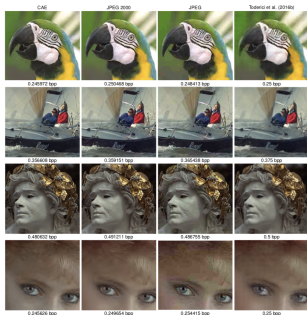


# Deep Learning

## Specific Autoencoders and Applications



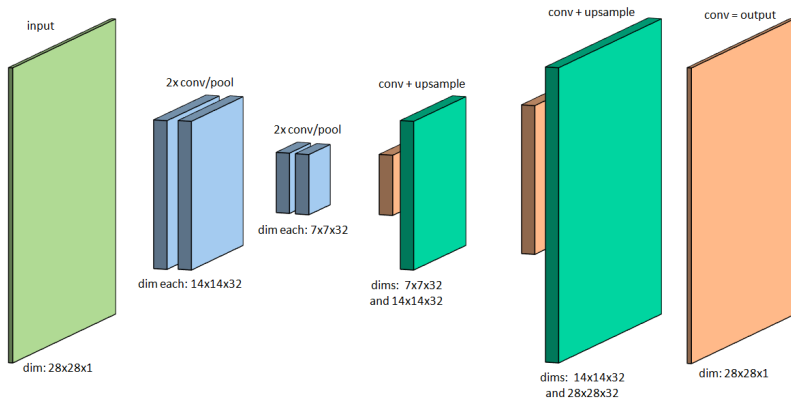
### Learning goals

- convolutional AEs
- applications of AEs

# CONVOLUTIONAL AUTOENCODER (CONVAE)

- For the image domain, using convolutions is advantageous. Can we also make use of them in AEs?
- In a ConvAE, the encoder consists of convolutional layers. The decoder, on the other hand, consists of transpose convolution layers or simple upsampling operations.

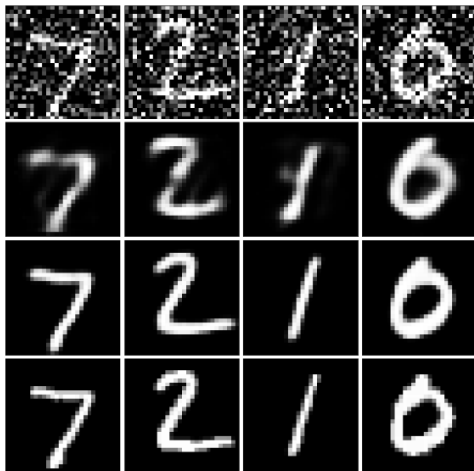
# CONVOLUTIONAL AUTOENCODER (CONVAE)



**Figure:** Potential architecture of a convolutional autoencoder.

We now apply this architecture to denoise MNIST.

# CONVOLUTIONAL AUTOENCODER (CONVAE)



**Figure:** Top row: noised data, second row: AE with  $\dim(z) = 32$  (roughly 50k params), third row: ConvAE (roughly 25k params), fourth row: ground truth.

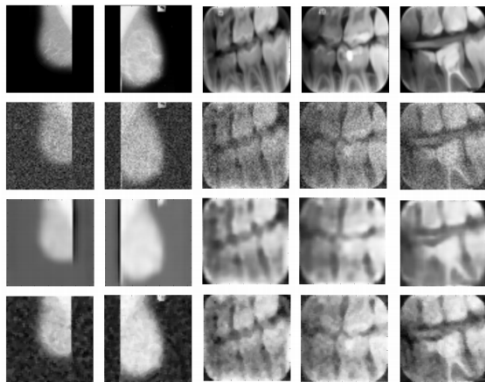
# REAL-WORLD APPLICATIONS

Today, autoencoders are still used for tasks such as:

- data de-noising,
- compression,
- and dimensionality reduction for the purpose of visualization.

# REAL-WORLD APPLICATIONS

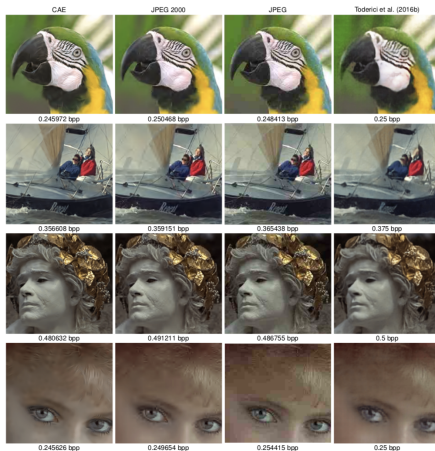
## Medical image denoising using convolutional denoising autoencoders



**Figure:** Top row : real image, second row : noisy version, third row : results of a (convolutional) denoising autoencoder and fourth row : results of a median filter (Lovedeep Gondara (2016))

# REAL-WORLD APPLICATIONS

AE-based image compression.



**Figure:** from Theis et al.