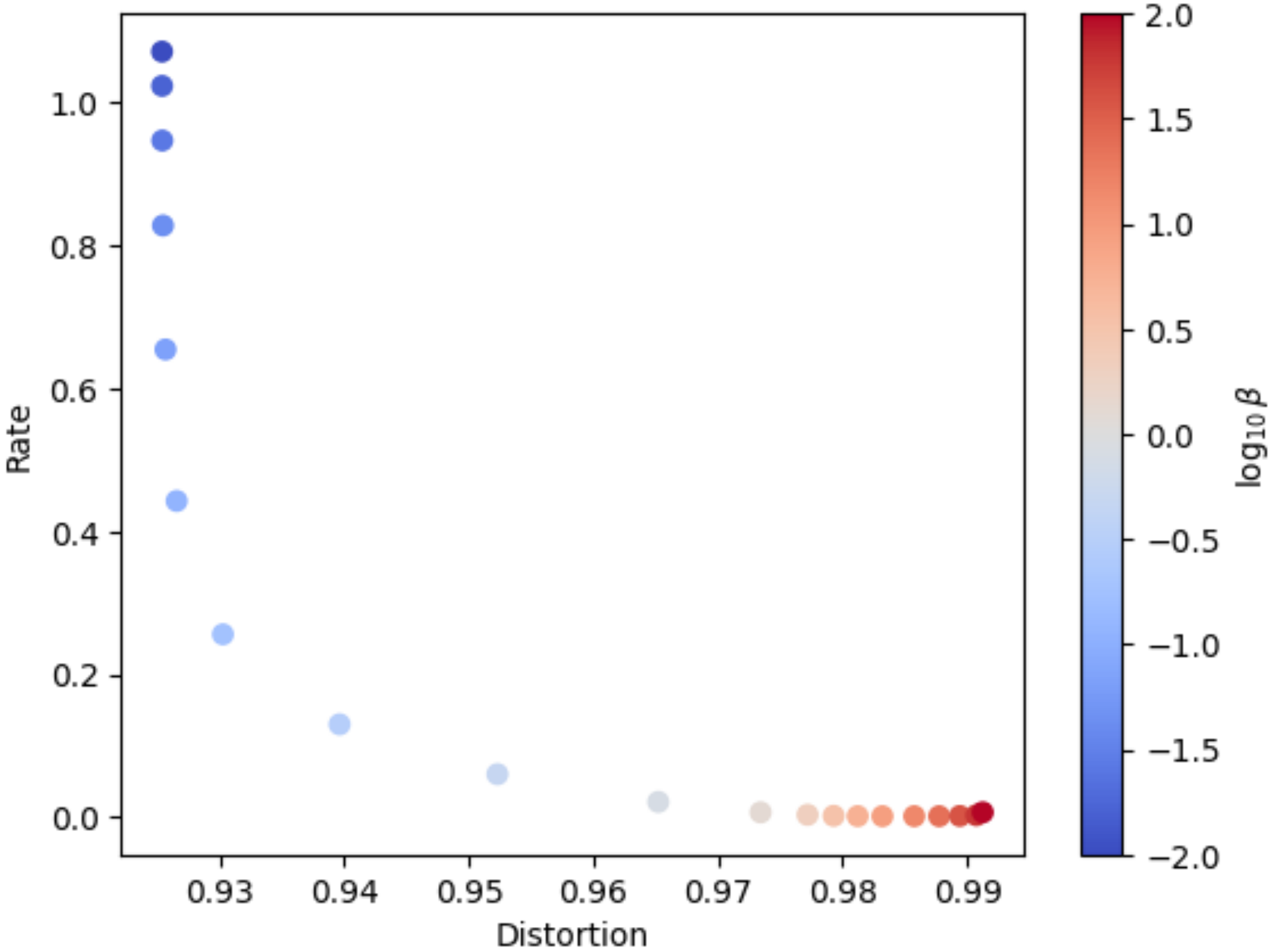
/70

30

Controlling compression and disentanglement: β-VAEs


Rate
1.0
0.8
0.6
0.4
0.2
0.0
0.93
0.94
0.95
0.96
0.97
0.98
0.99
Distortion
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
$\log_{10}\beta$

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

Rate

Distortion

If the data-generating process is associated with a principled noise model, by using it (the *likelihood*) as the reconstruction loss we are aiming to reconstruct the mean data.

$$\log p(x \mid z; x') = -\frac{1}{2}\left(\frac{x - x'}{\sigma}\right)^2 + \log\left(\frac{1}{\sigma\sqrt{2\pi}}\right)$$

- Larger σ: More of the data variation is attributed to the likelihood → larger "β", more compression
- Smaller σ: Latents z try to capture more of the variation in the data (e.g. small perceptual features)

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Distortion | Rate

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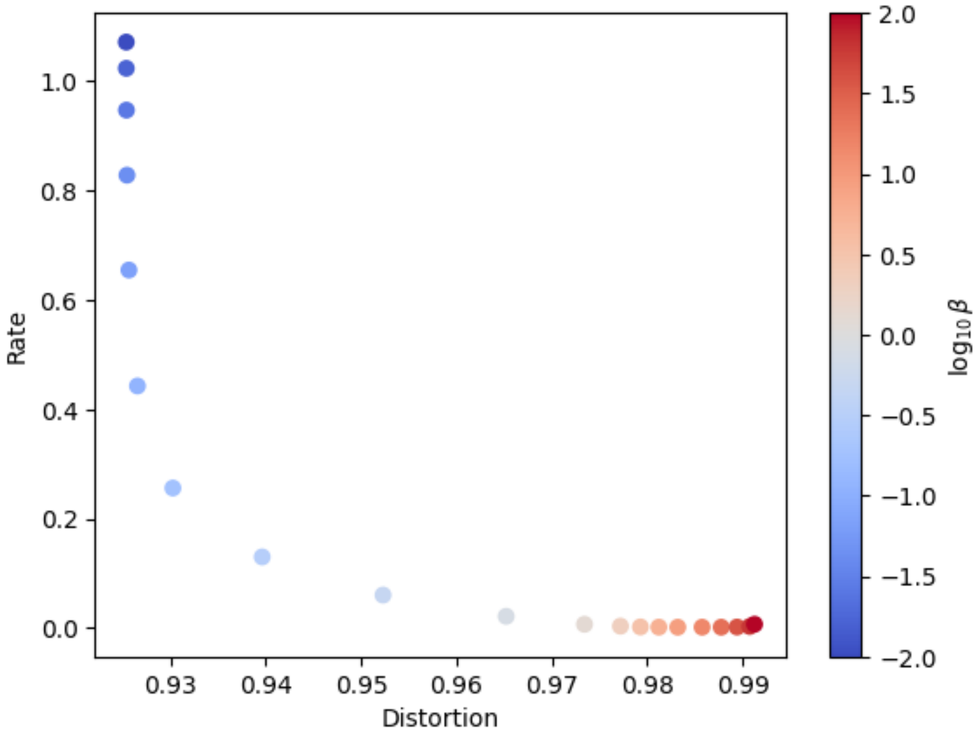
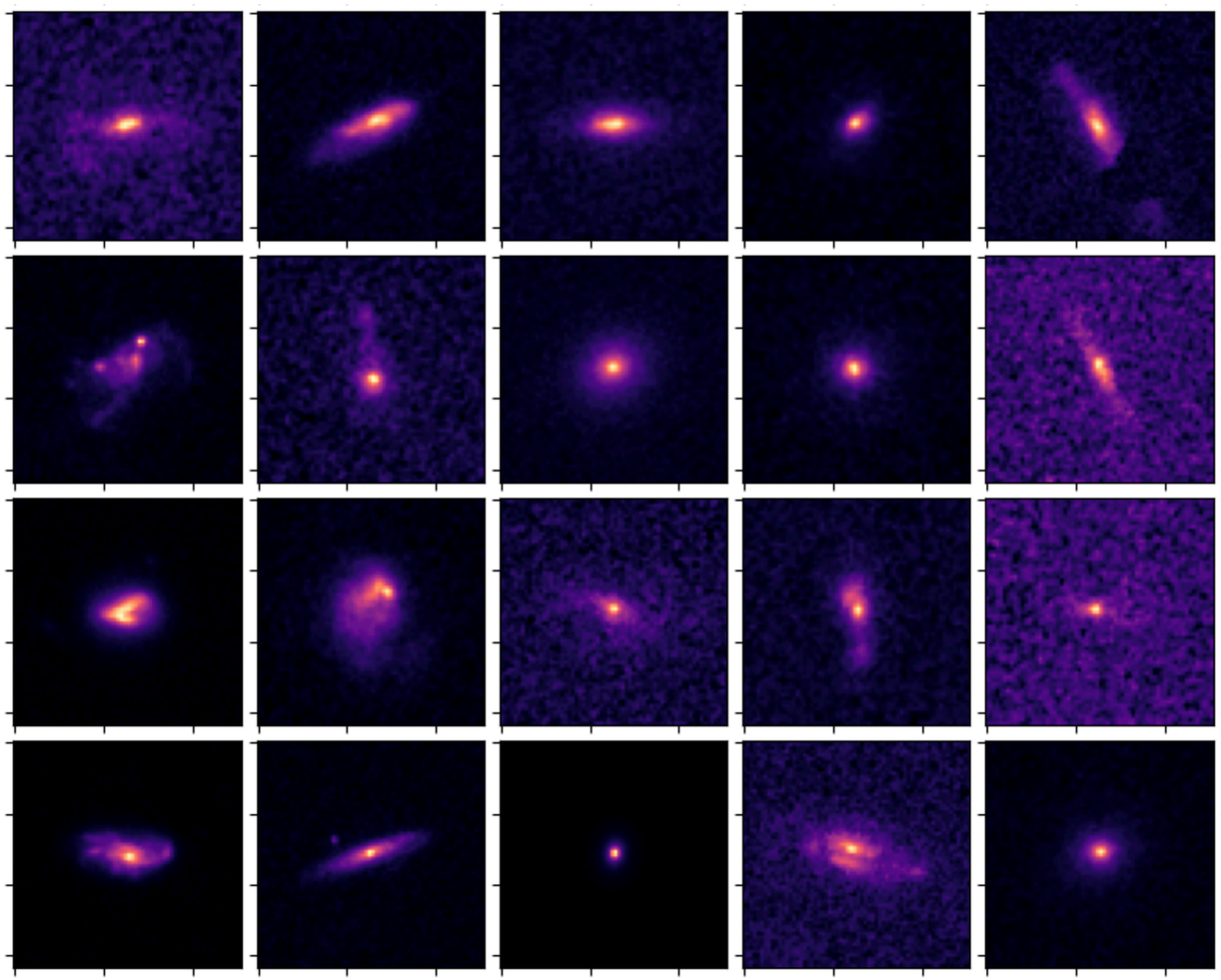


Tutorials 1 and 2: variational inference and VAEs

Lead: Carol Cuesta-Lazaro



[Mandelbaum et al; https://zenodo.org/record/3242143]

- Implement the ELBO objective for variational inference
- Construct a VAE and use it to build a generative model of galaxy images using samples form the HST COSMOS dataset
- Boilerplate code for training/reconstruction/sampling for quick iteration
- Experiment with trade-offs between pure reconstruction and a latent space regularization