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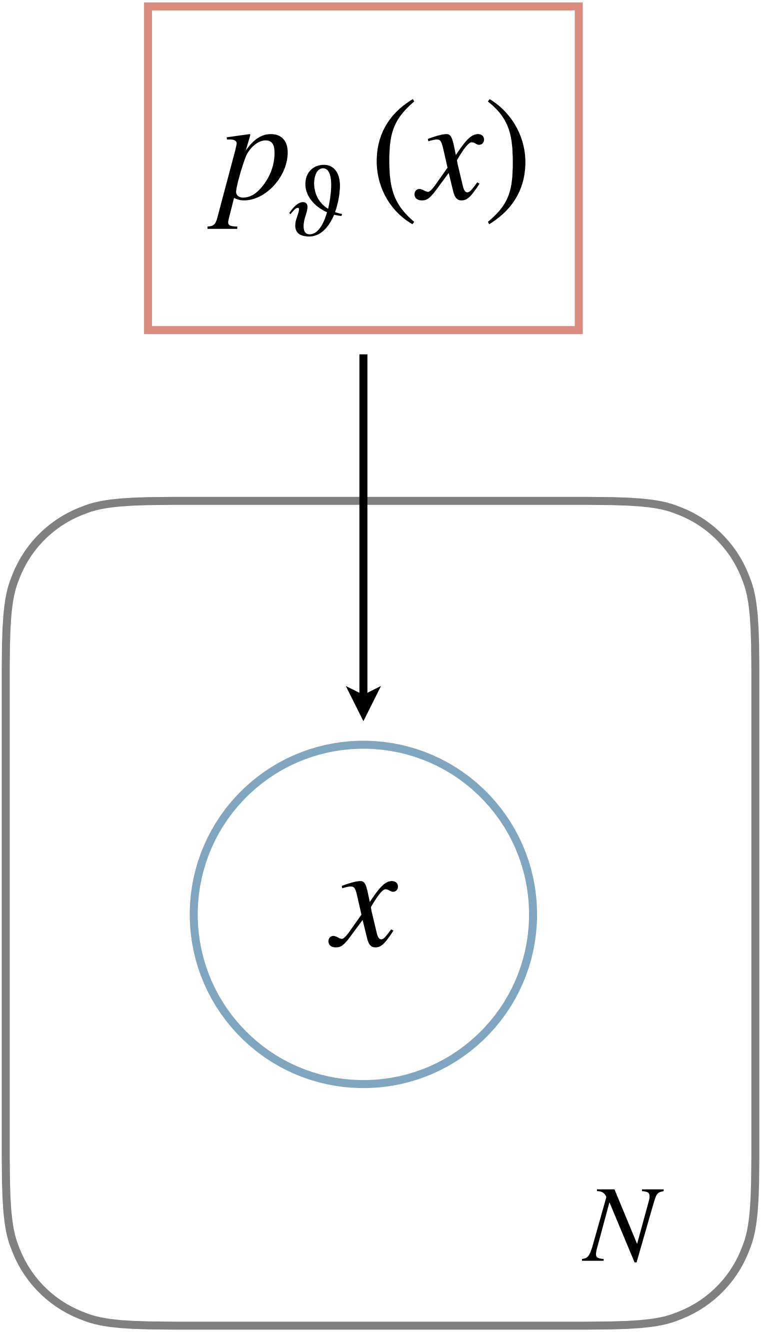
14

Latent-variable modeling

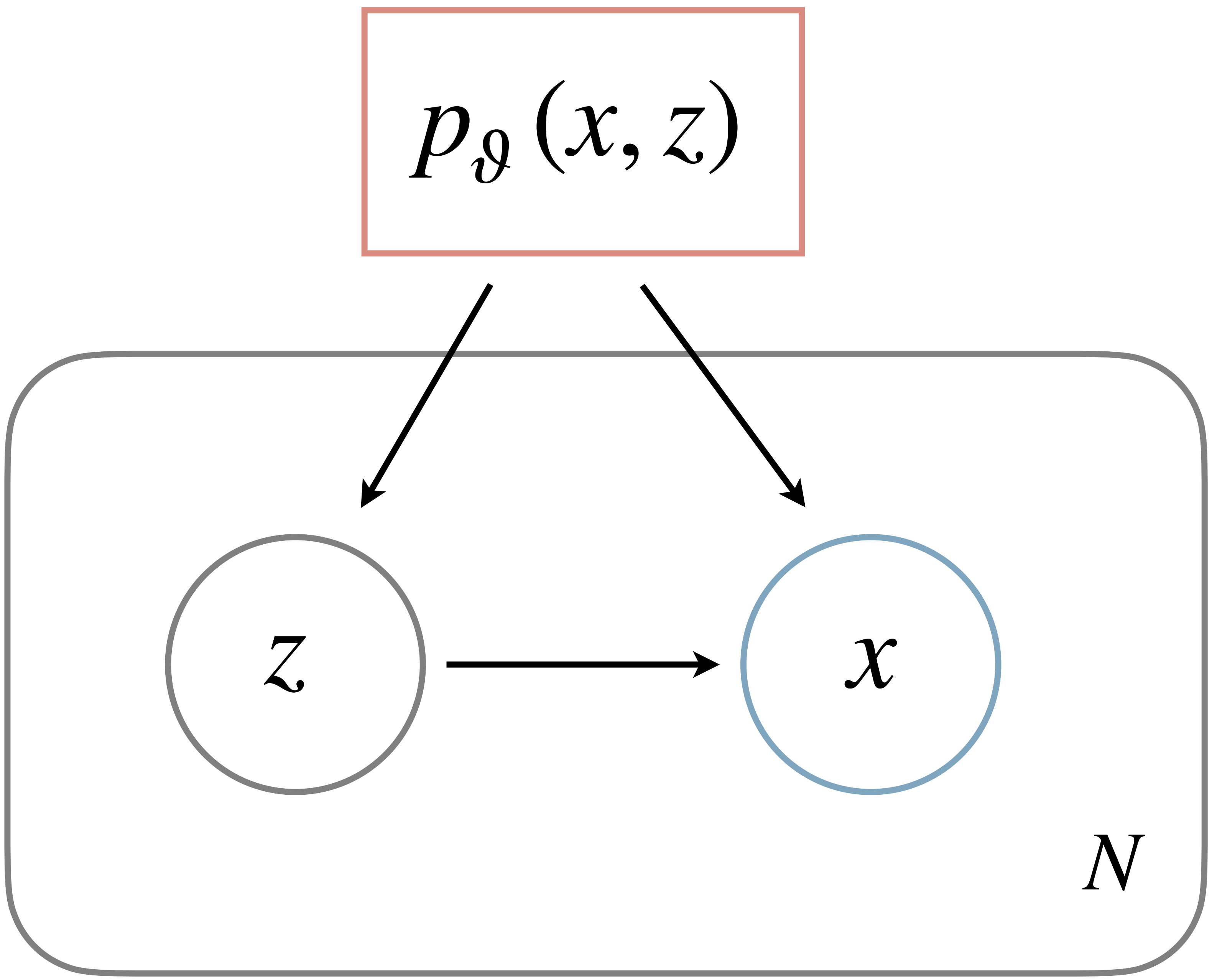
Learn lower-dimensional structure in the data distribution

Observed variables


$p_\vartheta(x)$
x
N

Make the problem easier by making it "harder":

introduce *joint distribution* $p_\theta(x, z)$



Latent variables

Observed variables

Common factorization:

$$p_\vartheta(x, z) = p(z) \cdot p_\vartheta\left(x \mid z\right)$$

Latent-variable modeling

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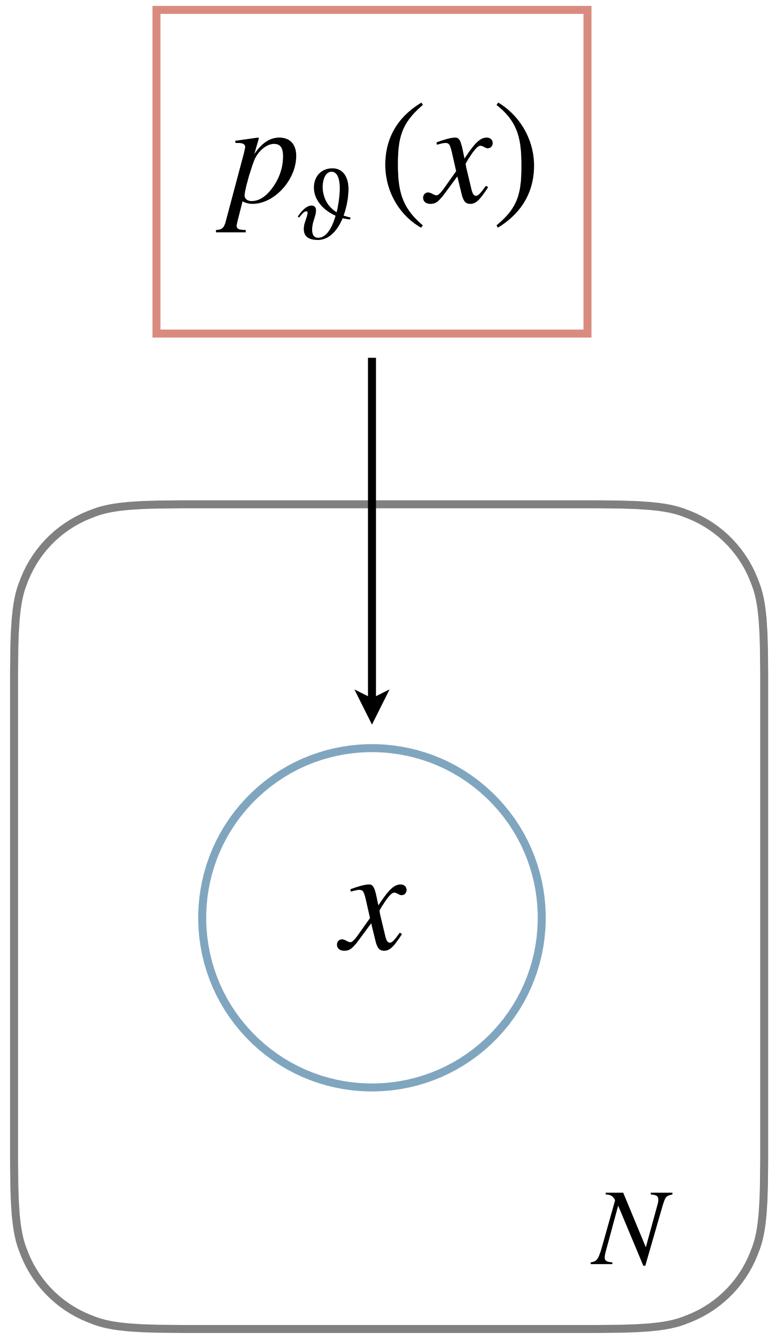
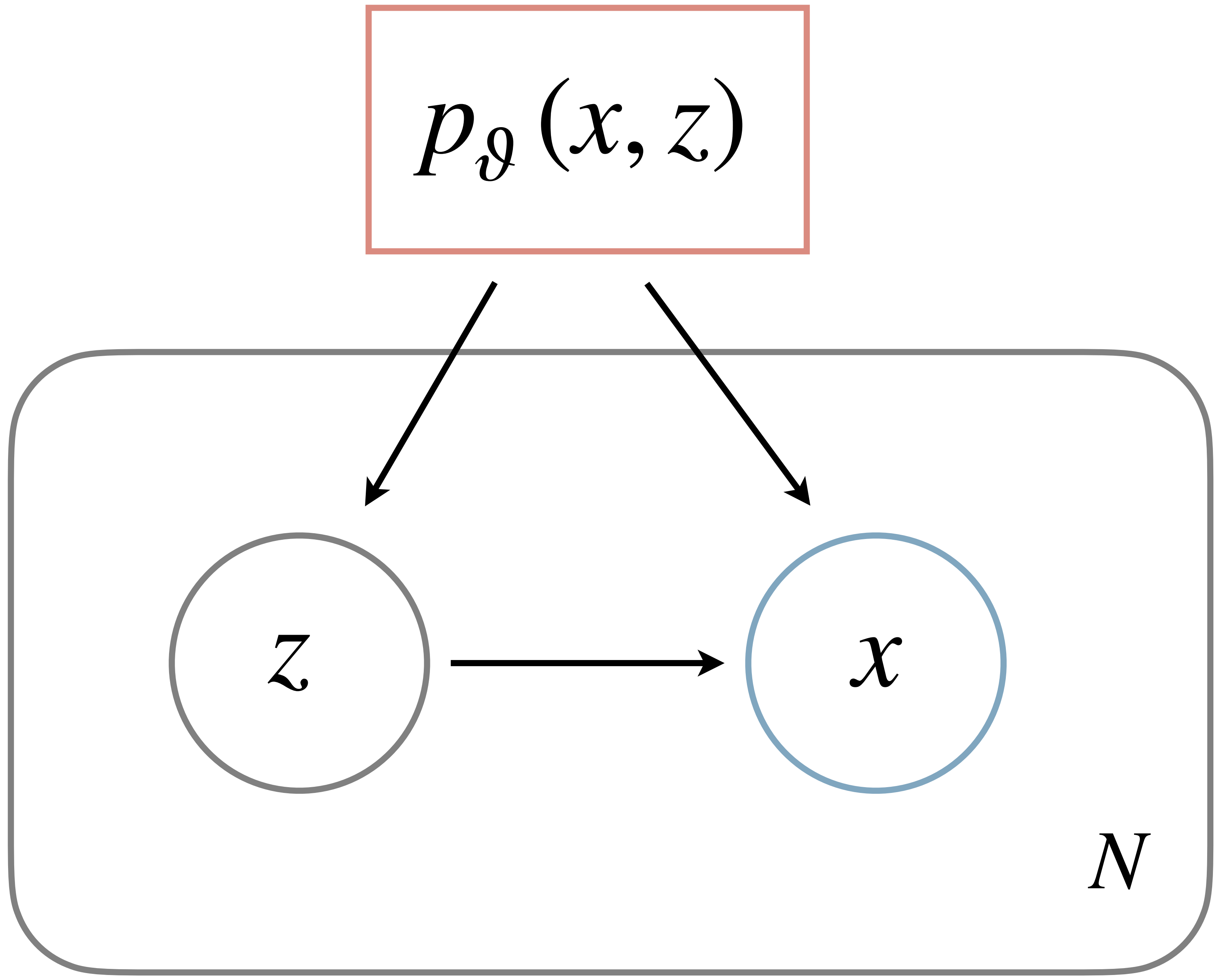


Observed variables



Latent variables

Observed variables

Common factorization:

$$p_\vartheta(x, z) = p(z) \cdot p_\vartheta\left(x \mid z\right)$$

Latent-variable modeling

Maximum-likelihood training?

$$\vartheta^* = \arg\max_{\vartheta} p_\vartheta(x)$$

$$= \arg\max_{\vartheta} \int p_\vartheta(x \mid z) p(z)\,\mathrm{d}z$$

$$= \arg\max_{\vartheta} \left\langle p_\vartheta(x \mid z) \right\rangle_{p(z)}$$