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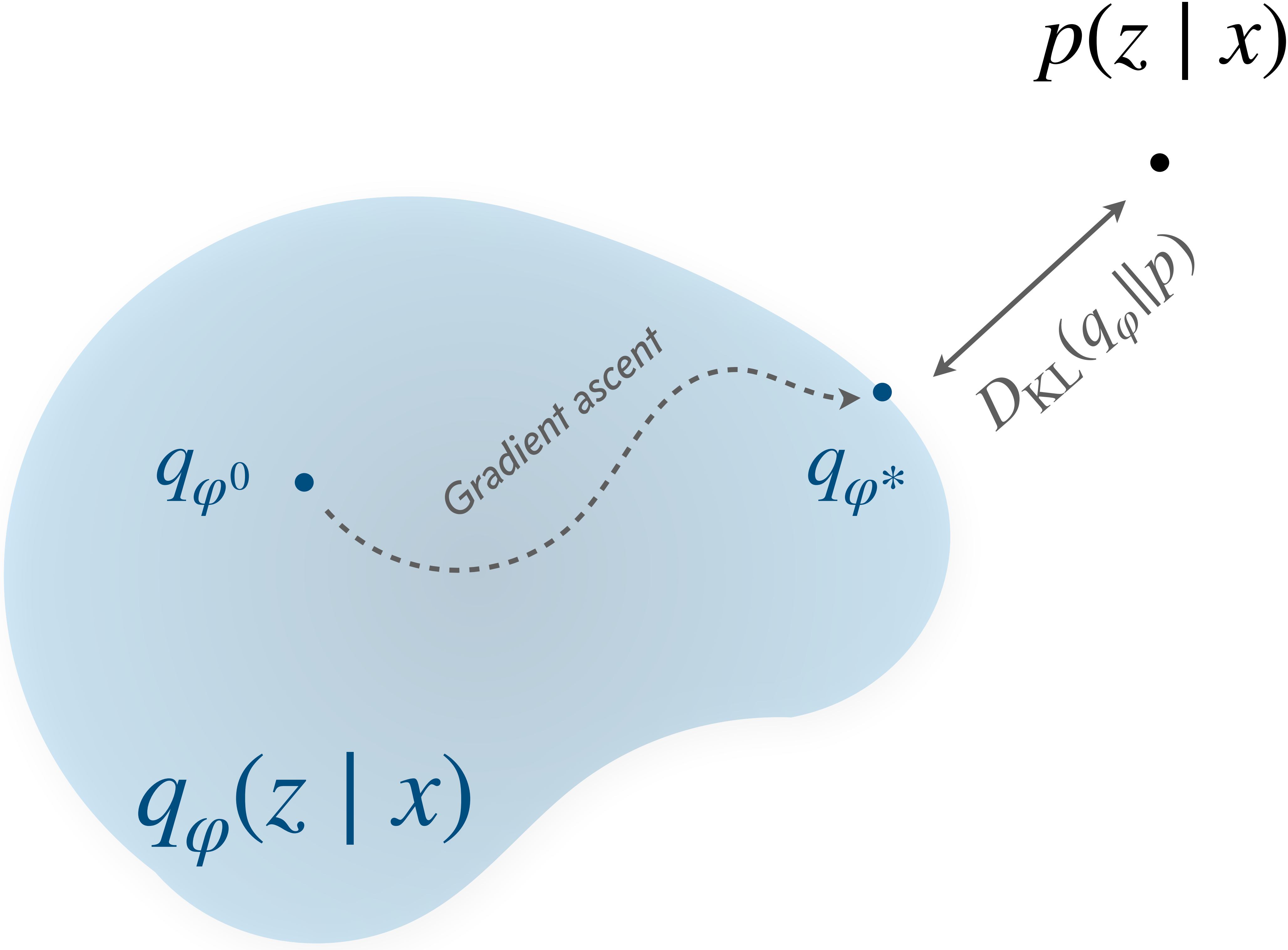
21

Variational inference

Infer the posterior over the latent parameters



$p(z \mid x)$
$D_{KL}(q_\varphi \| p)$
Gradient ascent
q_{φ^0}
q_{φ^*}
$q_\varphi(z \mid x)$

$$\underbrace{D_{\mathrm{KL}}\left(q_\varphi(z \mid x) \| p(z \mid x)\right)}_{\geq 0} = \underbrace{\log p(x)}_{\text{Evidence}} - \underbrace{\left\langle \log p_\vartheta(x, z) - \log q_\varphi(z) \right\rangle_{q_\varphi(z)}}_{\text{Evidence Lower BOund (ELBO)}}$$

A two-for-one!

- ☑ Estimate approximate posterior $q_\varphi(z \mid x) \approx p(z \mid x)$
- ☑ Estimate likelihood/evidence $\mathrm{ELBO} \approx p(x)$

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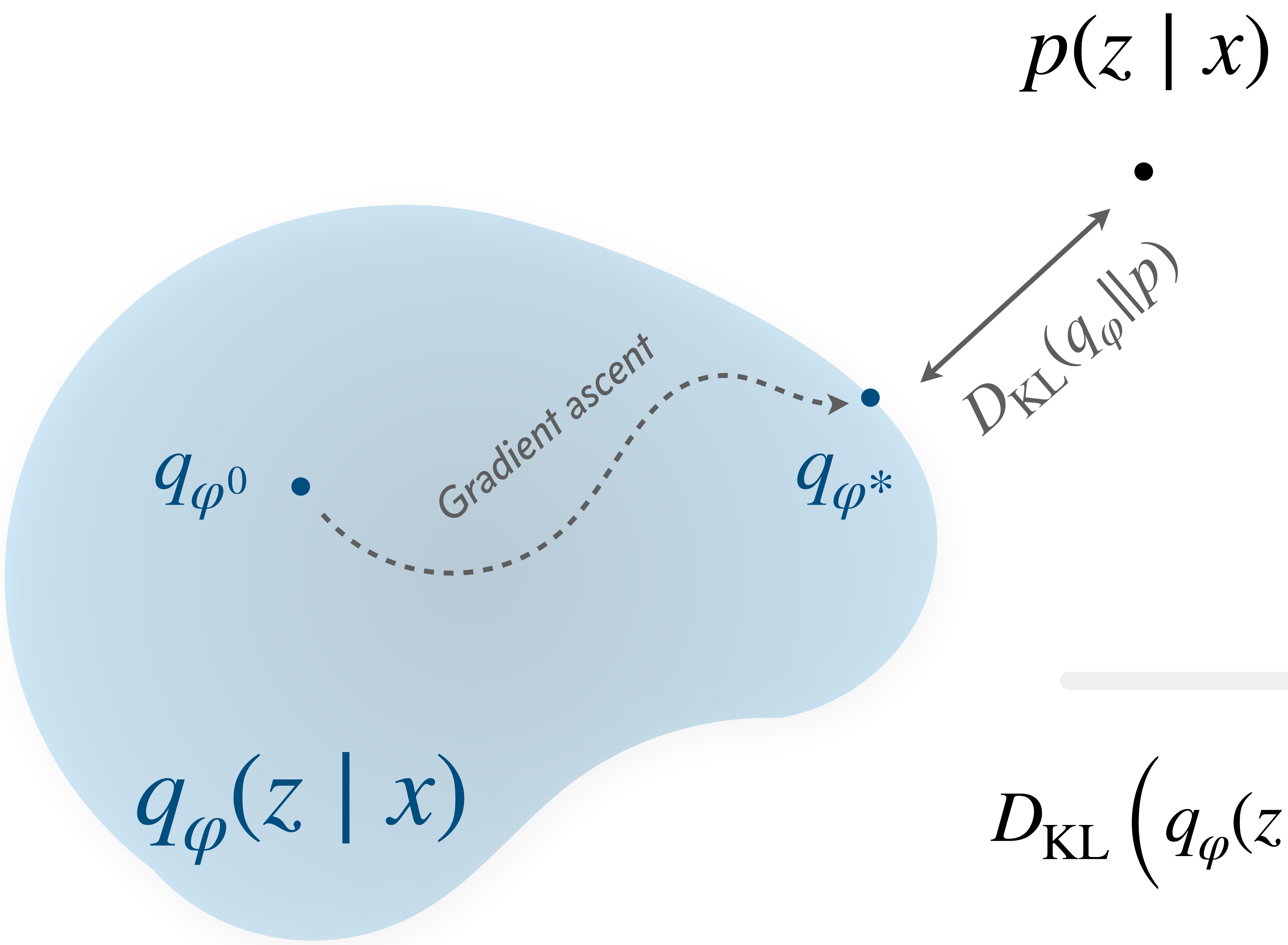

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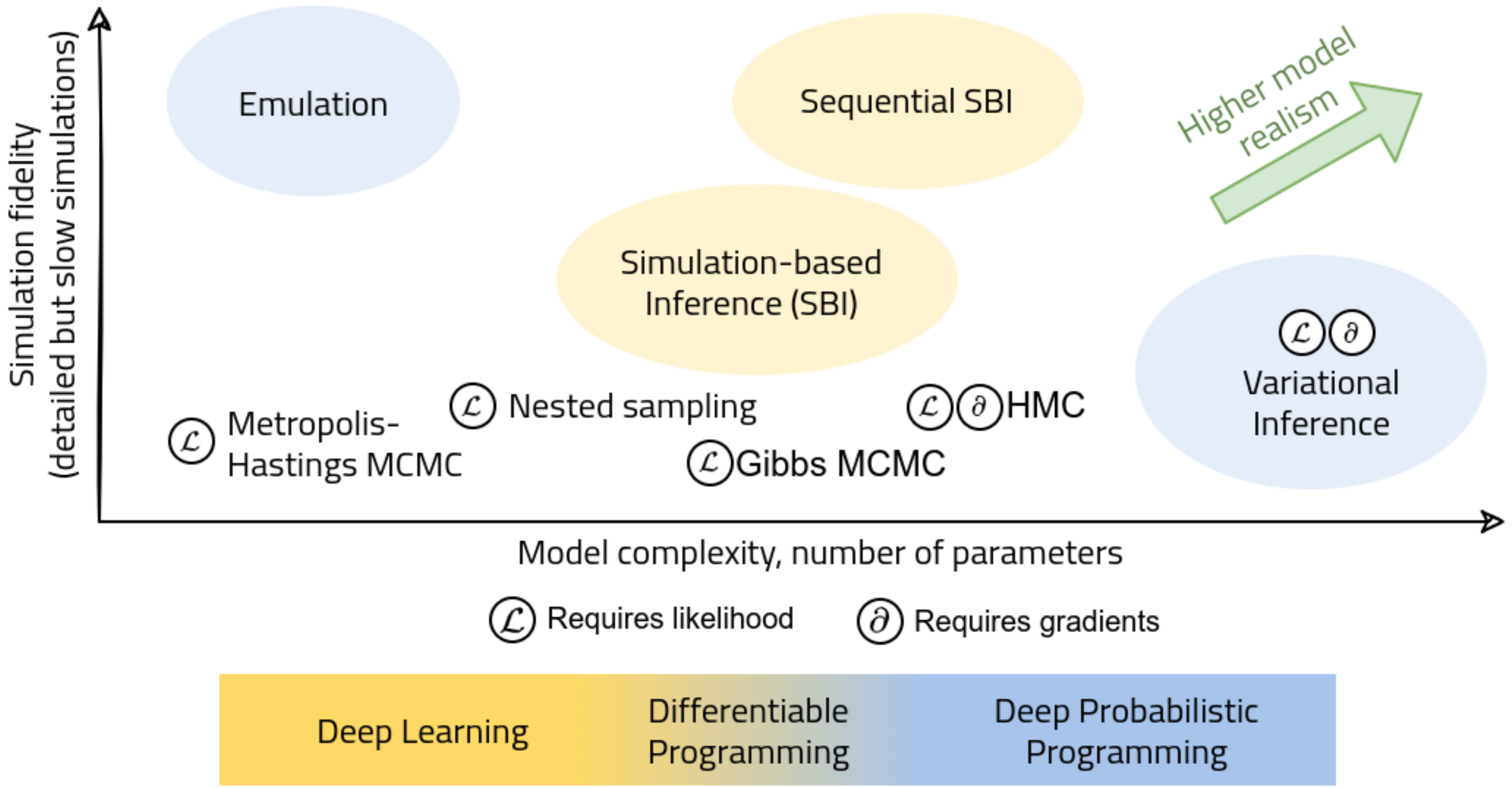
Variational inference

A general-purpose technique for posterior estimation: *optimization* instead of *sampling*



[EuCAPT White Paper 2021]