Chapter 10 Variational Inference

1. **Goal** Evaluate posterior $P(\mathbf{Z}|\mathbf{X})$ of the latent variables $\mathbf{Z}$ given observed variables $\mathbf{X}$.
2. **Use Case** In EM, need to evaluate expectation of $\log(p(\mathbf{X}, \mathbf{Z}))$ w.r.t. $p(\mathbf{Z}|\mathbf{X})$
3. **Problem** Latent space may have very high dimension or posterior distribution too complex to be analytically tractable.
4. **Approaches**
   (a) **Stochastic** Markov chain Monte Carlo and other sampling methods
   (b) **Deterministic** variational inference, laplace approximation

10.1 Variational Inference

1. **Functional derivative** How value of a functional changes in response to infinitesimal changes to the input function