VIVEKANAND EDUCATION SOCIETY'S INSTITUTE OF TECHNOLOGY

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Department of Artificial Intelligence and Data Science

Subject: AAI Lab **Class:** D16AD **Semester:** 8

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Exp. No.: 7	Title: To implement VAE using fashion mnist dataset		
DOP:		DOS:	
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Subrato_60_D16AD

A.AI. Experiment #7

* Aim: To implement variational autoencoder using fashion MNIST dataset

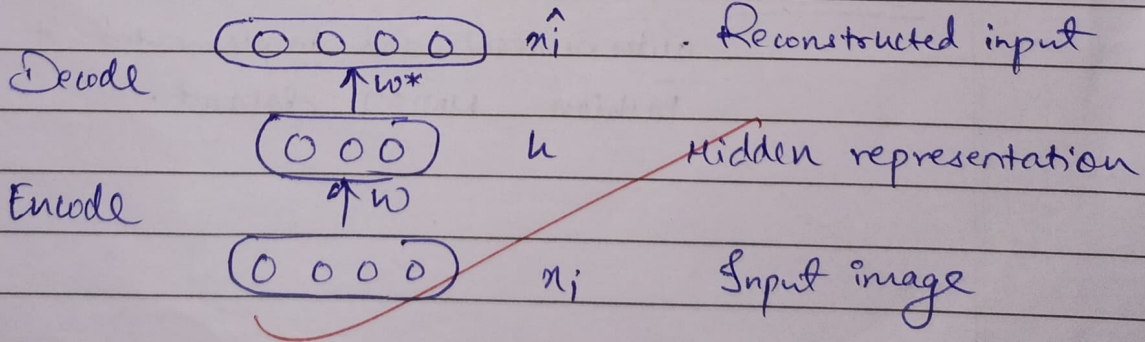
* Theory: • Autoencoder: An autoencoder is a special type of feed forward neural network which does the following:

- Encode: It takes input 'x' and encodes in into hidden representation 'H' using encoding function: $h = g(wx_i + b)$
- Decode: It decodes the hidden representation 'h' Back to input (x_i) again. Decoding function: $\hat{x}_i = f(w^* h + c)$

This is done in order to capture all the important characteristic of input data in hidden representation 'h' so that we can reconstruct it back. This process is known as dimensionality reduction which helps to save bandwidth and cost by transferring data.

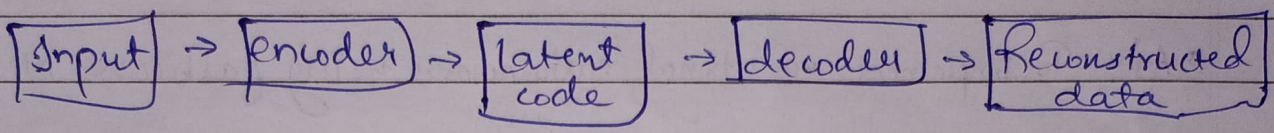
Types of AE are → Undercomplete & Overcomplete

* Vanilla Autoencoders:



* Variational AE: Deep learning model that can generate new data samples. It comprises of 2 parts → Encoder & Decoder n/w. The encoder maps the input data to a lower dimensional latent space, the decoder n/w maps the latent representation back to the original data space.

* Variational AE:



• Regularisation in VAE → It is applied to the latent code.
In a VAE, the latent code is regularized using Gausian distribution with fixed mean and variance. This regularization helps to prevent overfitting by encouraging the latent code to have smooth distribution rather than memorizing the training data.

This regularization also allows the VAE to generate new data samples that are smoothly interpoled b/w training the data points. This makes VAEs powerful tool for generating new data samples similar to training data. Further more, regularization in VAE can also prevent the decoder n/w from reconstructing the input data perfectly. Instead the decoder n/w is forced to learn more general representation of data which can help to improve VAE's ability to generate new data samples.

* Conclusion: We have understood the working of variational autoencoders and implemented it using Python on Fashion MNIST dataset.