NPTEL ONLINE CERTIFICATION COURSES

Course Name: Deep Learning

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Topic

Lecture 33: Autoencoder Variants

CONCEPTS COVERED

Concepts Covered:

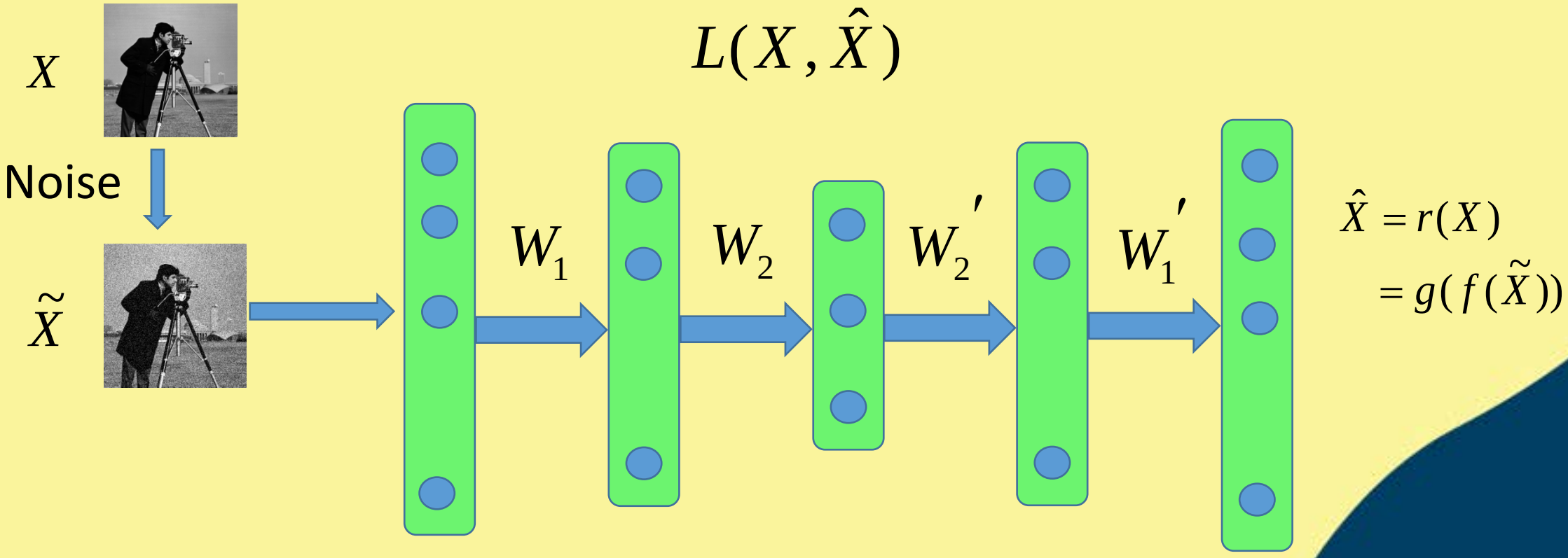
- Autoencoder
  - Undercomplete Autoencoder
  - Autoencoder vs. PCA
  - Deep Autoencoder Training
  - Sparse Autoencoder
  - Denoising Autoencoder
  - Contractive Autoencoder
  - Convolution Autoencoder

Denoising Autoencoder

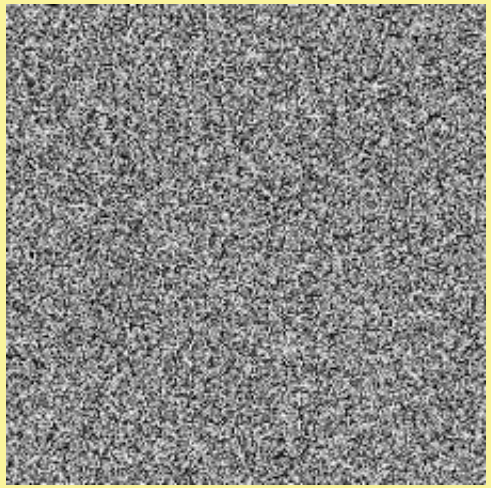
Denoising Autoencoder

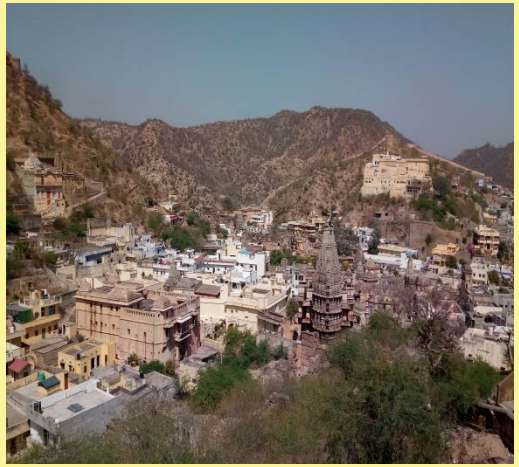
- The Autoencoder learns a generalizable encoding-decoding scheme.
- An approach:- while training use corrupt data as input but output as uncorrupted original data.
- The model can not memorize the training data as input and target output is not same any more
- The Model learns a vector field to map the input data towards a low dimensional manifold.

Denoising Autoencoder

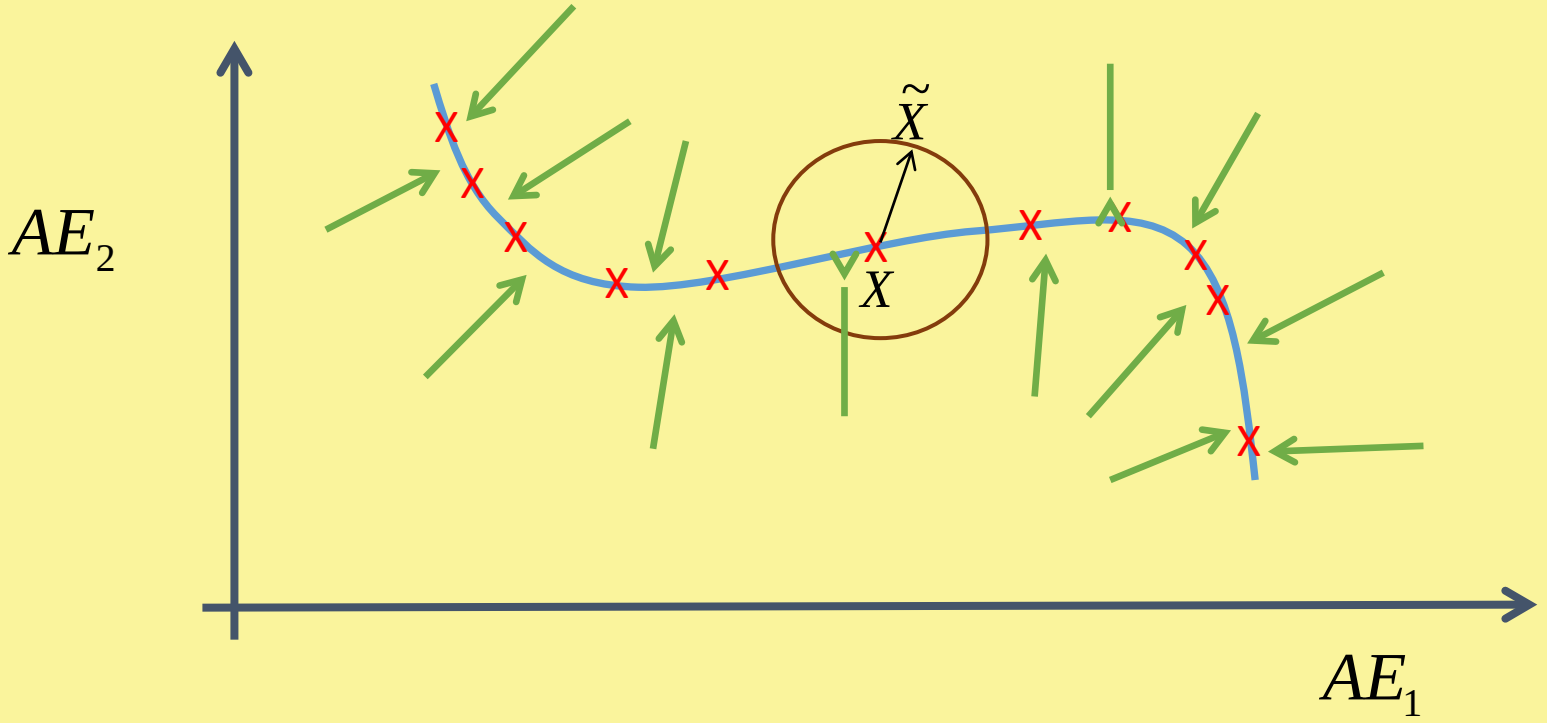


What is Manifold?





Manifold Learning



$r(x) - x$ Vector field

Contractive Autoencoder

Contractive Autoencoder

- For similar inputs- learned encoding (compressed domain representation should also be very similar.
- Hidden layer activation variation with input data should be small.

Effectively the Model learns to contract a neighborhood of Inputs to a small neighborhood of Outputs

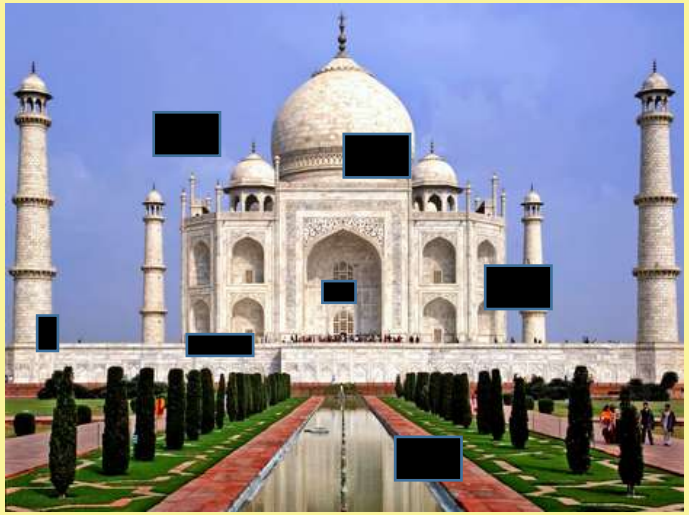
Regularization

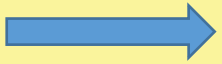
$$\|A\|_F = \sqrt{\sum_{j=1}^{m}\sum_{i=1}^{N_h}|a_{ij}|^2}$$

$$J = \begin{bmatrix} \frac{\partial a_1^h(X)}{\partial x_1} & \frac{\partial a_1^h(X)}{\partial x_2} & .. & \frac{\partial a_1^h(X)}{\partial x_m} \\ \frac{\partial a_2^h(X)}{\partial x_1} & \frac{\partial a_2^h(X)}{\partial x_2} & .. & \frac{\partial a_2^h(X)}{\partial x_m} \\ .. & .. & .. & .. \\ \frac{\partial a_{N_h}^h(X)}{\partial x_1} & \frac{\partial a_{N_h}^h(X)}{\partial x_2} & .. & \frac{\partial a_{N_h}^h(X)}{\partial x_m} \end{bmatrix}$$

$$L(X, \hat{X}) + \lambda \sum_{i=1}^{N_h} \| \nabla_X a_i^h(X) \|^2$$

Applications





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Thank you