Hope to Skills

Lecture# 26

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Agenda

- Applications of CNN
- Auto Encoders
  - Introduction
  - Architecture
  - Encoder
  - Feature space
  - Decoder
- Types of Decoders
- Applications of Decoders
- Quiz

Previously

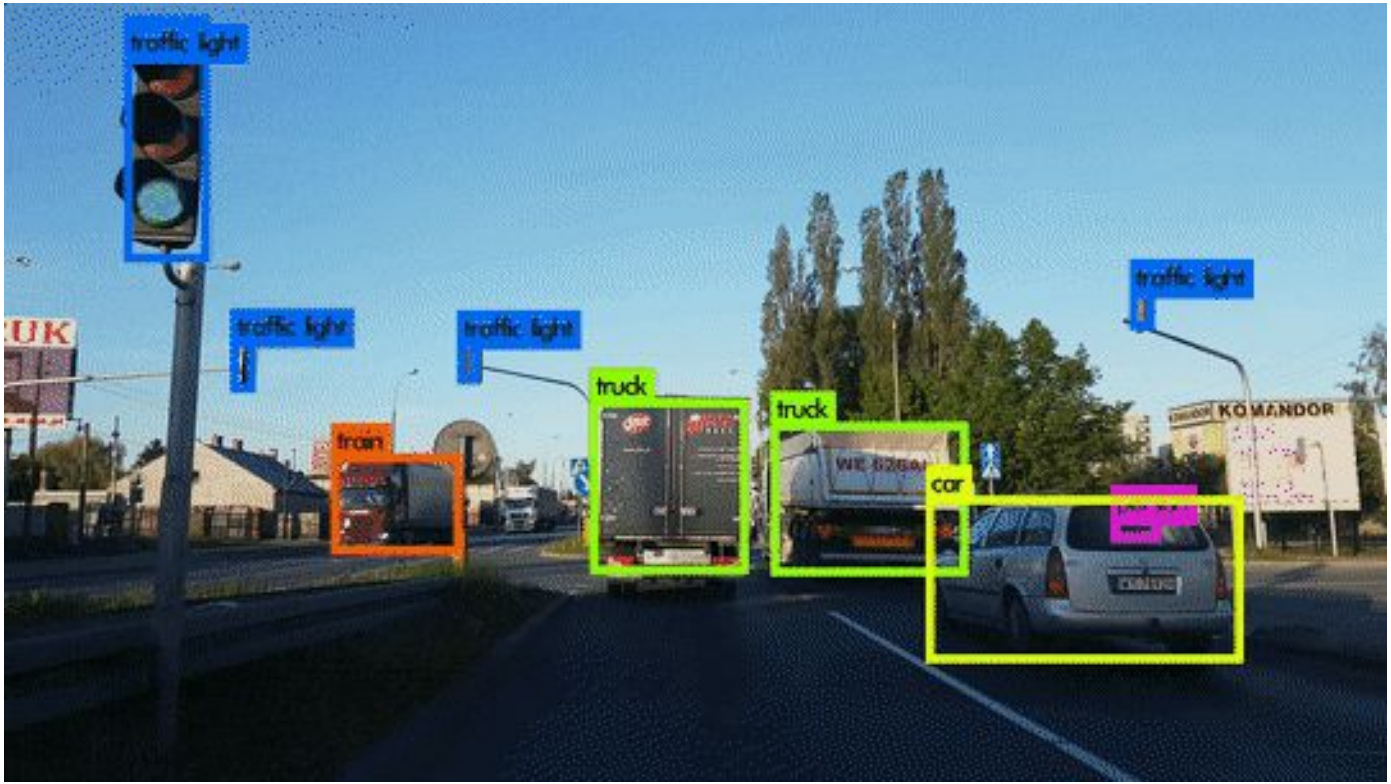
- Artificial Neural Networks (ANN)
- Convolutional Neural Networks (CNN)

Application of CNN

- Image Classification
- Image Segmentation
- Facial Recognition
- Gesture Recognition

Image Segmentation

Object Detection



Gesture Recognition

Face Detection

Encoders & Decoders in Deep Learning

Encoder

- Converts **original data** into a **secret code**.
- Uses rules or transformations to hide the message.

Decoder

- Reverts the **secret code** back to the **original data**.
- Understands the **rules** to reverse the encoding.
- Enables understanding of the hidden message.

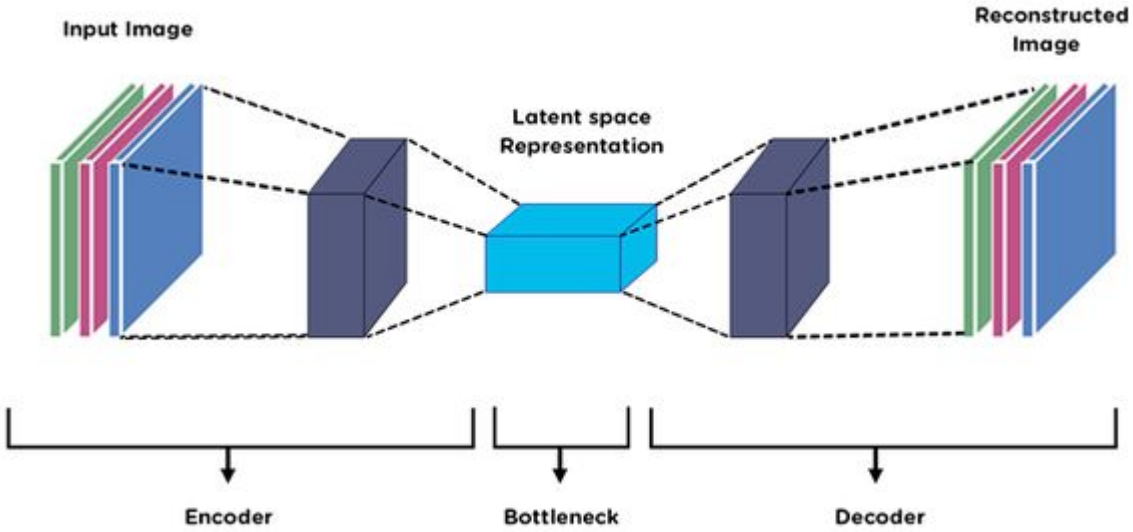
What Are Autoencoders?

A type of neural network designed for **dimensionality reduction** and **feature learning**.

Primary goal: To encode data into a **compact representation** and then decode it for **reconstruction**.

Anatomy of an Autoencoder

Components: Encoder, Bottleneck/Hidden Layer, Decoder.



Anatomy of an Autoencoder

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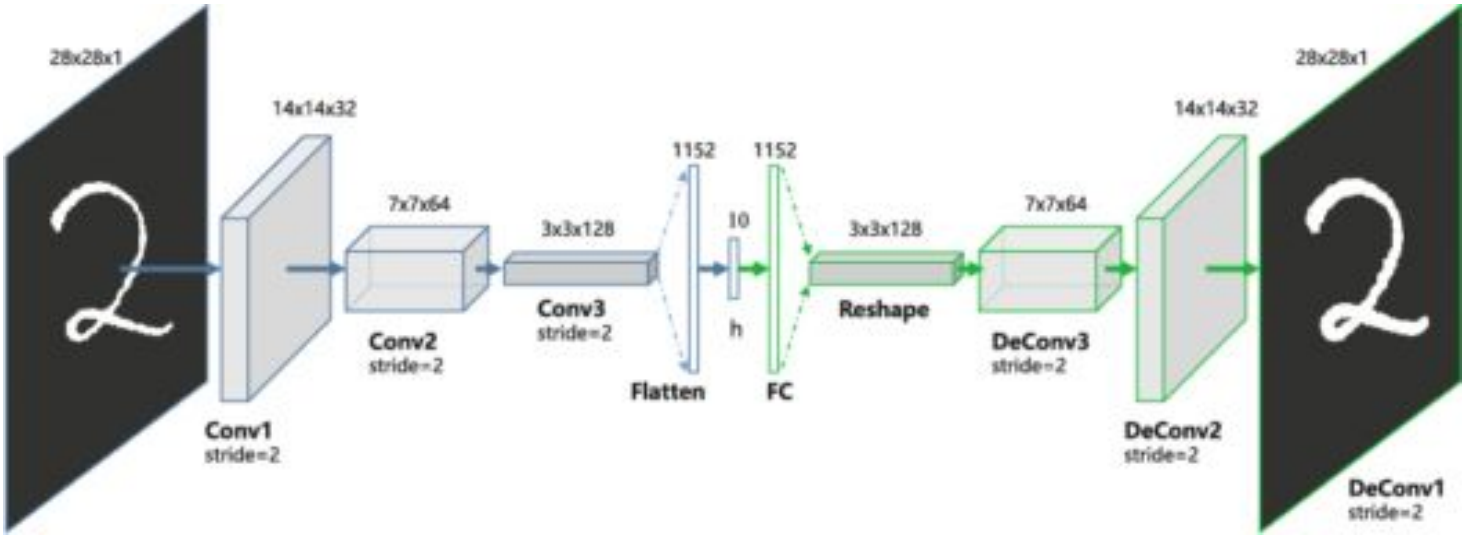


Encoder

The encoder is like a **detective** that learns to capture the most **important features** of an image or data.

It's the first part of the autoencoder and responsible for compressing the input data.

How Does the Encoder Work?

Imagine an encoder as a **funnel that squeezes** a big picture into a smaller **representation.**

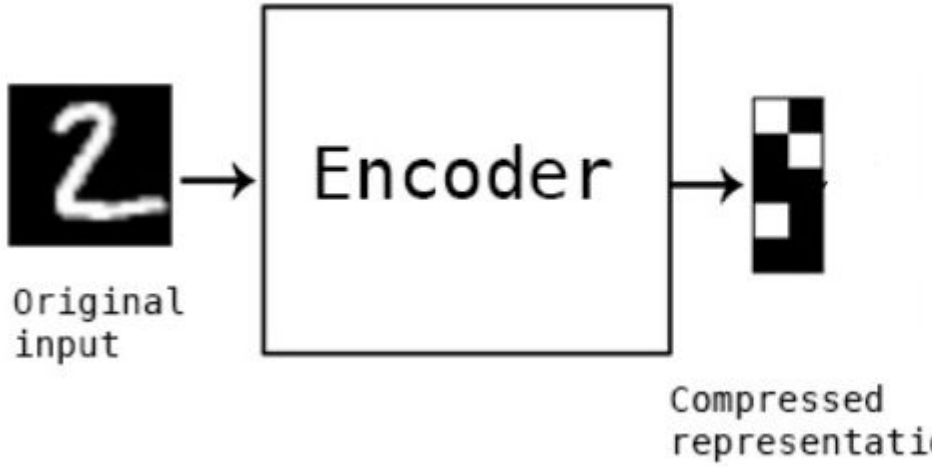
It transforms the input data (e.g., an image) into a compact form called the latent space or **encoding**.

Encoding Process

Step 1: The input data, such as an image, is fed into the encoder.

Step 2: The encoder consists of layers of neurons that learn patterns and features in the data.

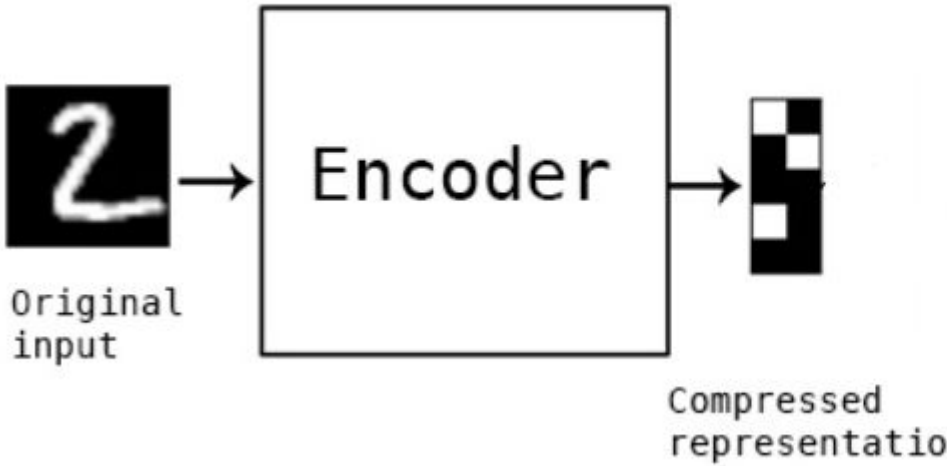
Step 3: These patterns are combined and transformed into a compact representation in the latent space.



Why is it Important?

Data Compression: The encoding is much smaller than the original data, making it efficient to store and transmit.

Feature Extraction: The encoder learns to extract valuable information, which can be used for various tasks



What is a Decoder?

The decoder is like an **artist** that takes the compact representation (**encoding**) from the encoder and **recreates** the **original data**.

It's the second part of the autoencoder and responsible for generating output from the encoding.

How Does the Decoder Work?

Imagine a **decoder** as a **reverse funnel** that **expands** the compact representation back into a **full image** or **data**.

It transforms the encoding from the **latent space** back into a **reconstructed output**.

Decoding Process

Step 1: The encoded data (latent space representation) is fed into the decoder.

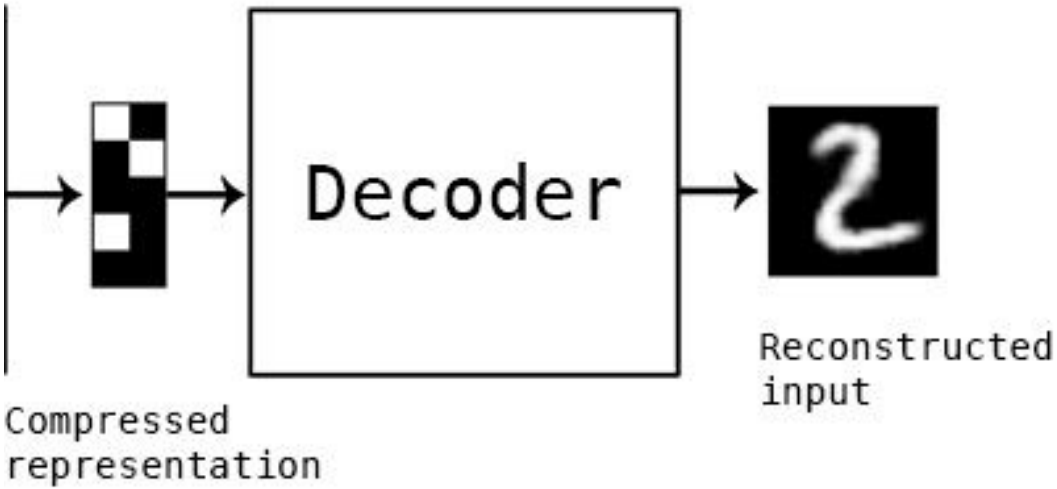
Step 2: The decoder consists of layers that learn to reverse the compression process by generating features and patterns.

Step 3: These generated features are combined to reconstruct the original data.

Recreating Original Data

The decoder's goal is to **recreate** data as close to the **original** input as possible.

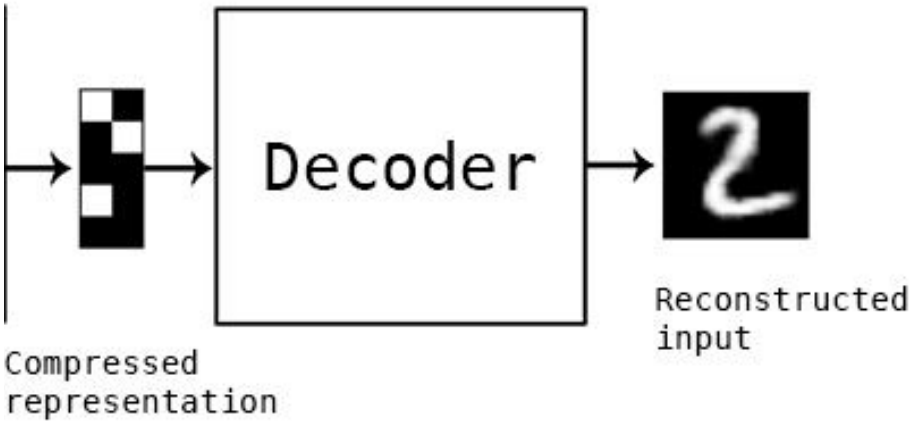
It uses the **knowledge** it gained from the encoder to generate meaningful features.



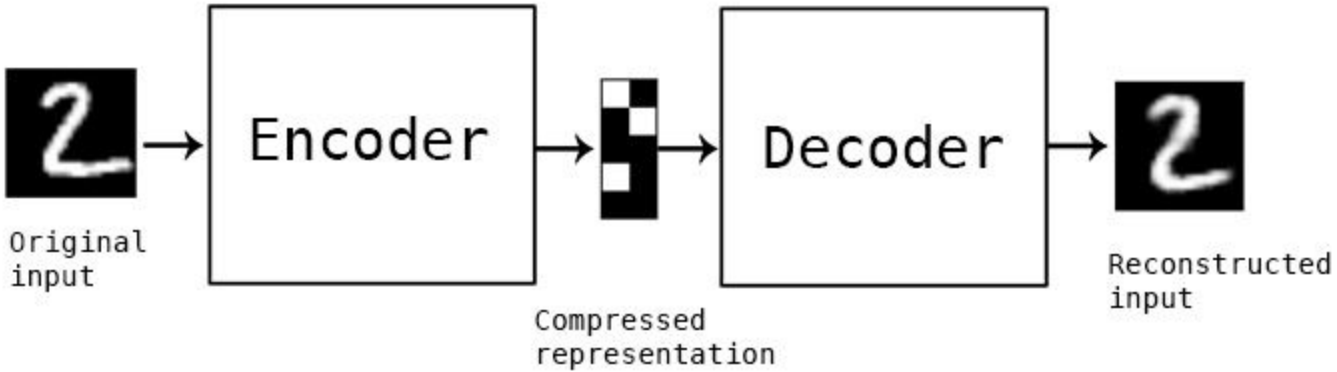
Why is it Important?

Data Reconstruction: The decoder's job is to bring back the data's original form from the compressed encoding.

Completing the Loop: Autoencoders aim to minimize the difference between the input and the reconstructed output.



Simple/Vanilla Auto-encoder

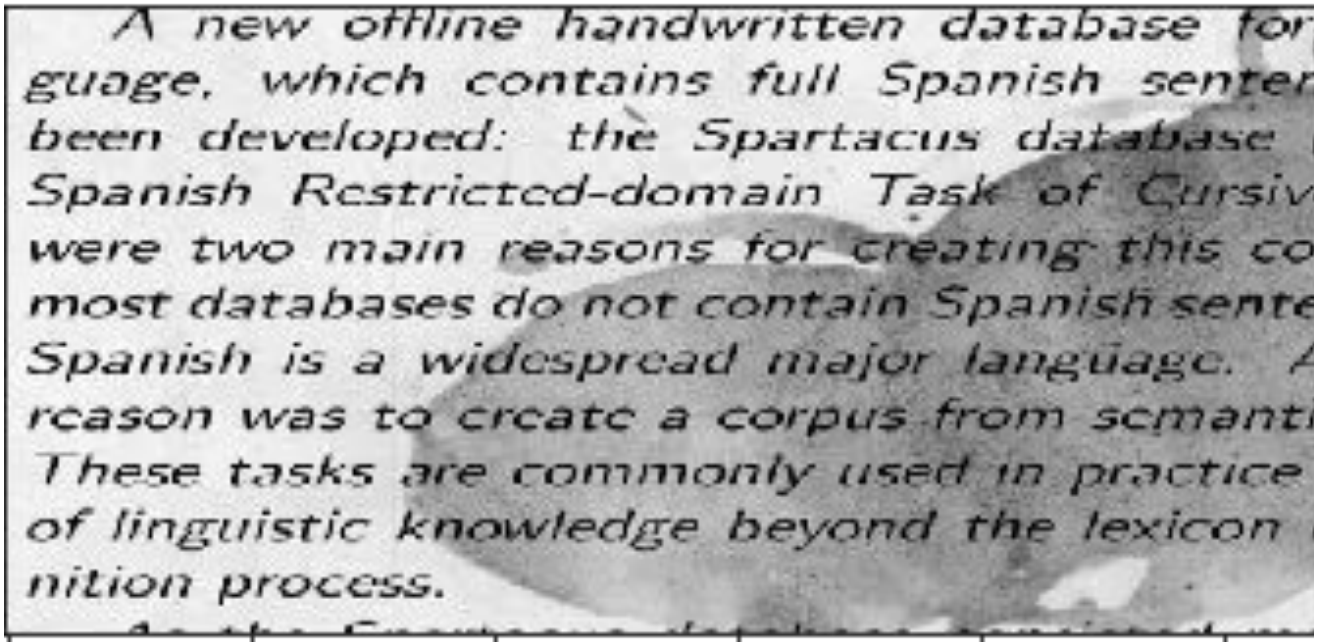


Types of Auto-Encoders

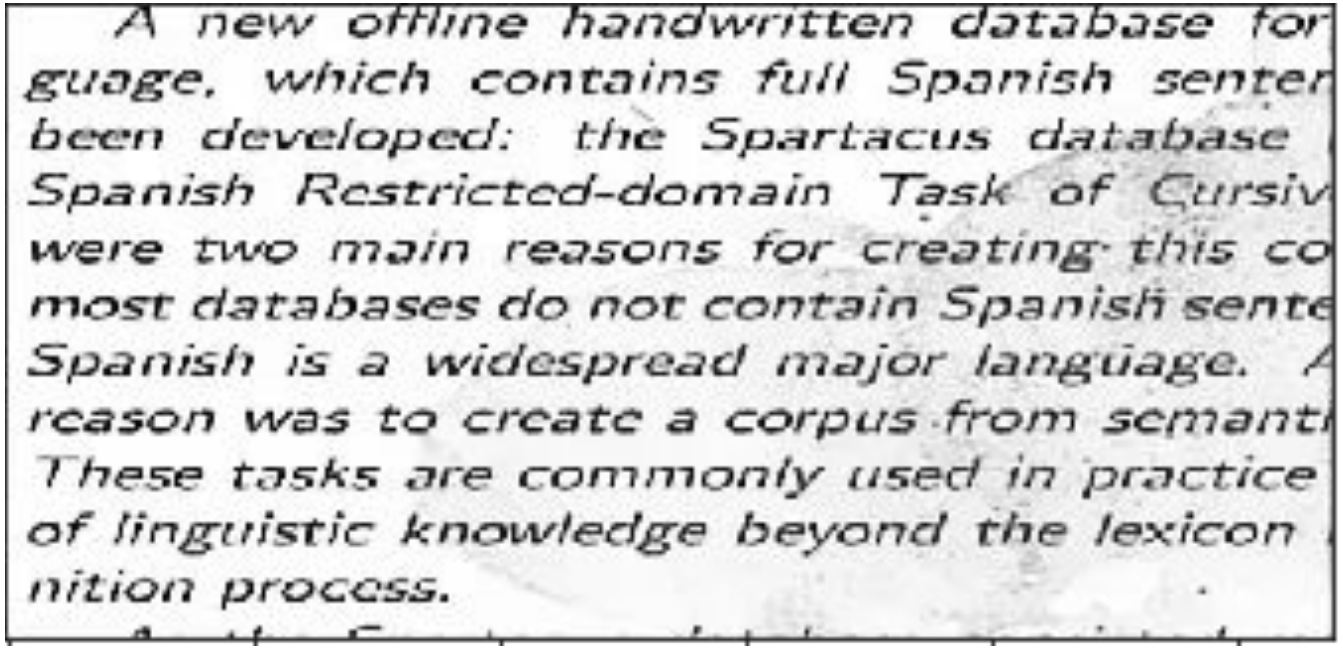
1. Vanilla Autoencoder
2. Denoising Autoencoder
3. Variational Autoencoder (VAE):

Denoising Autoencoder

Input Image


A new offline handwritten database for
guage, which contains full Spanish senter
been developed: the Spartacus database
Spanish Restricted-domain Task of Cursiv
were two main reasons for creating this co
most databases do not contain Spanish sente
Spanish is a widespread major language.
reason was to create a corpus from semanti
These tasks are commonly used in practice
of linguistic knowledge beyond the lexicon
nition process.

Output Image

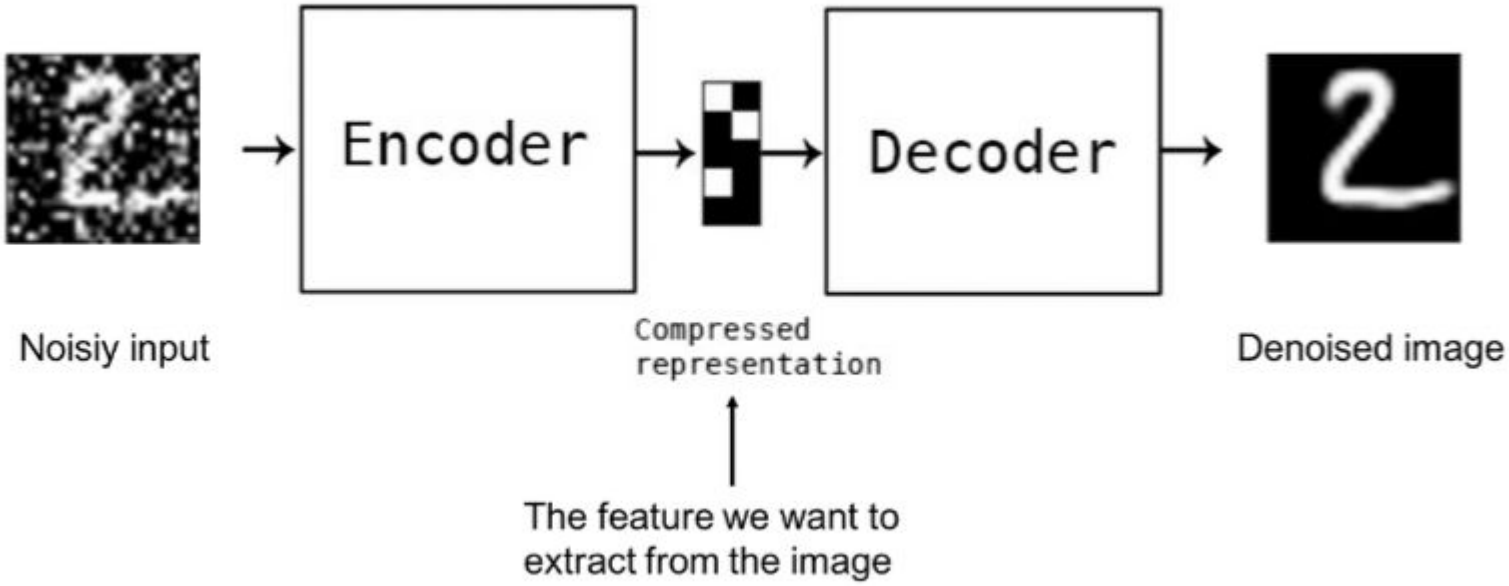


Denoising Autoencoder

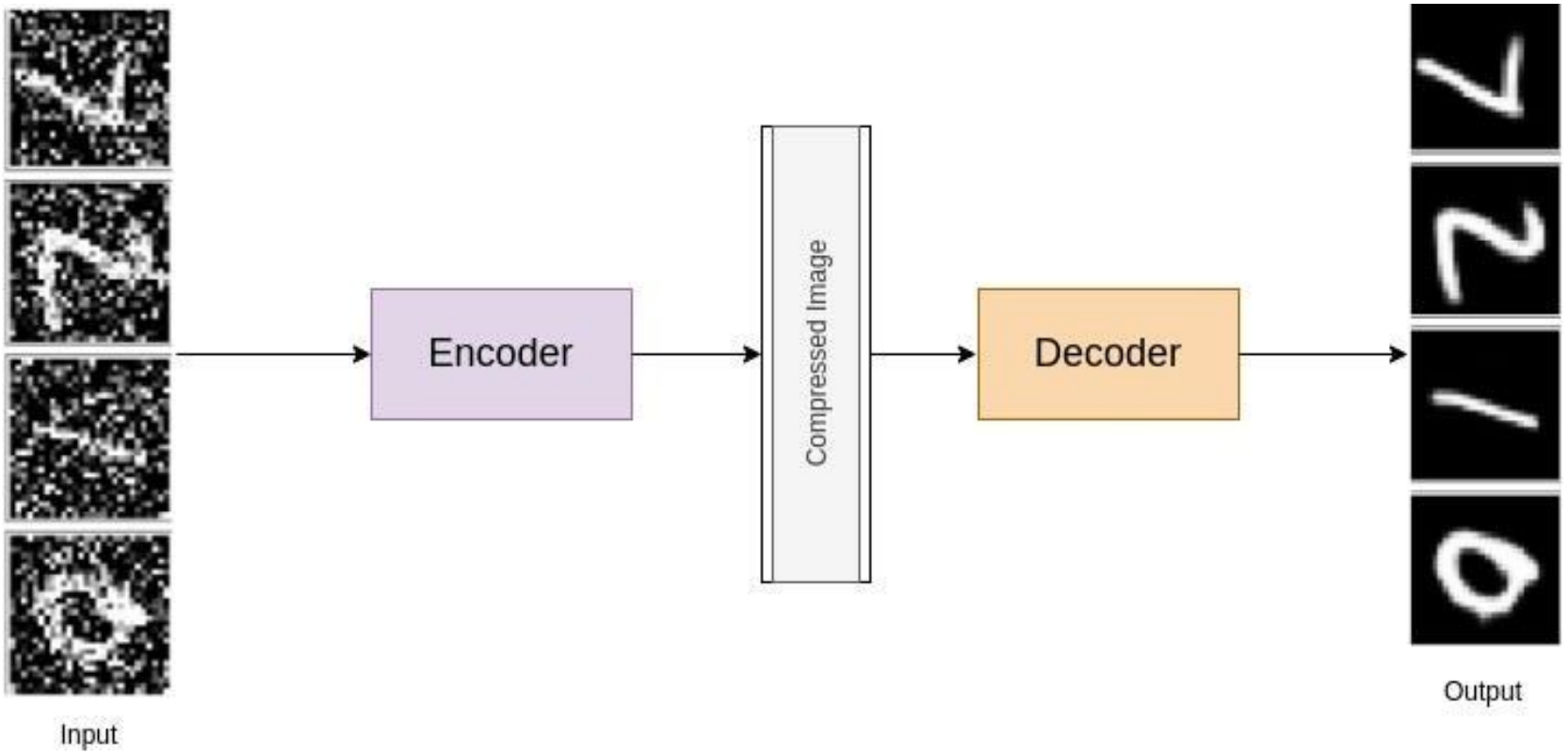
Denoising Autoencoders are a type of neural network.

Designed to **clean noisy** or **corrupted data** and extract **essential features**.

Denoising Autoencoder



Denoising Autoencoder



Quiz