**Variational Autoencoders**

Summary

Variational Autoencoders are an approach to unsupervised learning. With the help of VAEs, we can describe latent variables (variables that are not directly observed but are instead inferred through a mathematical model from other variables that are directly-measured) in probabilistic terms rather than a single value.

Most of the approaches may require strong assumptions about the structure in data. They might make severe approximations, which leads to suboptimal models. They also might rely on computationally expensive inference problems.

**Benefits of VAEs:**

* Assumptions of this model are weak, and training is fast via backpropagation.
* Makes an approximation, but the error introduced by this approximation is minimal given high capacity models.

**The problem dealt by VAEs:**

How to choose the latent variables to capture latent information?

VAEs overcome this problem by assuming that there is no simple interpretation of the dimension of z and by asserting that samples of z can be drawn from a simple distribution.

Note: z is the digit value from the set {0,1,2……, 9}

**Conditional Variational Autoencoders:**

It allows us to tackle problems where the input-to-output mapping is one-to-many without explicitly specifying the output structure.

CVAEs are used when we want to add digits in an existing string of numbers written by a single person. This problem is commonly known as hole filling.