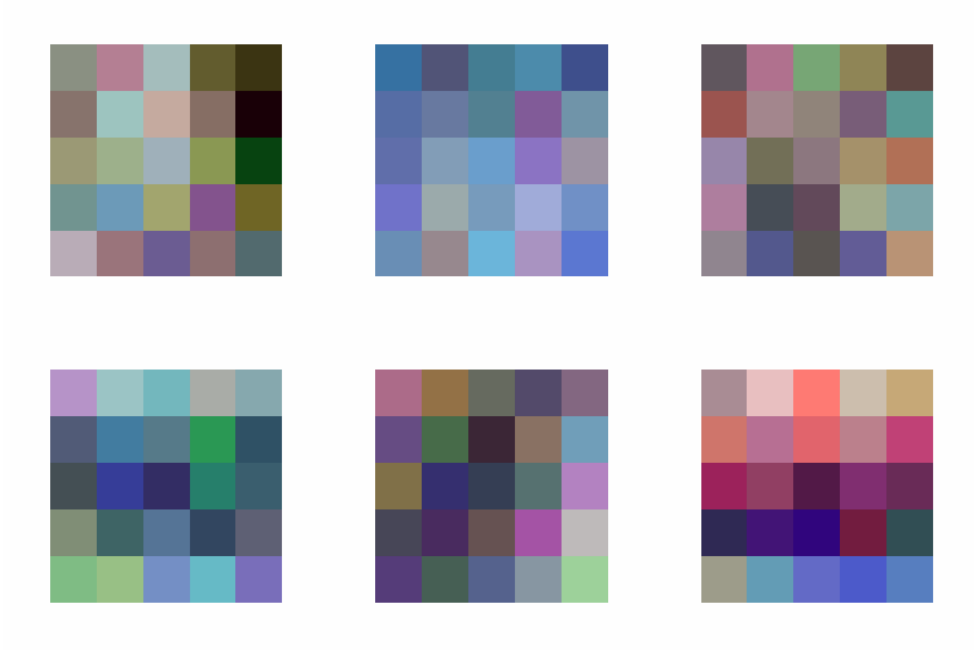


Figure 2: W1 filters learned from CIFAR-10.

Learned filters in W2

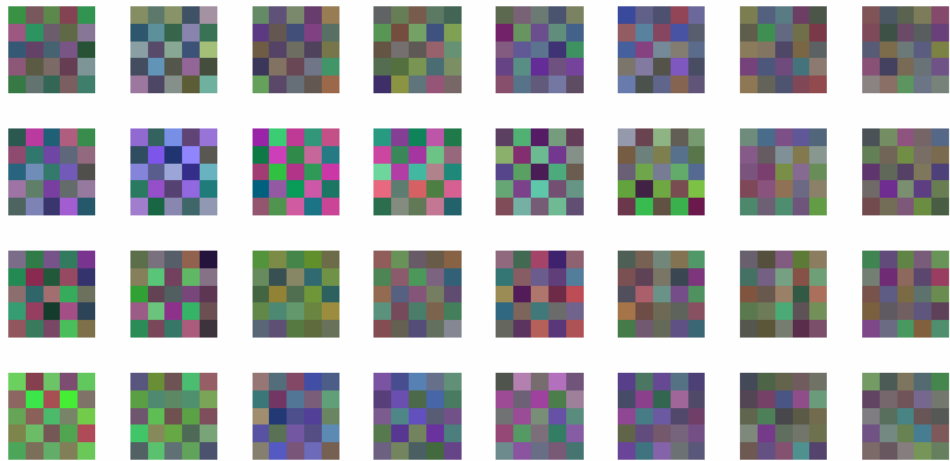


Figure 3: W2 filters learned from CIFAR-10.

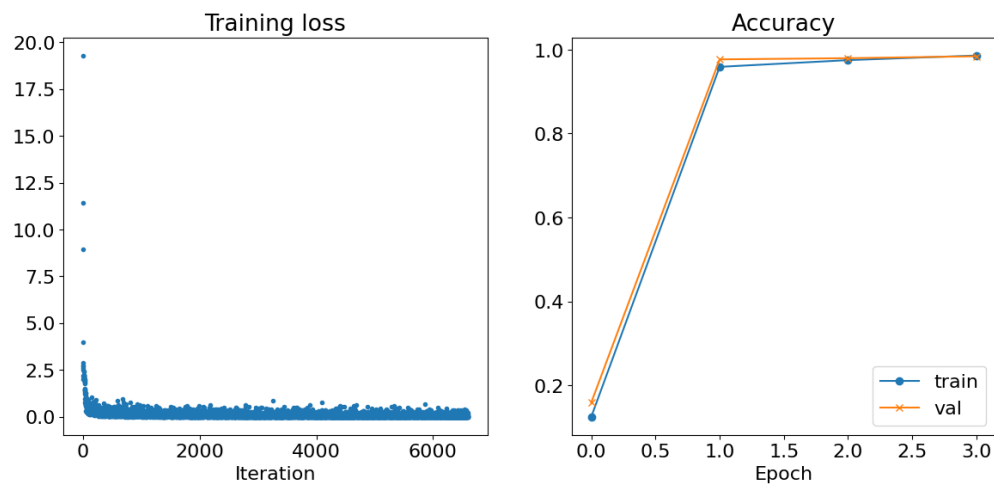


Figure 4: Training curves on MNIST.



Figure 5: W1 filters learned from MNIST.



Figure 6: W2 filters learned from MNIST.

2 [29 points] Image Captioning

- (a) Autograder.
- (b) Autograder.
- (c) We get a loss of around 0.08.

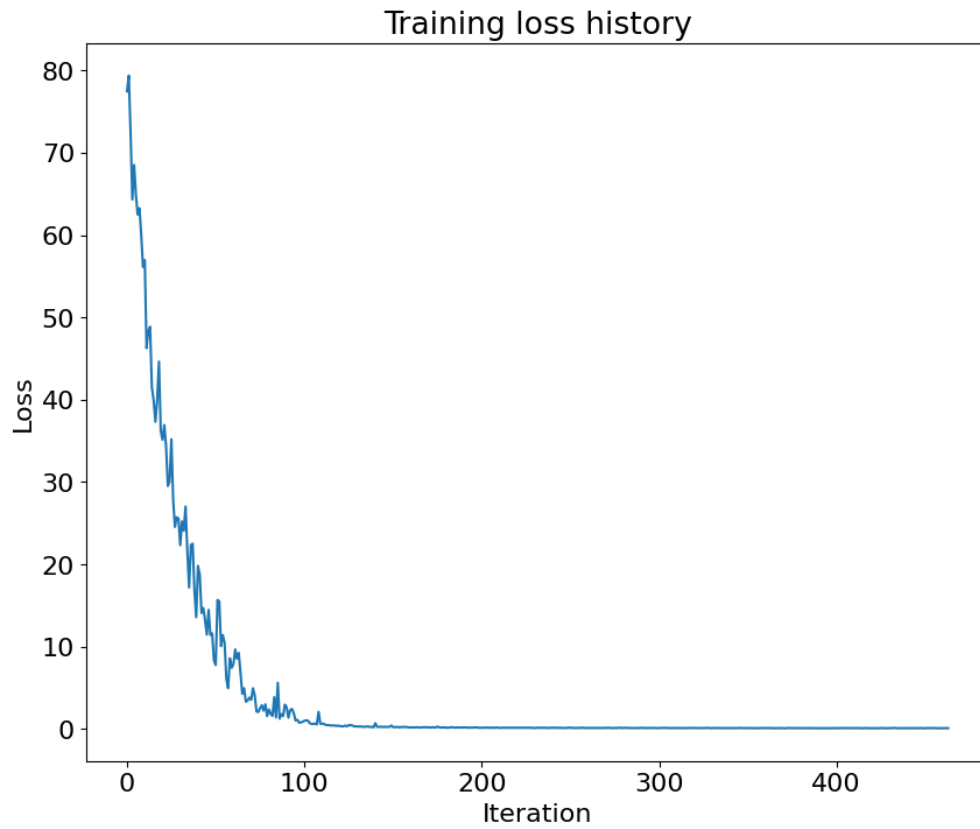


Figure 7: Captioning training loss.

Training samples

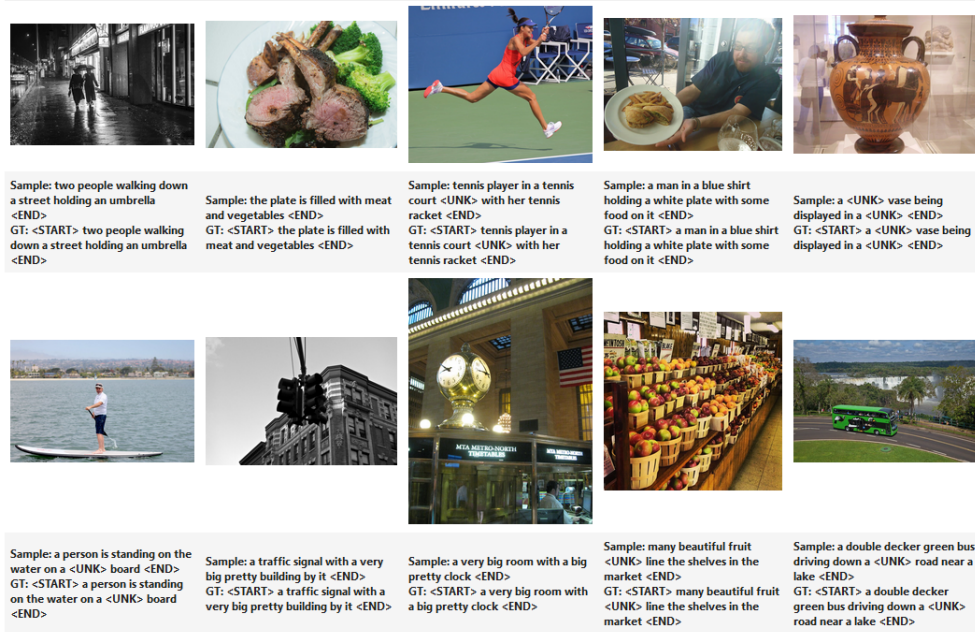


Figure 8: Captioning samples on train.

Validation samples



Figure 9: Captioning samples on validation. Note: We are overfitting by a large amount, as the validation samples are mostly nonsensical yet the train samples are almost perfect. This is expected since we only trained with a small number of training samples (only 200).

3 [18 points] Transfer Learning

Generated logs for finetuning:

```
Performance of pre-trained model without finetuning
Training complete in 0m 2s
Best val Acc: 0.535948
Finetune the model
Epoch 0/4
-----
train Loss: 0.5928 Acc: 0.6721
val Loss: 0.2599 Acc: 0.8824
Epoch 1/4
-----
train Loss: 0.5344 Acc: 0.8033
val Loss: 0.6706 Acc: 0.7516
Epoch 2/4
-----
train Loss: 0.5307 Acc: 0.7828
val Loss: 0.2479 Acc: 0.9085
Epoch 3/4
-----
train Loss: 0.5422 Acc: 0.7705
val Loss: 0.2626 Acc: 0.9085
Epoch 4/4
-----
train Loss: 0.4630 Acc: 0.8033
val Loss: 0.3123 Acc: 0.8954
Training complete in 0m 8s
Best val Acc: 0.908497
```

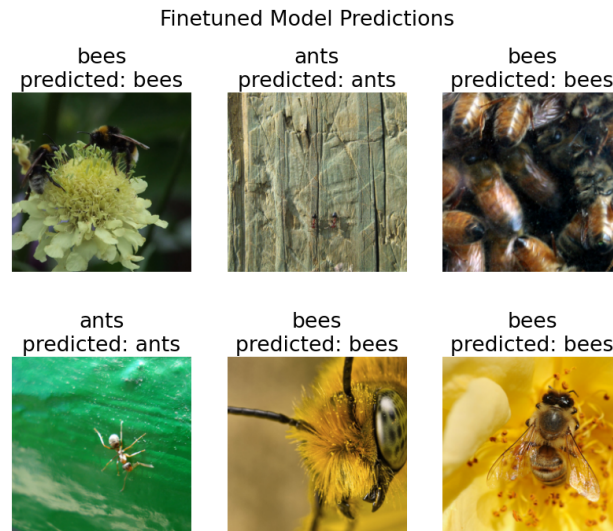


Figure 10: Finetune model predictions.

Generated logs for freezing:

```

Performance of pre-trained model without finetuning
Training complete in 0m 0s
Best val Acc: 0.692810
Finetune the model
Epoch 0/4
-----
train Loss: 0.6436 Acc: 0.6639
val Loss: 0.4897 Acc: 0.7582
Epoch 1/4
-----
train Loss: 0.5805 Acc: 0.7295
val Loss: 0.7089 Acc: 0.7255
Epoch 2/4
-----
train Loss: 0.3389 Acc: 0.8484
val Loss: 0.2048 Acc: 0.9346
Epoch 3/4
-----
train Loss: 0.4196 Acc: 0.7992
val Loss: 0.1989 Acc: 0.9412
Epoch 4/4
-----
train Loss: 0.4982 Acc: 0.7705
val Loss: 0.3592 Acc: 0.8627
Training complete in 0m 5s
Best val Acc: 0.941176

```

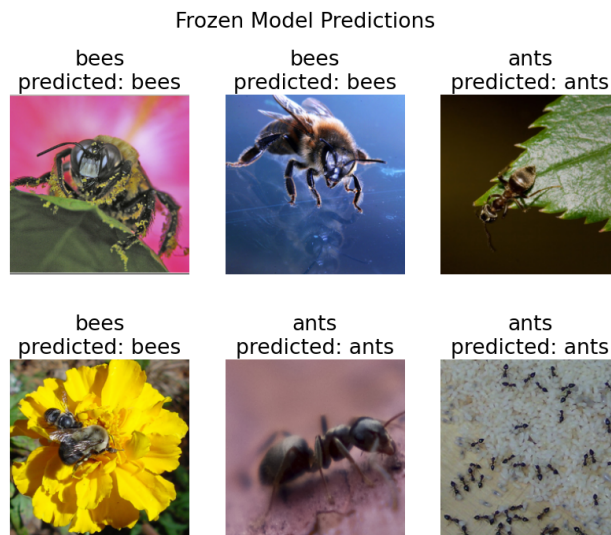


Figure 11: Freeze model predictions.

4 [19 points] Transformer Neural Networks

- (a) Autograder.
- (b) Instructor training accuracy: 99.78%, testing accuracy: 93.55%.

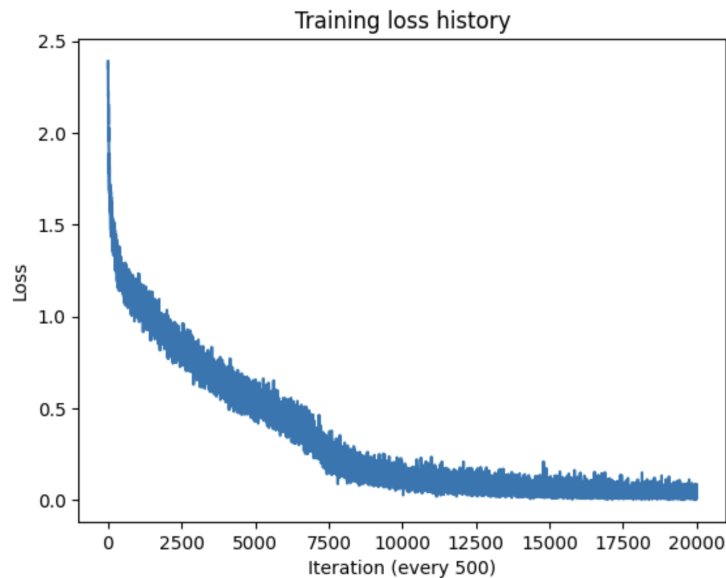


Figure 12: Transformer Multiplication Loss.

- (c) Instructor final loss: 0.6193.

Stories:

Story (1): Once upon a time, there was a girl named Lilly. She loved to help her mom whistle a small tower. One day, Lilly's mom asked her to play with her toys to practice on fun. Lilly felt happy that she wanted to catch her tower and tear her screws. She put an old wool in it tonight, and she smiled at her mom's face. She said, "Look, Lilly, a tower!" Her mom smiled and said, "Thank you, Lilly. You're my surprise." After a few weeks, Lilly's face came true. "Let's come hereal the tower again," her mom said, "we have no weel!". Lilly was happpy when she could study the tower. And she could not get her surprmise to drive much tower.

Story (2): Once there was an old man named Tom. Tom lived in a small corner on a center on a forest. One day, Tom's mom gave him a space. Tom asked, "What are you doing, my lovely?" Tom said, "I don't know, Tom." Tom was very sad and strange at Tom's head. They wanted to hear the man's friends. Tom wipt the man in the boring forest. He ran inside the house and ran inside. They smiled and said, "Let's fix this morning?" Tom noddod, eager to catch Tom's bike. He did not hear the loud noise. He smiled with delight when he tried to fix it, but he could never fix things again. He waved gooodbye to the leopator and went fast again through and waved back home. Tom was happpy to have his bike so he crosssed his feet in the water. He felt happpy and freee again.

Story (3): One day, Anna's mom told her to help and get it sad, but she wanted to make a wonderful storm. But Anna didn't want to make her sad orange. She said, "No mice, shooting many people were very sick." Anna said, "I want to help people, Anna. I will help you clean. You are not more fire to use me to make her happy."