

Censai

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July 27, 2021

Recurrent Inference Machine (RIM)

The RIM is designed to solve problems of the form

$$\mathbf{y} = f(\mathbf{x}) + \boldsymbol{\eta}$$

The noise model is usually chosen to be Gaussian $\boldsymbol{\eta} \sim \mathcal{N}(0, \Sigma)$, such that

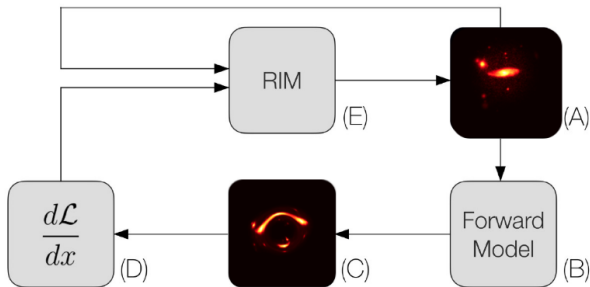
$$\log \mathcal{L}(\mathbf{y} \mid \mathbf{x}) \propto -\frac{1}{2}(\mathbf{y} - f(\mathbf{x}))^T \Sigma^{-1}(\mathbf{y} - f(\mathbf{x}))$$

RIM solves this problem recursively, similarly to a downhill optimizer

$$\hat{\mathbf{x}}_{t+1} = \hat{\mathbf{x}}_t + \underbrace{g_{\varphi}(\mathbf{x}_t, \nabla \mathcal{L}_{\mathbf{y}|\hat{\mathbf{x}}_t})}_{-\gamma_t \Delta \hat{\mathbf{x}}_t}$$

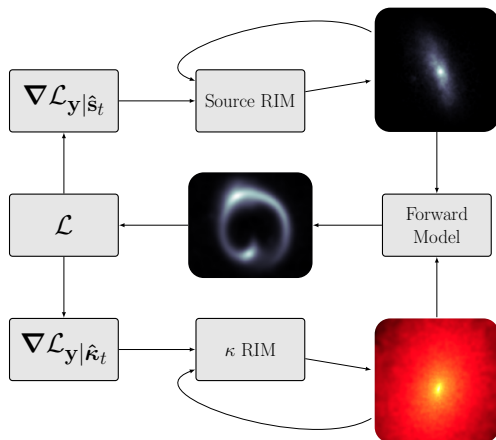
Estimating Background Source Brightness

Morningstar, Perreault-Levasseur *et al.*



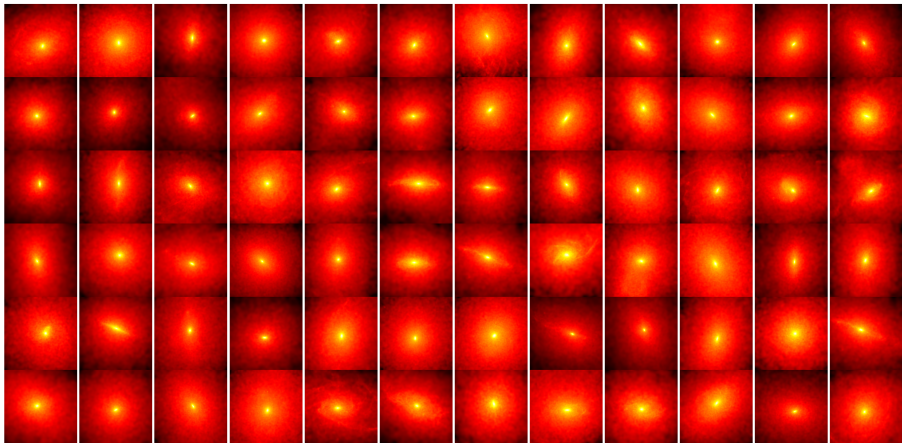
Estimating both source and κ

Adam, Perreault-Levasseur *et al.*, in prep.



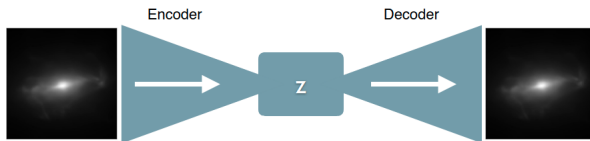
Simulated Mass Distributions

Illustris TNG100-1: Dark Matter, Baryons, Gas and Black Holes

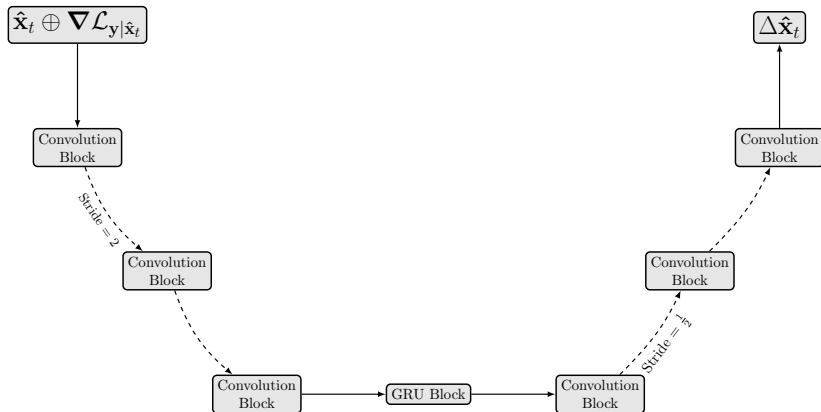


Data Augmentation

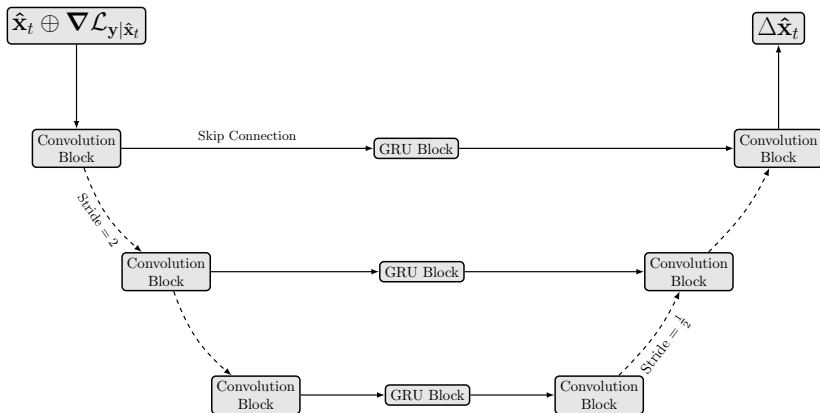
VAE



Original Architecture



New Architecture



Early Results

$$\chi^2 = 1.944\text{e-}01$$

