

Week 5 Practice

CSCI 567 Machine Learning

Fall 2025

Instructor: Haipeng Luo

1. MULTIPLE-CHOICE QUESTIONS: One or more correct choice(s) for each question.

1.1. Which of the following is/are **true** about neural nets?

- (A) A neural net with one hidden layer and a fixed number of neurons can approximate any continuous function.
- (B) A fully connected feedforward neural net without nonlinear activation functions is the same as a linear model.
- (C) Dropping random neurons in each iteration of Backpropagation helps prevent overfitting.
- (D) A max-pooling layer with a 2×2 filter has 4 parameters to be learned.

1.2. Which of the following can help prevent overfitting in neural nets?

- (A) Retraining on the same data many times.
- (B) Using a validation set for early stopping.
- (C) Data augmentation.
- (D) Training until you get the smallest training error.

1.3. Suppose a convolution layer takes an 8×8 image with 3 channels as input and outputs a $4 \times 4 \times 8$ volume. Which of the following is a possible configuration of this layer?

- (A) One 4×4 filter with depth 8, stride 2, 1 pixel of zero-padding.
- (B) Three 4×4 filters with depth 8, stride 2, no zero-padding.
- (C) Eight 4×4 filters with depth 3, stride 2, 1 pixel of zero-padding.
- (D) Eight 4×4 filters with depth 3, stride 1, 1 pixel of zero-padding.

- 1.4.** How many parameters do we need to learn for the following network structure? An $32 \times 32 \times 3$ image input, followed by a convolution layer with 3 filters of size 3×3 (stride 1, 1 pixel of zero-padding), then another convolution layer with 4 filters of size 2×2 (stride 2, no zero-padding), and finally a max-pooling layer with a 2×2 filter (stride 1, no zero-padding). (Note: the depth of all filters are not explicitly spelled out, and we assume no bias/intercept terms are used.)
- (A) 43
 - (B) 97
 - (C) 129
 - (D) 145

- 1.5.** What is the final output dimension of the last question?
- (A) $15 \times 15 \times 1$
 - (B) $16 \times 16 \times 4$
 - (C) $32 \times 32 \times 1$
 - (D) $15 \times 15 \times 4$