Generative Exam

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Course	Generative

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Instructions

Questions

Question 1 (Multiple Choice)

In the context of training Generative Adversarial Networks (GANs), what is crucial for maintaining a stable training process and preventing the discriminator from becoming overwhelmingly superior?

Question 2 (Multiple Choice)

In the context of Generative Adversarial Networks (GANs), what is 'mode collapse'?

Question 3 (Multiple Choice)

In the context of generative models, what is mode collapse?

Question 4 (Multiple Choice)

In the context of disentangled Z-space, what is the primary advantage of using a one-hot class vector as input alongside the noise vector?

Question 5 (Multiple Choice)

In the context of controllable generation using classifier gradients, what is the primary purpose of a pre-trained classifier?

Question 6 (Fill Blank)

To modify your output in controllable generation, you manipulate the to influence specific features.

Question 7 (Fill Blank)

Batch normalization helps speed up the training process by reducing , which refers to the change in the distribution of activations during training.

Question 8 (Fill Blank)

In image processing, the process of reducing the size of an image by selecting the maximum value within a given region is called .

Question 9 (Fill Blank)

Activation functions are and differentiable.

Question 10 (Fill Blank)

In PyTorch, the function is used to define the forward computation of a model with inputs x.

Question 11 (Short Essay)

Explain the concept of disentanglement in the context of generative models, including methods to encourage it and the challenges posed by entanglement. Use examples from the provided course content.

Question 12 (Short Essay)

Explain the roles of the generator and discriminator in a Generative Adversarial Network (GAN), and describe how their interaction leads to the generation of realistic fake data. Include a discussion of the feedback mechanism between the two components.

Question 13 (Short Essay)

Compare and contrast controllable generation and conditional generation in the context of image generation. Discuss the key differences in their approaches, training requirements, and the resulting outputs.

Question 14 (Short Essay)

Compare and contrast StyleGAN2 and CycleGAN, focusing on their applications and the types of image generation they excel at. Include a brief explanation of Generative Adversarial Networks (GANs) in your response.

Question 15 (Short Essay)

Explain the concept of batch normalization in deep learning, detailing its benefits and how it addresses the problem of internal covariate shift. Include a comparison of its training and testing phases.

Question 16 (Long Essay)

Critically analyze the training dynamics and architectural considerations of Generative Adversarial Networks (GANs), focusing on the interplay between the generator and discriminator, the importance of the 1-Lipschitz continuous condition for the critic, and the contrasting approaches of unconditional and conditional generation. Discuss how these elements contribute to the generation of high-quality and controllable outputs, illustrating your points with examples from the provided course content.

Question 17 (Long Essay)

Critically analyze the Generative Adversarial Network (GAN) framework, focusing on the roles and interactions of the generator and discriminator. Discuss how the adversarial process leads to the generation of realistic synthetic data, highlighting the importance of the Binary Cross-Entropy (BCE) cost function and the concept of probability in guiding the learning process. Finally, compare and contrast GANs with other generative models, briefly outlining their strengths and weaknesses.

Question 18 (Long Essay)

Critically analyze the development and applications of Generative Adversarial Networks (GANs) in computer vision, focusing on their strengths, limitations, and the evolution of their capabilities from early implementations to state-of-the-art models like StyleGAN2. Consider the impact of GANs on diverse applications such as image generation, image translation, and 3D object generation, citing specific examples from the provided course content and relevant research papers (Zakharov et al., 2019; Wu et al., 2016; Karras et al., 2020; Park et al., 2019). Discuss the ongoing challenges and future research directions in the field.

Question 19 (Long Essay)

Compare and contrast the training processes of a Generative Adversarial Network (GAN) and a standard supervised learning model in PyTorch. Analyze the roles of the cost function, optimizer, and the forward pass in both contexts. Furthermore, discuss the challenges associated with training GANs, particularly focusing on the need for a balance between the discriminator and generator performance and the implications of a superior discriminator. Finally, explain how the concept of a 'disentangled Z-space' relates to the generation of meaningful and controllable outputs from GANs.

Question 20 (Long Essay)

Critically analyze the Generative Adversarial Network (GAN) framework, focusing on the interplay between the generator and discriminator. Explain how each component functions, their respective goals, and how their interaction leads to the generation of realistic synthetic data. Furthermore, discuss the role of the Binary Cross Entropy (BCE) cost function in optimizing the network's performance and the limitations of GANs.

Question 21 (Coding)

Implement a function that performs a 2D convolution on a grayscale image represented as a list of lists.

Test Cases:

Input: {'image': [[50, 50, 0, 0, 0], [50, 50, 0, 0, 0], [50, 50, 0, 0, 0], [50, 50, 0, 0, 0], [50, 50, 0, 0, 0]], 'filter': [[1, 0, -1], [1, 0, -1], [1, 0, -1]], 'stride': 1, 'padding': 0}
Expected Output: [[150, 150, 0], [150, 150, 0], [150, 150, 0]]
Input: {'image': [[1, 2, 3], [4, 5, 6], [7, 8, 9]], 'filter': [[0, 1], [1, 0]], 'stride': 1, 'padding': 0}
Expected Output: [[2, 4], [8, 10]]
Input: {'image': [[1, 2, 3], [4, 5, 6], [7, 8, 9]], 'filter': [[1, 0], [0, 1]], 'stride': 2, 'padding': 0}
Expected Output: [[1, 6], [7, 0]]

Question 22 (Coding)

Implement a function to calculate the Binary Cross-Entropy (BCE) loss for a batch of predictions and labels. The function should handle both single-label and multi-label scenarios.

Test Cases:

Input: {'predictions': [0.9, 0.1, 0.7, 0.3], 'labels': [1, 0, 1, 0]}
Expected Output: 0.2364918666886964
Input: {'predictions': [[0.9, 0.1], [0.1, 0.9], [0.7, 0.3], [0.3, 0.7]], 'labels': [[1, 0], [0, 1], [1, 0], [0, 1]]}
Expected Output: 0.2364918666886964
Input: {'predictions': [0.1, 0.9, 0.2, 0.8], 'labels': [0, 1, 0, 1]}
Expected Output: 0.8618566267362774
Input: {'predictions': [[0.1, 0.9], [0.9, 0.1], [0.2, 0.8], [0.8, 0.2]], 'labels': [[0, 1], [1, 0], [0, 1], [1, 0]]}
Expected Output: 0.8618566267362774

Question 23 (Coding)

Implement a function to simulate a simplified version of disentanglement in a latent space. Given a list of feature vectors (representing points in a latent space) and a target feature, your function should find the direction in the latent space that maximizes the influence on the target feature while minimizing the influence on other features.

Test Cases:

Input: [[[1, 2, 3], [4, 5, 6], [7, 8, 9]], 0]
Expected Output: [0.5773502691896257, 0.5773502691896257, 0.5773502691896257]
Input: [[[1, 2, 3, 4], [5, 6, 7, 8], [9, 10, 11, 12], [13, 14, 15, 16]], 2]
Expected Output: [0.5, 0.5, 0.5, 0.5]