Statistical Learning

Session 4: (Convolutional) AutoEncoder Networks

FRC-EVL

MESIO UB-UPC, 2021

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Introduction

What are autoencoders?

"Autoencoding" is a data compression algorithm where the compression and decompression functions are:

1) **data-specific**: They will only be able to compress data similar to what they have been trained on.

2) **lossy**: The decompressed outputs will be degraded compared to the original inputs (similar to MP3 or JPEG compression).

3) **learned automatically from examples**: It doesn't require any new engineering, just appropriate training data.

Functions

You need three things:

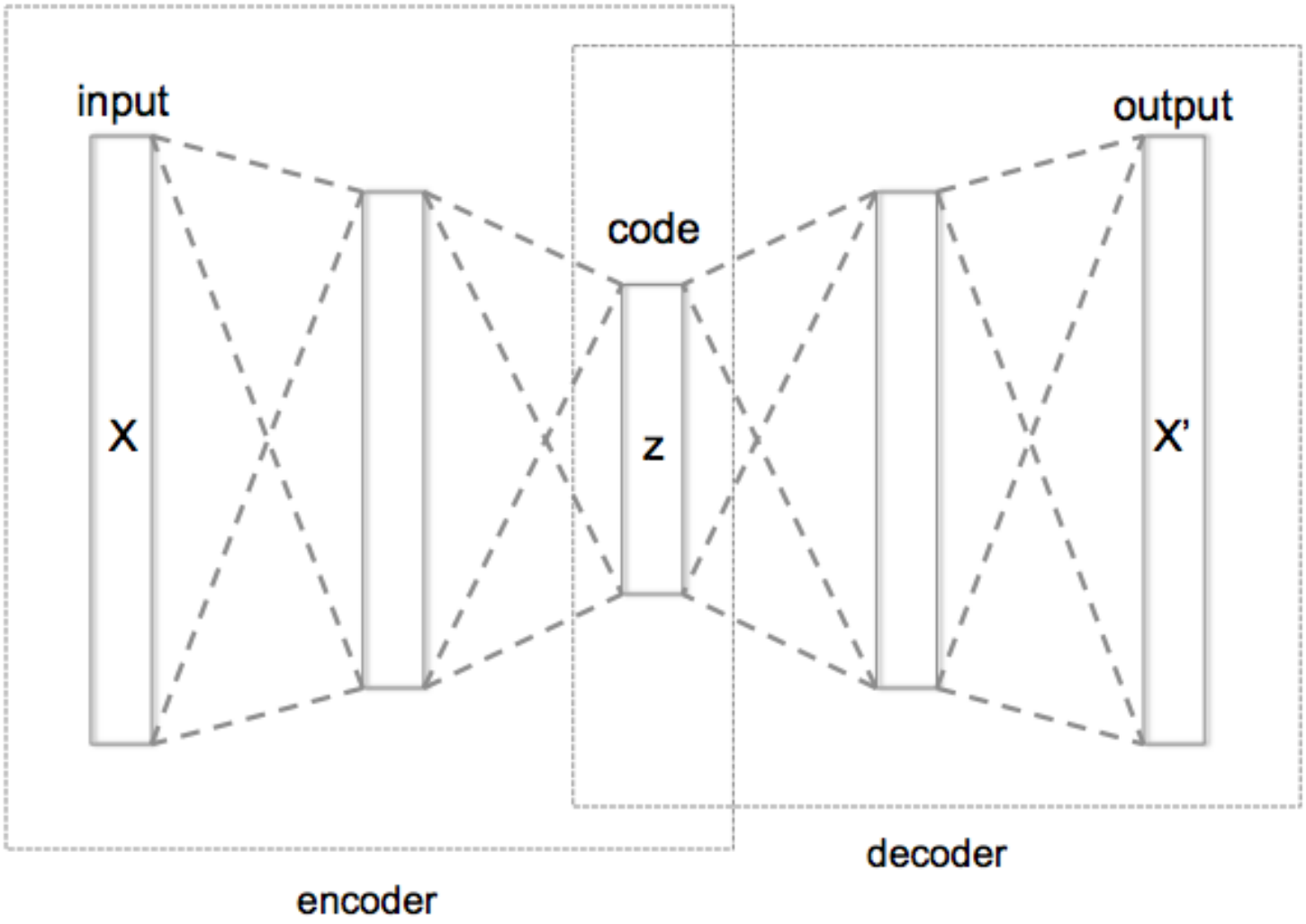
1) Encoding function,

2) Decoding function,

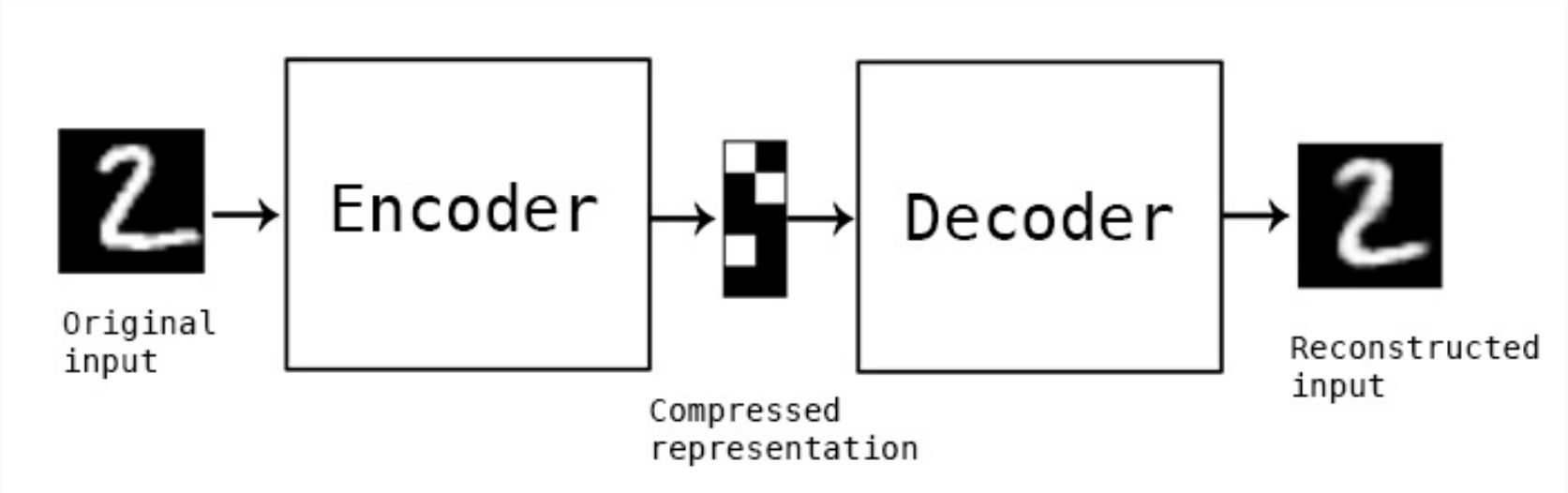
3) Distance function between the amount of information loss between the compressed representation of your data and the decompressed representation (i.e. a "loss" function).

The encoding/decoding functions can be optimize to minimize the reconstruction loss, using Stochastic Gradient Descent.

Architecture

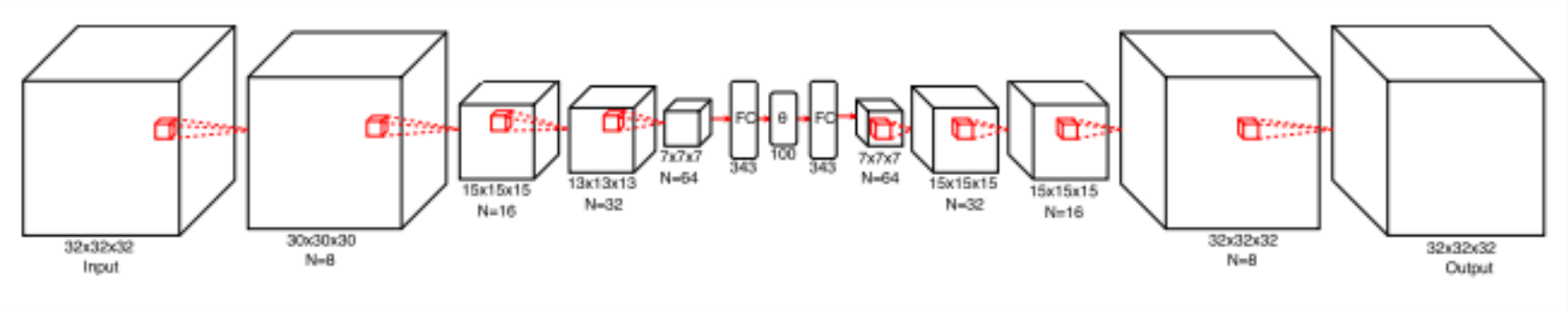


MNIST example



CAE architecture

An example


32x32x32
Input
30x30x30
N=8
15x15x15
N=16
13x13x13
N=32
7x7x7
N=64
FC
343
θ
100
FC
343
7x7x7
N=64
15x15x15
N=32
15x15x15
N=16
32x32x32
N=8
32x32x32
Output