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29

Neural compression: *Rate-distortion theory*

Autoencoding is a form of (neural) compression!

$$-\mathrm{ELBO} = -\left\langle \log p_\vartheta(x \mid z) \right\rangle_{q_\varphi} + D_{\mathrm{KL}}\left(q_\varphi(z \mid x) \,\|\, p(z) \right)$$

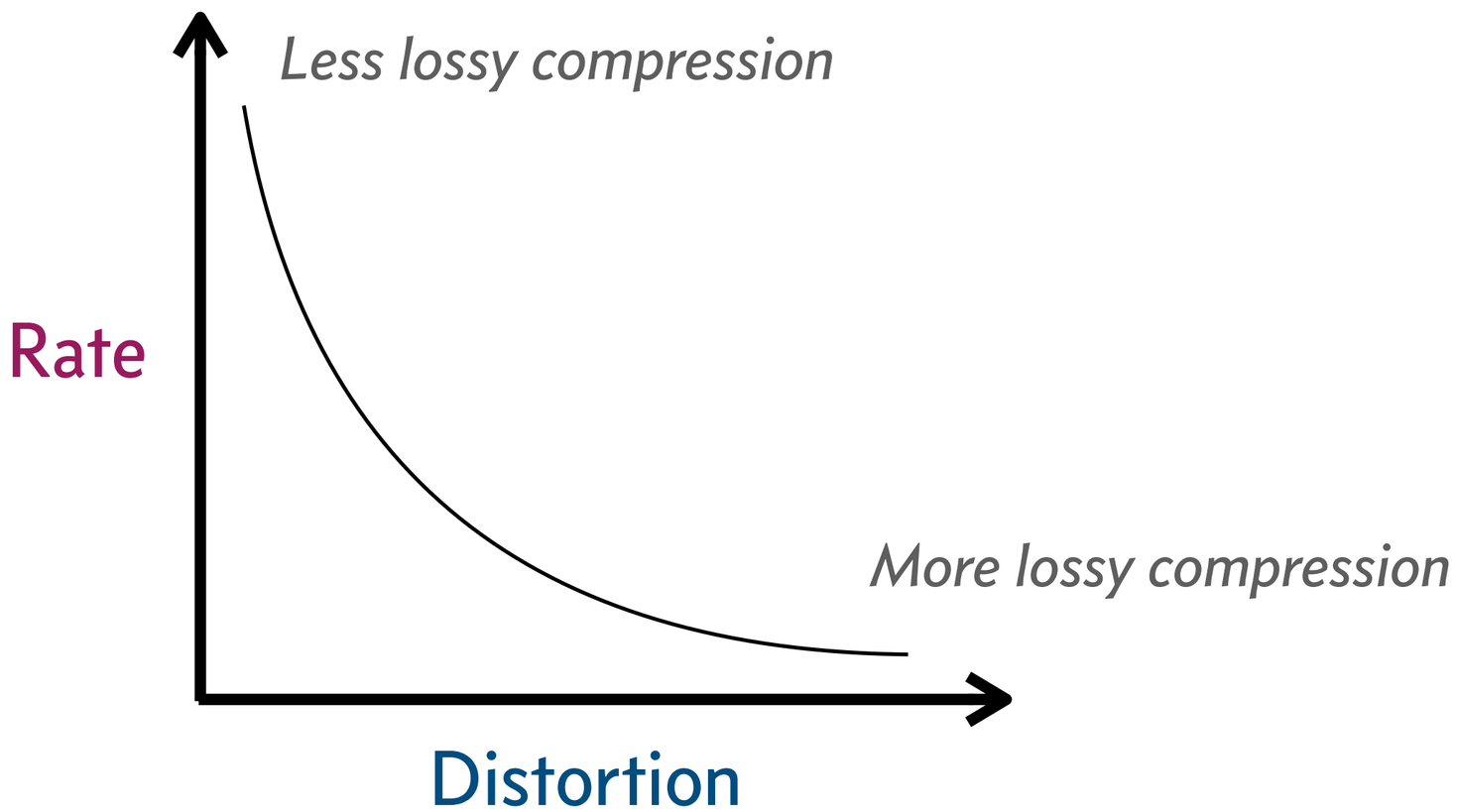
Rate

"Amount of compression"

Distortion

"Reconstruction loss"

Rate-distortion curve quantified this tradeoff



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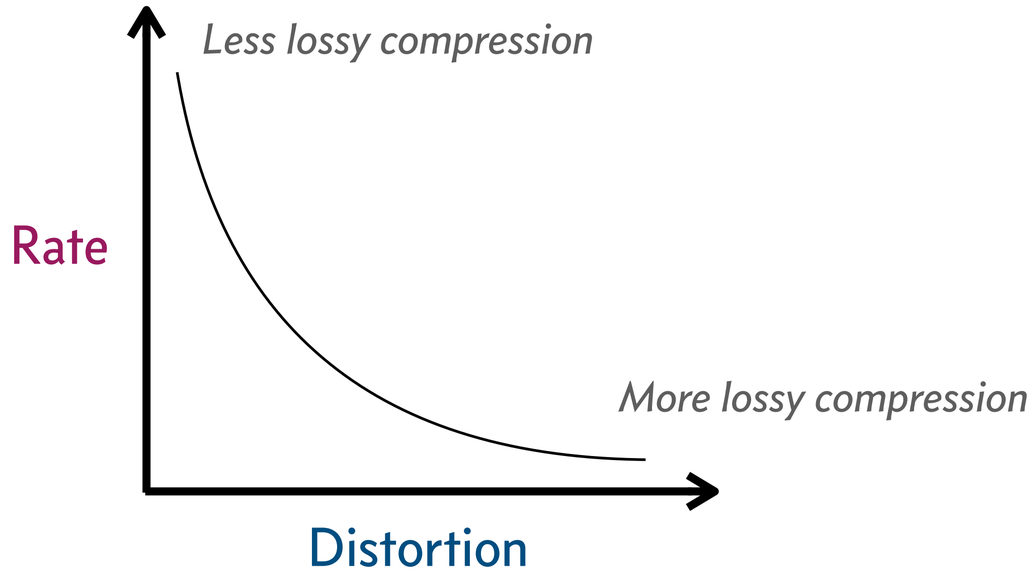

Controlling compression and disentanglement: β-VAEs

$$-\text{ELBO} = -\left\langle \log p_\vartheta(x \mid z) \right\rangle_{q_\varphi} + \beta \cdot D_{\text{KL}}\left(q_\varphi(z \mid x) \,\|\, p(z) \right)$$

Distortion

Rate