Variational Autoencoder

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Variational Encoder learns the distribution of latent features instead of learning the latent features from the sample input directly. The latent features of the input data follow a standard normal distribution. Variational Autoencoders (VAEs) calculate the mean and variance of the latent vectors (instead of directly learning latent features) for each sample.

Encoder.

The autoencoder has an encoder that usually consists of multiple repeating convolutional layers which have shared layers when the input data type is images. The encoder model has only two layers (enc_dense_1 and enc_dense_2) activated by ReLu activation function. The encoder has 2,083,284 trainable parameters.

Decoder.

The job of the decoder is to take the input from the encoder and recreate the original image. The decoder part is made up of multiple pairs of the Deconvolutional layers and upsampling layers. The Decoder model has only two layers (enc_dense_1 and enc_dense_2) activated by ReLu activation function and enc_dense_3 layer has sigmoid activation function. The Decoder has 2,083,552 trainable parameters.

Modified loss function for the model.

Computes the cross-entropy loss between true labels and predicted labels. Cross- entropy loss for binary (0, 1). The loss function requires the input which is, Y_true (true label): This is either 0 or 1. Y_pred (predicted value): This is the model's prediction, i.e., a single floating point.

Loading the MNIST hand-drawn digits datasets.

Datasets is divided into training and test sets. The training datasets consist of 60k hand-drawn digits with an image resolution of 28*28 and the test datasets consist of 10k digits with similar dimensions.

Training the Model.

In this section, we have trained the vae model using the settings epochs = 100, batch size = 64 and validation as (x_test, y_test) and have stored them in the dictionary "History" to plot them later. The model was trained using different epochs and batch sizes, but the validation loss had no difference. The epochs tried were 10, 20, 50, and 100.

Plotting and generating the results.

In this section, the reconstruction capabilities can be seen of the model on the test images. The code had picked 5 hand-drawn images from the test dataset, and we have plotted the reconstruction images for them. Unfortunately, I tried my level best to plot the reconstructed images but I don't know where the problem is.