Autoencoder Architectures

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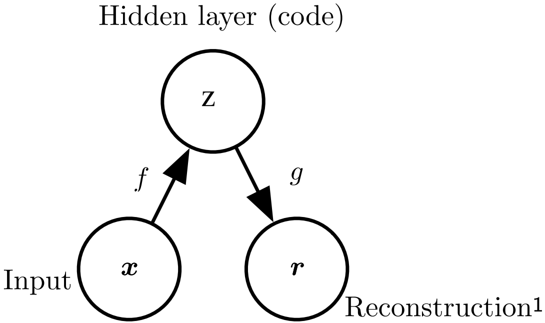
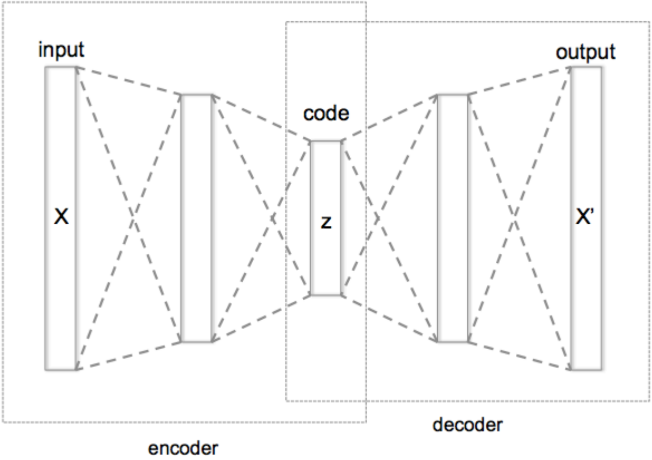
Autoencoder

The aim of an autoencoder is to learn a representation (encoding) for a set of data, typically for dimensionality reduction, by training the network to ignore signal noise.



[1] Image taken from Deep Learning book by Goodfellow et al.

Deep Autoencoder



[2]

[2] Image taken from wikipedia

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- A normal autoencoder is used with $\tilde{x}$ is used as input and x as output.
- In a denoising autoencoder, the loss should be computed on $\mathcal{L}(x, \hat{x})$ as opposed to $\mathcal{L}(\tilde{x}, \hat{x})$.

Sparse Autoencoder

- In a sparse autoencoder, there are more hidden units than inputs, but only a small number of the hidden units are allowed to be active at the same time.

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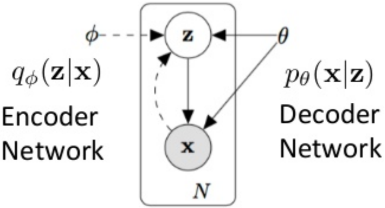
- Pretraining networks by learning your network weights using a stacked AE.

Variational Autoencoders (VAEs)

Variational Autoencoder



Minimize: $D_{KL}[q_\phi(\mathbf{z}|\mathbf{x})||p_\theta(\mathbf{z}|\mathbf{x})]$

Intractable: $p_\theta(\mathbf{z}|\mathbf{x}) = \dfrac{p_\theta(\mathbf{x}|\mathbf{z})p_\theta(\mathbf{z})}{p_\theta(\mathbf{x})}$

[3]

[3] Slide taken from
https://www.slideshare.net/ckmarkohchang/variational-autoencoder

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- The encoder is learning an approximation $q_\phi(z|x)$ to the posterior distribution $p_\theta(x|z)$, where ϕ and θ denote the parameters of the encoder and decoder, respectively.
- The objective of the VAE has the following form $\mathcal{L} = D_{KL}(q_\phi(z|x)||p_\theta(z)) - \mathbb{E}_{q_\phi}(log p_\theta(x|z))$