**Autoencoder (AE)**

Autoencoders was introduced all the way back in 1986 by Rumelhart et al [19] as a neural network that were reconstructing the input [18, 19]. An autoencoder is an unsupervised learning methods for lower dimensional feature representations [93] and is a neural network that consists of two parts: an encoder and a decoder. The model encodes the dimension of the original data into a smaller (or bigger) represen- tation of the original data, then try to recreate (decode) the original data. The compressed representation of the original data is known as the latent space or latent representation, which can learn the features of the data or its distribution [93, 17, 18]. The latent representation is a lower dimension representation of the data, which is a lower dimensionality approximation of the data [93]. Autoencoders are typically used for noise reduction and data compression [18]. The most basic autoencoders with only linear operations would manage to accomplish similar latent representation as Principal Component Analysis (PCA), which implies that autoencoders is a generalization of PCA [18, 20].

Diagram of a diagram of a bottleneck and a bottleneck

Description automatically generated

Figure 1. <https://medium.com/@ashwinnaidu1991/unraveling-the-mystique-of-variational-autoencoders-a-comprehensive-guide-to-understanding-and-10cf71925b20>

An autoencoders is not a generative model, since it only reconstructs the input, so why is it relevant in this user case? Autoencoders is often seen as the first step or introduction to generative models. And a GAN also utilize an encoder-decoder structure, which is similar to an autoencoder. The training instability of a GAN can have many explanations, but it is possible to check the capacity of the GANs encoder-decoder structure to verify if it is able to reconstruct the original data; and that is possible to check using and training the GANs encoder-decoder (generator) structure as a simple autoencoder. The idea is that if an autoencoder manages to reconstruct the input data, then the same encoder-decoder structure should have the capacity to reconstruct the input data in a GAN.