

Deep Image Deblurring: A Survey

- <https://arxiv.org/pdf/2201.10700>

Problem Formulation

- 元画像を I_s , blurred image を I_b の関係はパラメータ θ_η を用いて

$$I_b = \Phi(I_s; \theta_\eta)$$

- 解きたいタスクはこの逆写像を求めることである

$$I_{db} = \Phi^{-1}(I_b; \theta_\eta)$$

- I_{db} は deblurred image であり I_s を推定したもの

Blur

- 4種類ある
 - Motion Blur
 - Out-of-focus Blur
 - Gaussian Blur
 - Mixed Blur
- 一般的に以下の式でかける

$$I_b = K * I_s + \theta_\mu$$

- K は blur kernel
- θ_μ は gaussian noise
- deblur の際に kernel が事前にわかっているものを Non-Blind Deblurring という
- 逆に kernel がわからないものを Blind Deblurring という

IQA(Image Quality Assessment)

- Full-Reference Metrics(正解画像 gt が与えられている場合の評価方法)
 - PSNR
 - SSIM

- WSNR
- MS-SSIM
- IFC
- NQM
- UIQI
- VIF
- LPIPS
- No-Reference Metrics
 - BIQI
 - BLINDS2
 - BRISQUE
 - CORNIA
 - DIIVINE
 - NIQE
 - SSEQ

network

- CNN, RNN, ResNet, ViTベースの手法がある

Method	Category	Blur type	Dataset	Architecture	Key idea
Learning-to-Deblur [109]	Uniform	Motion	Convolution	Cascade	The first stage uses a CNN to estimate blur kernels and latent images. The second stage operates on the blurry images and latent image for kernel estimation.
TextDBN [40]		Motion & defocus		CNN	Trains a CNN for blind deblurring and denoising.
SelfDeblur [100]		Gaussian & motion		DAE	Two generative networks capture the blur kernel and a latent sharp image, respectively, which is trained on blurry images.
MRFCNN [125]	Non-uniform	Motion	Convolution	CNN	Estimate motion kernels from local patches via CNN. An MRF model predicts the motion blur field.
NDEBLUR [11]			Convolution	CNN	Train a network to generate the complex Fourier coefficients of a deconvolution filter, which is applied to the input patch.
MSCNN [86]			Averaging	MS-CNN	A multi-scale CNN generates a low-resolution deblurred image and a deblurred version at the original resolution.
BIDN [91]			Convolution	DAE	The network regresses over encoder-features to obtain a blur invariant representation, which is fed into a decoder to generate the sharp image.
MBKEN [146]			Convolution	Cascade	A two-stage CNN extracts sharp edges from blurry images for kernel estimation.
RNN_Deblur [152]			Convolution	RNN	Deblurring via a spatially variant RNN, whose weights are learned via a CNN.
SRN [131]			Averaging	MS-LSTM	Deblurring via a scale-recurrent network that shares network weights across scales.
DeblurGAN [59]			Averaging	GAN	A conditional GAN-based network generates realistic deblurred images.
UCSDBN [75]			Convolution	Cycle-GAN	An unsupervised GAN performs class-specific deblurring using unpaired images as training data.
DMPHN [150]			Convolution	DAE	A DAE network recovers sharp images based on different patches.
DeepGyro CNN [84]			Convolution	DAE	A motion deblurring CNN makes use of the camera's gyroscope readings.
PSS-SRN [28]			Averaging	MS-LSTM	A selective parameter sharing scheme is applied to the SRN architecture and ResBlocks are replaced by nested skip connections.
DR.UCSDBN [72]			Convolution	Cycle-GAN	Unsupervised domain-specific deblurring method by disentangling the content and blur features from input images.
Dr-Net [3]			Averaging	CNN	A network to learn both the image prior and data fidelity terms via Douglas-Rachford iterations.
DeblurGAN-v2 [60]			Averaging	GAN	An extension of DeblurGAN using a feature pyramid network and wide range of backbone networks for better speed and accuracy.
RADN [98]			Averaging	DAE	Region-adaptive dense deformable module to discover spatially varying shifts.
DBRBGAN [154]			Averaging	Reblur	Two networks, BGAN and DBGAN, which learn to blur and to deblur, respectively.
SAPHN [123]			Averaging	DAE	Content-adaptive architecture to remove spatially-varying image blur.
ASNet [52]			Convolution	DAE	DAE framework, which first estimates the blur kernel in order to recover sharp images.
EBMD [46]			Averaging	DAE	An event-based motion deblurring network, introducing a new dataset, DAVIS240C.

(論文より引用)

英語

- taxonomy : 分類学