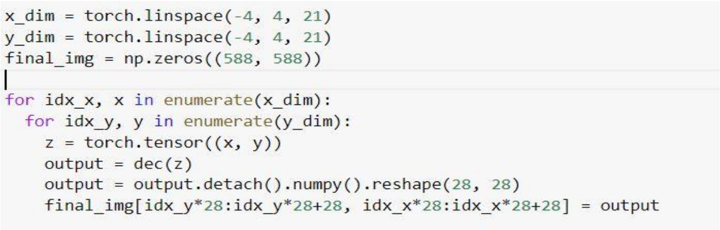
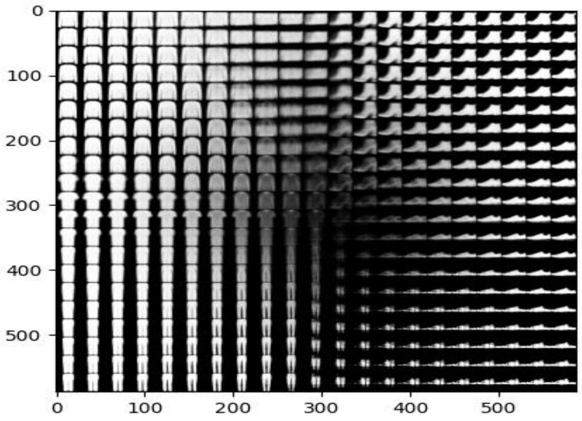
LAB 8 **Student ID: 32770995**

Question 1

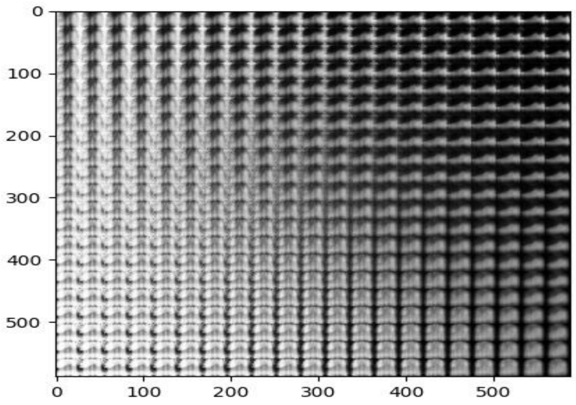


```
x_dim = torch.linspace(-4, 4, 21)
y_dim = torch.linspace(-4, 4, 21)
final_img = np.zeros((588, 588))

for idx_x, x in enumerate(x_dim):
  for idx_y, y in enumerate(y_dim):
    z = torch.tensor((x, y))
    output = dec(z)
    output = output.detach().numpy().reshape(28, 28)
    final_img[idx_y*28:idx_y*28+28, idx_x*28:idx_x*28+28] = output
```



Question 2



Question 3

In image in question 2, the autoencoder produces outputs that are not clear. The outputs produced in image in question 1 are clearer and the category of each tiny image more distinguishable. In autoencoder, The encoder compresses the image and represents it as a point in latent space. Each category of the data (boots, shoes, etc) may form their own point in the latent space and there may be some region in the latent space that are not occupied by any points. Hence, these regions when sampled may produce output that are not clear as they do not have any points. In VAE, the encoder produces the mean and standard deviation of latent variables, and these are used to create sampled latent distribution passed into the decoder. The loss function used ensures that there are no big gaps between the distributions formed by each category of data in the latent space. When regions from overlapping distributions of categories are sampled, morphed data is formed. The multivariate distribution allows VAE to generate diverse set of images for each data category.