Assignment 3

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# Introduction

This lab assignment explores the implementation and application of Variational Autoencoders (VAEs) using the Fashion MNIST dataset. The project involves building a custom VAE architecture with a latent dimension of 2, including both encoder and decoder components, and implementing a custom sampling layer for the latent space. The VAE is designed to learn compressed representations of fashion items while maintaining the ability to generate new samples from the learned latent space. Through this implementation, the assignment demonstrates key concepts in deep learning including convolutional neural networks, dimensionality reduction, and generative modeling.

The implemented VAE demonstrates effective learning and generation capabilities with Fashion MNIST data. The architecture consists of an encoder with five convolutional layers reducing the 28x28 images to a 2-dimensional latent space, followed by a decoder that successfully reconstructs the images through transposed convolutions. The latent space visualization shows clear clustering of different fashion items, indicating the model has learned meaningful representations. The 10x10 grid of generated samples displays fashion items with varying levels of detail, suggesting that while the model has captured the overall data distribution, additional training epochs could potentially enhance the generation quality in certain regions of the latent space. The generated images maintain recognizable characteristics of clothing items, validating the effectiveness of the VAE's generative capabilities.

### Display (print) a summary of the model using summary(). Draw a diagram illustrating the structure of the neural network model, making note of the size of each layer (# of neurons), number of weights in each layer and the unique connection between the latent space layer and the sample output layer.

A diagram of a diagram

Description automatically generated

### 5. Display (print) a summary of the model using summary(). Draw a diagram illustrating the structure of the neural network model, making note of the size of each layer (# of neurons), number of weights in each layer.

A diagram of a layer structure

Description automatically generated

### Display (print) a summary of the model using summary(). Draw a diagram illustrating the structure of the neural network model, making note of the size of each layer (# of neurons), number of weights in each layer.

A diagram of a data flow

Description automatically generated

## Review sample code below and generate 10x10 sample

A yellow and blue pattern

Description automatically generated

## Display (plot) the latent space of z\_mu of the test dataset

A colorful dots in a chart

Description automatically generated with medium confidence