



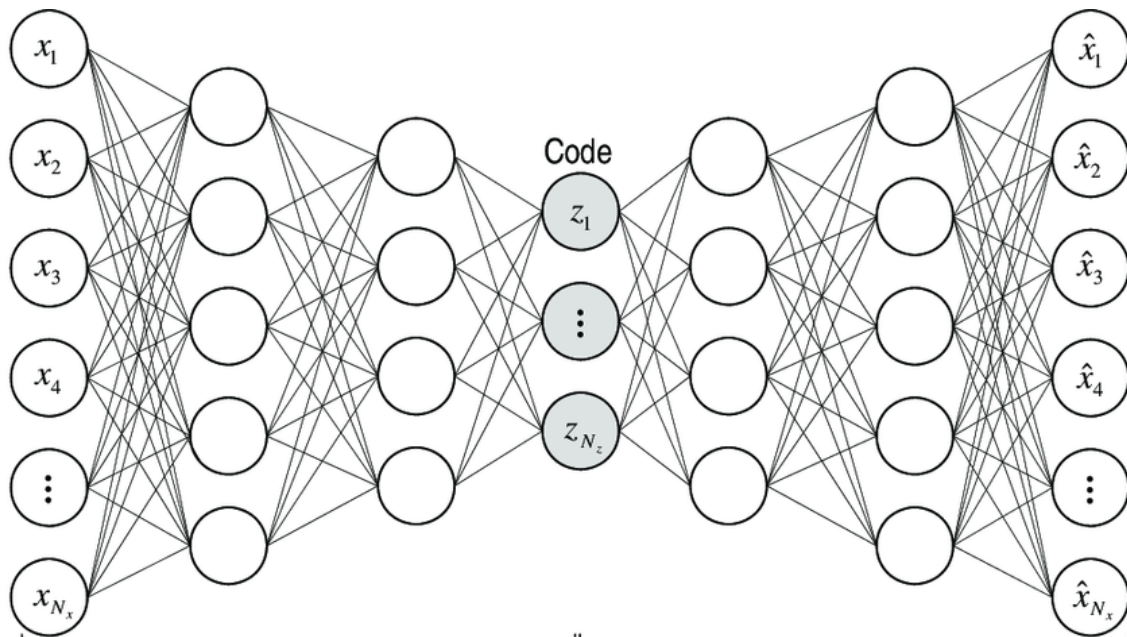
Neural Networks (June 2020)

Assignment #3:

Deep Auto-Encoder

Due Date: Khordad 31, 1399

An auto-encoder (AE) is a neural network that learns to copy its input to its output. It has an internal (hidden) layer that describes a code used to represent the input, and it is formed by two main parts: an encoder that maps the input into the code (latent space), and a decoder that maps the code to a reconstruction of the original input. One of the main usage of AEs is to reduce the dimension by extracting meaningful features in the latent space (code layer). Representing data in a lower-dimensional space can improve performance on different tasks, such as classification and clustering. In the following you can see a standard deep auto-encoder:



In this assignment, you are supposed to design a deep AE to perform feature extraction and dimension reduction on a given dataset (Lung Cancer Microarray Dataset) which contains 1626 genes and each of them has 181 features.

1. First, you should construct an AE with two neurons in the latent space ($Z=2$).
2. Train the network with 70 percent of the given dataset and use the other 30 percent as test data.
3. Feed the test data to the network, extract features from the latent space and use k -means clustering algorithm ($k=2$) to put them in suitable clusters.
4. At the end, use Davies–Bouldin index (DBI) to measure how well the clustering has been done. Report your results as a table.
5. Repeat the mentioned steps for $Z= 3, 4$ and 5 .
6. Plot the second step for $Z=2$ and 3 .

Notes:

- Feel free to use any predefined functions.
- Due Date: Khordad 31, 1399.
- Pay extra attention to the due date.
- Be advised that all submissions after the deadline **would not be graded**.
- Prepare a complete report.
- Email your files as a folder in this format (HW#_student#_name_family.zip).
Email: hashemi.mahshadd@gmail.com

Kind Regards