MGT802 Quiz: Neural Networks

October 28, 2024

Instructions

- Do not flip over this page or read the questions on the other side of this page until the start of class.
- Your quiz will be collected after ten minutes.
- Write your netid *clearly* at the top right.
- *Unless otherwise stated*, each question has one correct answer.
- Fill in the appropriate bubble below. I will grade nothing but these bubbles. If you need to change an answer please indicate your final answer clearly.
- If a question stinks, Kyle will fix it later. I will not answer questions during the quiz.
- This quiz is closed book, closed device. You can only use your own meat computer.
- When you're done, *raise your hand* and an instructor will collect it.

Answers

1. (A) (B) (C) (D) (E)
2. (A) (B) (C) (D) (E)
3. (A) (B) (C) (D) (E)
4. (A) (B) (C) (D) (E)
5. (A) (B) (C) (D) (E)
6. (A) (B) (C) (D) (E)
7. (A) (B) (C) (D) (E)
8. (A) (B) (C) (D) (E)
9. (A) (B) (C) (D) (E)
10. (A) (B) (C) (D) (E)
11. (A) (B) (C) (D) (E)
12. (A) (B) (C) (D) (E)
13. (A) (B) (C) (D) (E)

0

1. Activations in one layer of a neural network are
   - 1 0 x Based on a weighted sum of the activations in the previous layer
   - 1 1 Randomly determined
   - 1 2 Set by the developer who is creating the neural network
   - 1 3 Independent of all the other layers in the neural network

1

1. In the 2Blue1Brown videos, the author's network for recongizing hand-written digits has about 13,000 parameters. These are *roughly*...
   - 2 0 The number of neurons
   - 2 1 x The number of connections between neurons
   - 2 2 The number of inputs
   - 2 3 The number of outputs

2

1. What is the significance of the "weights" and "biases" in a neural network as discussed in the video?
   - 3 0 x Weights determine the pixel pattern a neuron is picking up on, and biases indicate how high the weighted sum needs to be before the neuron becomes meaningfully active.
   - 3 1 Weights and biases are the types of neurons present in a neural network.
   - 3 2 Biases are responsible for recognizing edges while weights recognize patterns.
   - 3 3 Weights and biases are external inputs required to initiate the neural network.

3

1. What is the primary purpose of the sigmoid function in the neural network described in the video?
   - 4 0 To detect edges in the image input.
   - 4 1 To multiply the weighted sum of pixel values.
   - 4 2 x To squish the real number line into the range between 0 & 1 for neuron activation.
   - 4 3 To increase the complexity of the network for better digit recognition.

4

1. Which of the following best describes gradient descent in the context of neural networks as discussed in the video?
   - 5 0 A function with 784 inputs and 10 outputs defined in terms of all of the weighted sums.
   - 5 1 A method to initialize all weights and biases randomly in the network.
   - 5 2 x A process of repeatedly nudging an input of a function by some multiple of the negative gradient to minimize a cost function.
   - 5 3 A method to visualize the weights of the connections between neurons in different layers.

5

1. What is the primary purpose of a cost or "loss" function in a neural network as described in the video?
   - 6 0 To initialize the weights and biases of the network.
   - 6 1 To visualize the transitions from one layer of neurons to the next.
   - 6 2 x To provide a measure of how well the network is performing based on training examples.
   - 6 3 To categorize the output into one of the 10 digits.

6

1. According to the video, why is the concept of gradient descent crucial in the training of neural networks?
   - 7 0 It allows the network to memorize the training data perfectly.
   - 7 1 x It facilitates the minimization of a cost function to improve the network's performance.
   - 7 2 It randomly initializes the weights and biases to start the training process.
   - 7 3 It helps in visualizing the weights between different layers of neurons.

7

1. If $f(x) = (2x + 3)^5$, find $f'(x)$ using the chain rule.
   - 8 0 $(2x + 3)^5$
   - 8 1 $2(2x + 3)^4$
   - 8 2 x $10(2x + 3)^4$
   - 8 3 $5(2x + 3)^4$

8

1. Imagine A is a 2x3 matrix and B is a 3x5 matrix. What are the dimensions of AB?
   - 9 0 3x3
   - 9 1 x 2x5
   - 9 2 3x5
   - 9 3 5x2
   - 9 4 5x3

9

1. How does backpropagation use individual training examples to adjust the weights and biases in a neural network?
   - 10 0 x By computing how each training example would like to nudge the weights and biases, then averaging these desired changes across all examples.
   - 10 1 By randomly shuffling the training examples and selecting one to adjust the weights and biases.
   - 10 2 By directly modifying the activations of neurons based on each training example.
   - 10 3 By creating new layers in the network based on the complexity of each training example.

10

1. What is the purpose of using mini-batches in the context of stochastic gradient descent as explained in the video?
   - 11 0 To ensure that the network converges to a global minimum of the cost function.
   - 11 1 To increase the accuracy of the gradient calculation by considering all training examples.
   - 11 2 x To take steps according to a subset of training data, providing a good approximation of the gradient while speeding up computation.
   - 11 3 To create a new cost function based on subdivided data.

11

1. The videos suggests that when adding more neurons to each layer of the network, what primarily changes in the backpropagation calculus?

- 12 0 The fundamental equations of backpropagation change.
- 12 1 x More indices are introduced to keep track of various neurons within a layer.
- 12 2 The chain rule no longer applies in the same way.

12

1. What is the meaning of life?
   - 13 0 x 42
   - 13 1 x programming
   - 13 2 x machine learning

Answer Key