Proposed Approach – Variational Inference
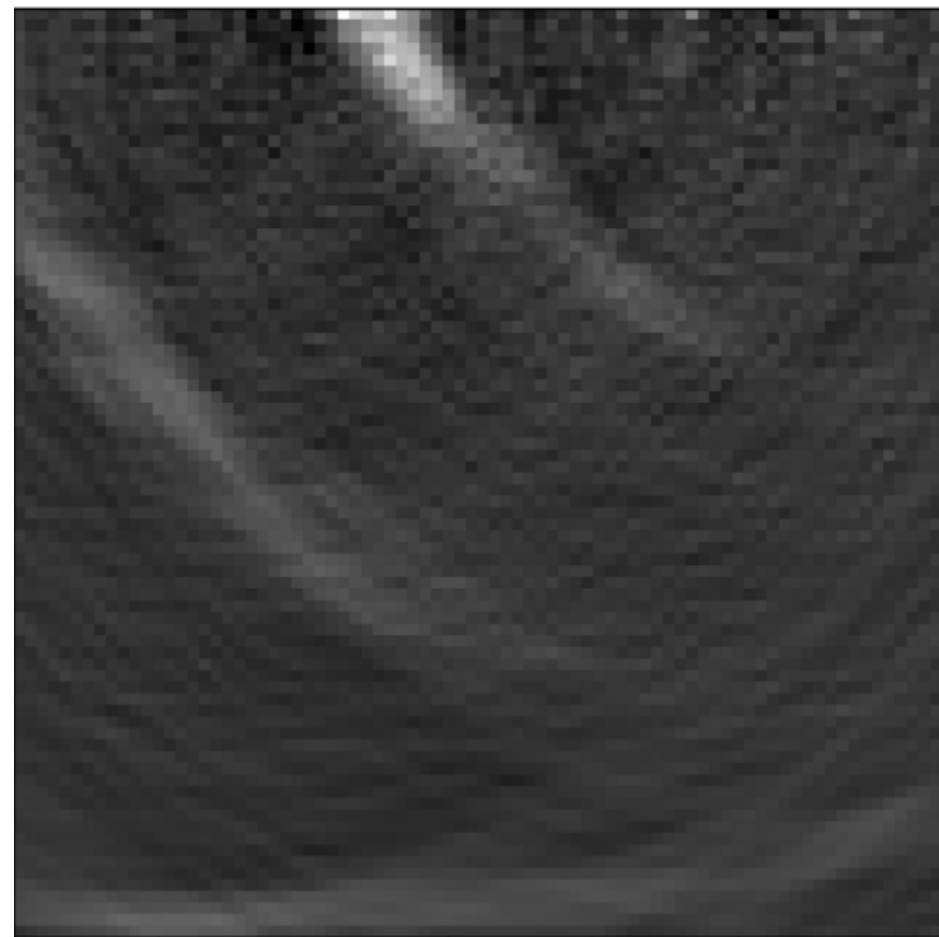
Pose inverse problem in Bayesian formulation where the (conditional) posterior distribution encodes all sources of uncertainty
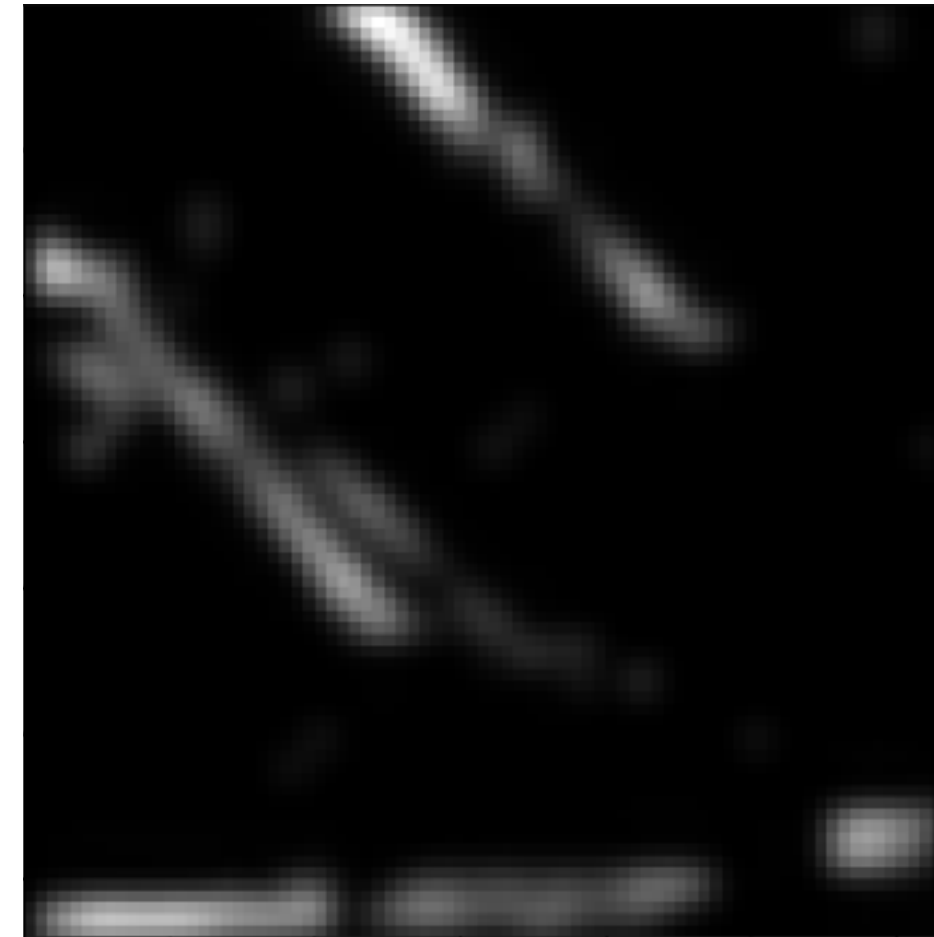
$$p(\mathbf{x}\,|\,\mathbf{y})$$

We want a method of **Variational Inference** to approximate this distribution

$$q_\theta(\mathbf{x}\,|\,\mathbf{y}) \approx p(\mathbf{x}\,|\,\mathbf{y})$$

Training samples & operator -> samples from joint distribution $\quad \mathbf{y}, \mathbf{x} \sim \pi_{y,x}(\mathbf{y}, \mathbf{x})$

$$\mathbf{y} = \mathbf{p}_{adj} = A^\top \mathbf{d}$$

$$\mathbf{x} = \mathbf{p}$$

We can sample directly from the posterior

$$(\mathbf{y}, \_) \xrightarrow{T_{\theta_y}(\mathbf{y})} (\mathbf{z_y}, \_)$$

$$\mathbf{z_x} \sim N(0, I)$$

$$(\mathbf{y}, \mathbf{x}_{post}) \xleftarrow{G_{\theta_x}(\mathbf{z_x}) = T_{\theta_x}^{-1}(\mathbf{z_y}, \mathbf{z_x})} (\mathbf{z_y}, \mathbf{z_x})$$

 Kruse, Jakob, et al. "HINT: Hierarchical invertible neural transport for density estimation and Bayesian inference." arXiv preprint arXiv:1905.10687 (2019).