ARTIFICIAL INTELLIGENCE AND DEEP LEARNING



WEEK 9 2021 SPRING

- Auto-Encoder is a neural network that is trained to copy the input it receives to its own output. It is frequently used to reduce the size of the data.
- Auto-Encoder is a special type of feed Forward Artificial Neural Networks (ANN).
- Auto-Encoder has a hidden layer that represents the input.
- A simple Auto-Encoder consists of two main components, namely; encoder and decoder.
- Encoder function is defined as h=f(x) and decoder function is defined as r=g(h).

- During the learning process of Auto-Encoder it is aimed to achieve r = x.
- If an Auto-Encoder is successful, it learns the set g(f(x))=x



- If the size of the hidden layer h in an Autoencoder is smaller than the size of x (undercomplete) it learns the significant features at the input.
- If the size of the hidden layer h in is equal to or larger than the size of x (overcomplete) it does not only learn significant features.
- During the learning process the loss function is minimized.

$$L(\boldsymbol{x}, g(f(\boldsymbol{x})))$$

• Loss function L, is a function that measures error.

Auto-Encoder reduces the number of neurons in layers with encoder. After this, it increases the number of neurons with decoder.



- The code obtained at the hidden layer of the Auto-Encoder, is the summary or compressed version of the input.
- In other words, encoder compresses the input and generates a code.
 - Decoder, on the other hand, tries to re-obtain the input.
- In order to form an Auto-Encoder, an encoding method, decoding method and loss function is necessary.



- Auto-Encoder is used to reduce the dimensions in the input data.
- The input data is expressed in a smaller size in hidden layer.
- Output data is always different than input data.
- Output does not require additional information for labels, i.e. it performs unsupervised learning.
- The output is named self-supervised as it creates its labels from training data (inputs) by itself.

Denoising Auto-Encoder is used to removed the noise from the noisy data.





Original Images















The output obtained with Denoising Auto-Encoder is different than the original image. However, in this image the noise is removed.

