



The Problem

Blind deconvolution problems are heavily ill-posed where the specific blurring kernel is not known.



Image recovery problems typically have two terms, the data fidelity term and the image prior.

$$x^* = \arg\min_{\hat{x}} f(y, x) + g(x)$$

•It is not trivial to correctly model the image prior using a hand-crafted function. •The assumed prior needs to be **expressive enough**.

•Modelling the data fidelity function is difficult when the blurring kernel or its prior distribution is unknown.

•Even in cases where the prior distribution of the kernel is known, it might be hard to find a closed form.

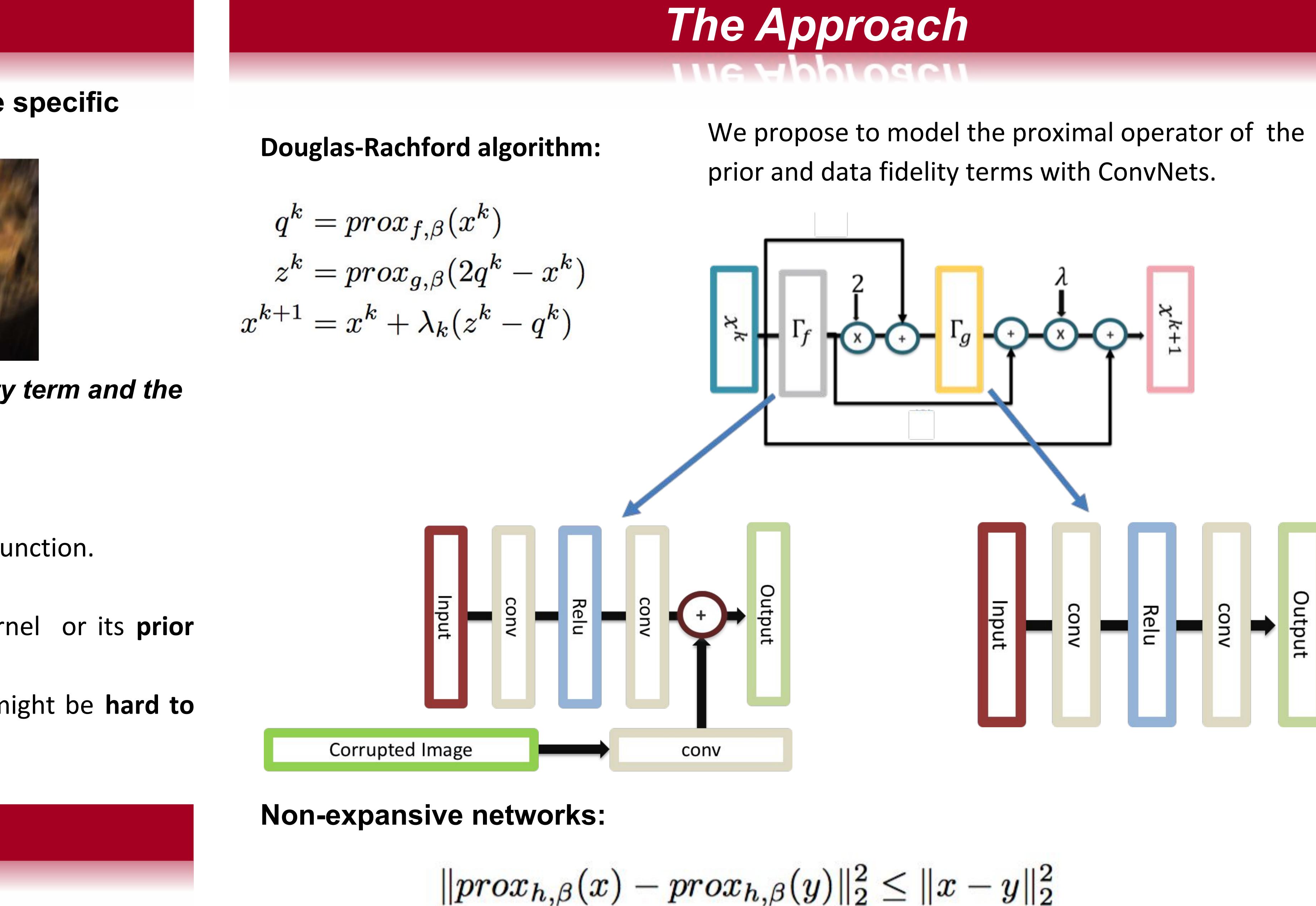
The Approach

- •We design an iterative optimization algorithm.
- •We **unfold** the iterative algorithm to be a deep network.
- •We learn the unknown parameters from the corrupted data.
- •We allow these unknown parameters to be tuned differently for each stage.

Douglas-Rachford Networks: Learning Both the Image Prior and Data Fidelity Terms for Blind Image Deconvolution

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Enforcing this condition for convolutional layers only required the projection of each filter weight into the unit norm ball.

The Loss Function:

L(x, y) =

Method	Gong	Whyte	Xu	Sun	Pan	Liu	Nah	Kupyn	Zhang	Xin	Dr-Net(IN)	Dr-Net
PSNR	26.06	24.53	20.30	25.31	23.52	25.75	28.49	28.7	29.19	30.26	28.20	30.35
SSIM	0.8632	0.8458	0.7407	0.8511	0.8336	0.8654	0.9165	0.958	0.9306	0.9342	0.902	0.961

Kohler dataset: This dataset consists of 48 images that are generated by convolving 12 motion kernels with 4 images. These motion kernels are generated to be similar to real camera motion.

	Method	Whyte	Xu	Sun	Nah	Kupyn	Tao	Dr-Net(IN)	Dr-Net
12	PSNR (dB)	27.03	27.47	25.22	26.48	25.86	26.75	25.12	27.20
5	SSIM	0.809	0.811	0.773	0.807	0.802	0.837	0.792	0.865



$$||x - y||_2^2 + \mu L_{GAN}(x, y)$$





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The Experiments

THE EVACULE 12 **GoPro test dataset:** The GoPro test dataset is generated by taking the average of several frames from videos that are captured with high frame rate cameras. Averaging these frames creates blurry images due to the preexisting motion.

Corrupted Image

Recovered Image