1.What are the main tasks that autoencoders are used for?

Ans.

Autoencoders are used for various tasks such as dimensionality reduction, data compression, feature extraction, denoising, anomaly detection, and image generation.

2.Suppose you want to train a classifier, and you have plenty of unlabeled training data but only a few thousand labeled instances. How can autoencoders help? How would you proceed?

Ans.

Autoencoders can be used to pretrain the neural network with unsupervised learning on the unlabeled data, and then fine-tune the network with supervised learning on the labeled instances. This can help improve the classifier's performance, as the pretrained network can learn useful features from the unlabeled data.

3.If an autoencoder perfectly reconstructs the inputs, is it necessarily a good autoencoder? How can you evaluate the performance of an autoencoder?

Ans.

Not necessarily. A good autoencoder should not only reconstruct the inputs accurately, but also learn useful representations or features from the data. The performance of an autoencoder can be evaluated by measuring the reconstruction error, or by examining the quality of the learned features in downstream tasks.

4.What are undercomplete and overcomplete autoencoders? What is the main risk of an excessively undercomplete autoencoder? What about the main risk of an overcomplete autoencoder?

Ans.

Undercomplete autoencoders have a smaller number of hidden units in the bottleneck layer than the input or output layers, while overcomplete autoencoders have more hidden units than the input or output layers. An excessively undercomplete autoencoder may not be able to capture all the important information in the data, while an overcomplete autoencoder may learn to simply copy the inputs without capturing useful features.

5.How do you tie weights in a stacked autoencoder? What is the point of doing so?

Ans.

Tying weights in a stacked autoencoder means using the transpose of the weights in the encoder layers as the weights in the decoder layers. The point is to reduce the number of parameters in the network and prevent overfitting, while still allowing the network to learn meaningful representations.

6.What is a generative model? Can you name a type of generative autoencoder?

Ans.

A generative model is a type of model that can generate new instances of data that are similar to the training data. A type of generative autoencoder is the variational autoencoder (VAE).

7.What is a GAN? Can you name a few tasks where GANs can shine?

Ans.

A GAN (Generative Adversarial Network) is a type of generative model that uses a pair of neural networks to generate new data that is similar to the training data. GANs can shine in tasks such as image generation, image editing, data augmentation, and style transfer.

8.What are the main difficulties when training GANs?

Ans.

The main difficulties when training GANs include mode collapse (where the generator produces limited variations of the same samples), vanishing gradients (where the discriminator gradients become too small to provide meaningful feedback to the generator), instability (where the generator and discriminator networks oscillate and fail to converge), and evaluation (where it is difficult to measure the quality of the generated samples objectively).