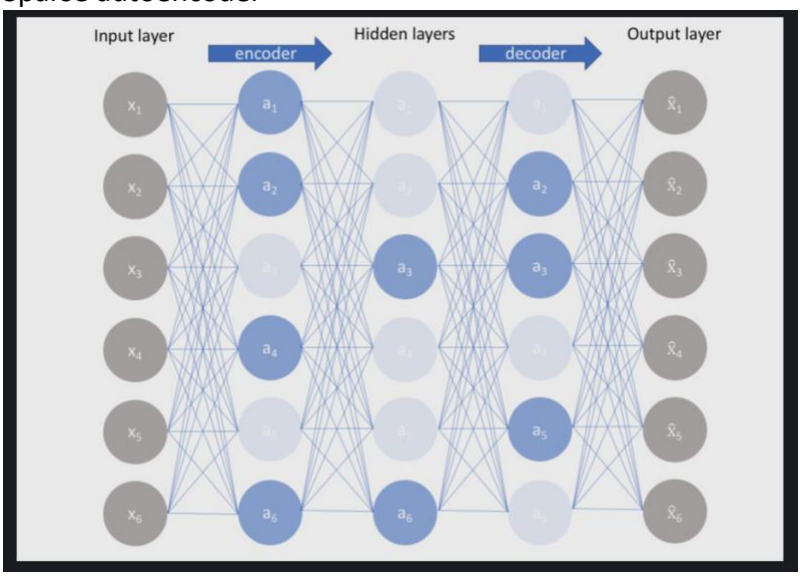
1.
Sparse autoencoder



Comparing with vanilla autoencoder
Advantage:
Sparse autoencoder doesn't need dimension reduction for bottle neck. It can be implemented by adding a L1 regularization to the loss function for each neuron. This way, we can let this model learn which neuron to has heavy penalty with the data it learns with.
Disadvantage:
Sparse autoencoder sometimes can be computationally expensive as it doesn't reduce dimension during the hidden layer.
Ref:
https://www.jeremyjordan.me/autoencoders/
https://web.stanford.edu/class/cs294a/sparseAutoencoder.pdf
2.
fully connected autoencoder model architecture:

```
fcn_autoencoder(
  (encoder): Sequential(
    (0): Linear(in_features=12288, out_features=2048, bias=True)
    (1): ReLU()
    (2): Linear(in_features=2048, out_features=1024, bias=True)
    (3): ReLU()
    (4): Linear(in_features=1024, out_features=512, bias=True)
    (5): ReLU()
    (6): Linear(in_features=512, out_features=256, bias=True)
    (7): ReLU()
    (8): Linear(in_features=256, out_features=128, bias=True)
  )
  (decoder): Sequential(
    (0): Linear(in_features=128, out_features=256, bias=True)
    (1): ReLU()
    (2): Linear(in_features=256, out_features=512, bias=True)
    (3): ReLU()
    (4): Linear(in_features=512, out_features=1024, bias=True)
    (5): ReLU()
    (6): Linear(in_features=1024, out_features=2048, bias=True)
    (7): ReLU()
    (8): Linear(in_features=2048, out_features=12288, bias=True)
    (9): Tanh()
  )
)
```

Original image

Reconstructed image **without** adjusting the latent representation

Latent adjustment 1: Reconstructed image with latent z *= 2

Latent adjustment 2: Reconstructed image with latent z += 2

From the above 4 pictures, the reconstructed images without latent adjustment looks more similar to the original image. With latent adjustment 1 z*=2, the picture becomes really dark. Therefore, it indicates that the latent representation's values actually have positive correlation with the reconstructed image(0~255, larger value is darker). Whereas latent adjustment 2 z+=2 the picture indeed becomes darker a little bit than the original reconstructed image, but the whole picture remains lighter color than latent adjustment 1.