

AI 2024, Assignment 2:

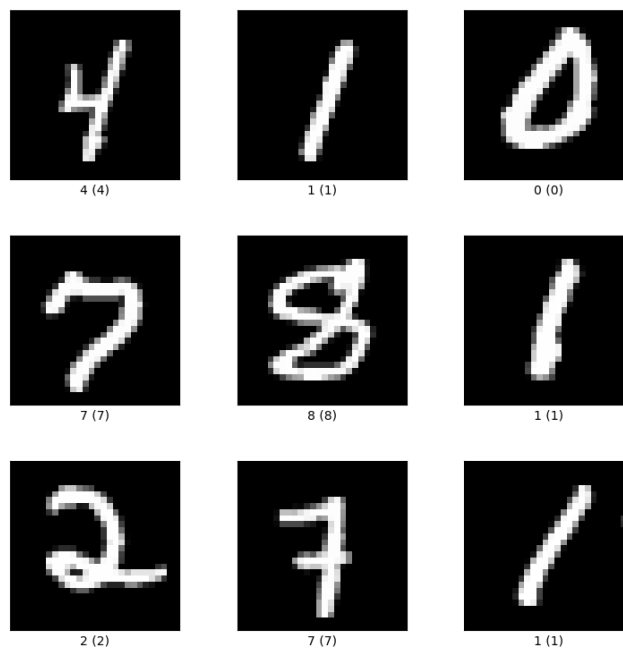
Autoencoders (AE)

In this assignment, you will explore and implement various Autoencoder architectures to process the MNIST dataset, focusing on three types of Autoencoders:

- Convolutional Autoencoder (CAE): The primary focus will be on the clarity and quality of image reconstruction.
- Variational Autoencoder (VAE): Emphasize generating new images and visualizing the latent space.
- Denoising Autoencoder (DAE): Concentrate on the effectiveness of denoising noisy input data.

MNIST

<https://yann.lecun.com/exdb/mnist/>



The **MNIST** dataset consists of 70,000 grayscale images of handwritten digits (0-9), which is widely used for benchmarking machine learning models.

Task Requirements:

1. **Model Construction:** Implement three Autoencoder models: CAE, VAE, and DAE using TensorFlow or PyTorch.
2. **Model Training:** Train each model with appropriate settings, including the optimizer, learning rate, and batch size. For VAE, ensure the latent space is visualized and demonstrate the generation of new samples from the latent space. For DAE, train the model to denoise input data that has been corrupted with noise.
3. **Performance Evaluation:** Compare the reconstruction results for each model using evaluation metrics like Mean Squared Error (MSE).
4. **Results Visualization:** Present sample reconstructions for each Autoencoder and visualize the latent space for VAE and provide examples of generated samples. Include training loss curves for each model, as well as comparisons between reconstructed and original images.

Deliverables:

1. The code implementation with appropriate comments.
2. A detailed report on the results, including reconstruction accuracy, loss metrics, and the rationale behind your model design decisions.
3. Relevant charts and visuals such as training curves, comparisons between reconstructed and original images for each model, and visualizations of the latent space and generated images for the VAE.