

**Introduction:**

For this part of the project, I will explore the mean-field inference for binary images using the first 500 MNIST training images.

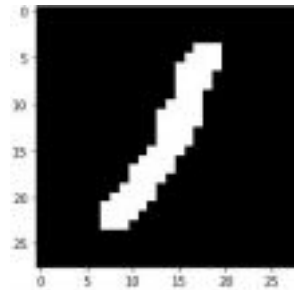
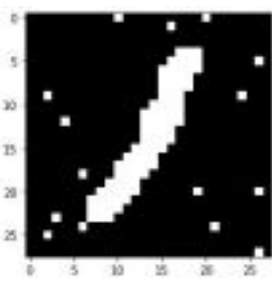
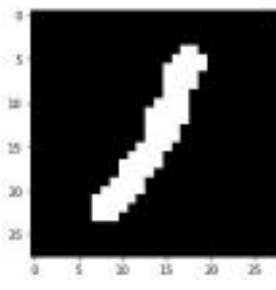
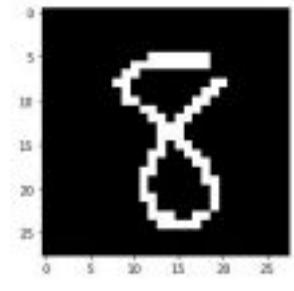
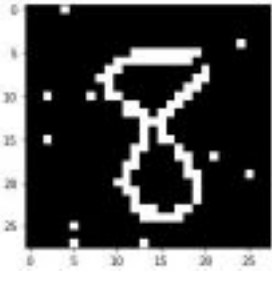
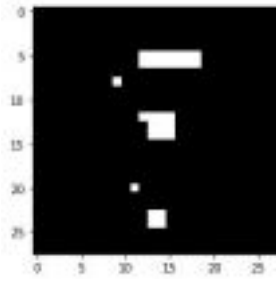
**Process:**

- Firstly, I binarize the first 500 images by mapping any value below 0.5 to -1 and any value above 0.5 to 1.
- Then, for each image, I create a noisy version by randomly flipping 2% of the bits.
- Moreover, I denoise each image using a Boltzmann machine model and mean-field inference.
- In the conclusion, I will report the accuracy of this machine model and the original, noisy, and reconstruction versions of the most and least accurate reconstruction.

**Conclusion:**

After denoising, each image by using a Boltzmann machine model and mean-field inference, the average accuracy over the 500 images is 0.9809.

The following table contains the original images, noisy images, and reconstruction images for the most accurate reconstruction and least accurate reconstruction.

	Original Images	Noisy Images	Reconstruction Images
Most Accurate Reconstruction			
Least Accurate Reconstruction			

For the image with the most accurate reconstruction, it is clear that the original, noisy, and reconstruction versions of the handwritten digit “1” are almost identical. For the image with the least accurate reconstruction, it is clear that the original and noisy versions of the handwritten digit “8” are almost identical but the reconstruction version of it is difficult to identify.