

[Return to Assessments page](#)

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Worksheet 06 - denoising challenge

Part 1

Please state the names of all the students you worked with on this assignment:

Answer Point Value: 0.0 points

Model Short Answer: -----

Part 2: Denoising challenge

You are given MNIST-type data 26000 images picturing the handwritten digits $\{0, \dots, 9\}$. The data consists of 20000 clean training images (**training_images_clean**), 2000 clean (**validation_images_clean**) and their corresponding noisy (**validation_images_noisy**) versions, and a noisy test set (**test_images_noisy**) of 2000 images. Your task is to train a denoising autoencoder (DAE) model to remove noise from images.

As a submission, please upload your denoised version of the test set (**test_images_clean**). For the tutorial, be prepared to show your code, explain how you prepared the data, how you chose the network architecture and other hyperparameters, how you validated the model, and show the convergence of the training error. To load and visualize the data as well as save your prediction, please refer to the following code snippet:

<https://gist.github.com/cwehmeyer/ad6b3e8adcc212ec493bb1fda69c1d22>

The noise in this challenge is of Gaussian type with mean $\mu = 0$ and an unknown parameter σ :

$$\text{image}_{c,i,j}^{\text{noisy}} = \text{image}_{c,i,j}^{\text{clean}} + \sigma \mathcal{N}(0, 1)$$

where $\mathcal{N}(0, 1)$ denotes a random number drawn from a normal distribution with mean 0 and variance 1, c is the channel index, and i, j are pixel indices.

Accepted characters: numbers, decimal point markers (period or comma), sign indicators (-), spaces (e.g., as thousands separator, 5 000), "E" or "e" (used in scientific notation). **NOTE:** For scientific notation, a period MUST be used as the decimal point marker.

Using either the data or suitable hyperparameter optimisation, compute an estimate for $\sigma = \underline{\hspace{1cm}}$.

Answer Point Value: 2.0 points

Answer Key: 0.15 | 0.25

Store the denoised images as a four-dimensional numpy.ndarray and upload your file.

Please note that you need to use exactly the shown file format, file name, and array shape as shown in the code snippet. Otherwise, we might not be able to correctly process your submission.

Please note that all members need to submit their own prediction or they won't be awarded points.

Please also note that this question is manually graded and that you should ignore any automatically set result until a teaching assistant had the opportunity to look at your submission.

In this challenge, we will measure the remaining noise in an image using Frobenius' norm:

$$\|\text{image}^{\text{noisy}} - \text{image}^{\text{clean}}\|_F = \sqrt{\sum_{c,i,j} \left(\text{image}_{c,i,j}^{\text{noisy}} - \text{image}_{c,i,j}^{\text{clean}} \right)^2}$$

You can measure the remaining noise after processing images with your model using the provided validation set.

The points will be awarded according to the average remaining noise in your submission according to the following scheme:

remaining noise	points
≤ 2.1	8

remaining noise	points
≤ 2.5	5
≤ 3.0	2

Click "Browse" to locate your file and then click "Upload" to upload your file.

File:

Answer Point Value: 8.0 points