

Universidade Federal de Pernambuco – UFPE

Centro de Informática – Cin

Pós-graduação em Ciência da Computação



Projeto de Processamento de Imagens Digitais 2016.1

Deconvolution Method to Speed Up Deblurring of a Single Photograph

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Agenda

- ➔ Proposta do Artigo
- ➔ Método Proposto
- ➔ Estágio 1 – Processing
- ➔ Estágio 2 – Interactive Refocussing
- ➔ Experimento e Resultados
- ➔ Conclusão
- ➔ Referencias

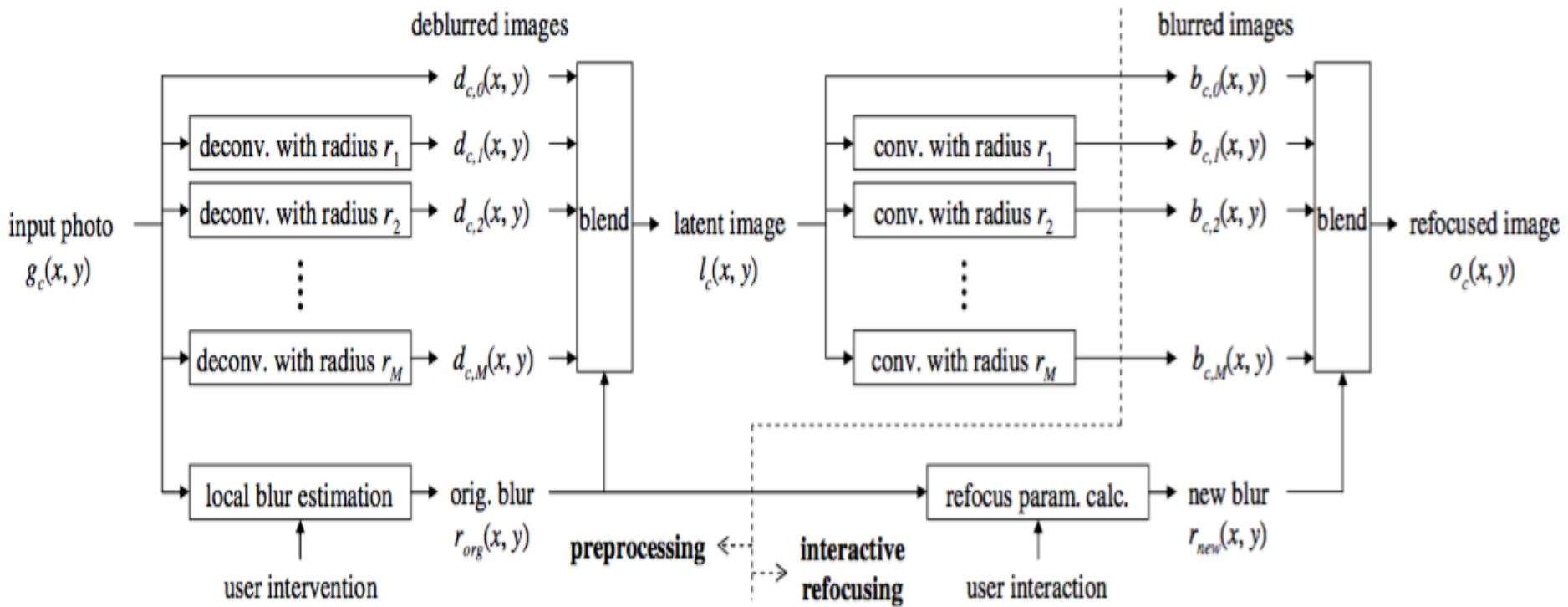
Proposta do Artigo

Blobozrs do Artigo

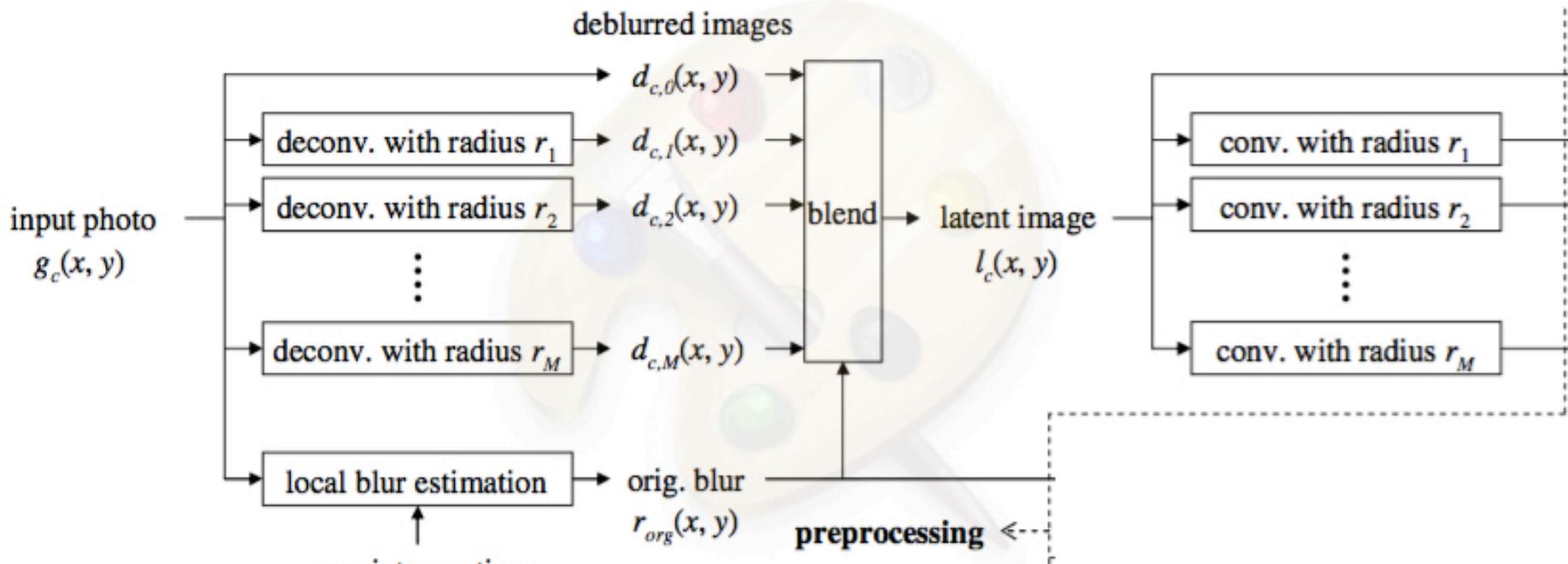


Método Proposto

Microblobozo



Estágio 1 - Processing



Point 2

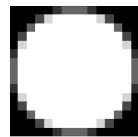
Estágio 1 - Processing

$$g_c(x, y) = h(x, y; r_j) * d_{c,j}(x, y) + n_c(x, y)$$

Gerar imagens desembassadas

$$l_c(x, y) = \frac{r_{j+1} - r_{org}(x, y)}{r_{j+1} - r_j} d_{c,j}(x, y) + \frac{r_{org}(x, y) - r_j}{r_{j+1} - r_j} d_{c,j+1}(x, y)$$

Mistura as imagens



Point Spread
Function-Usado
como Kernel

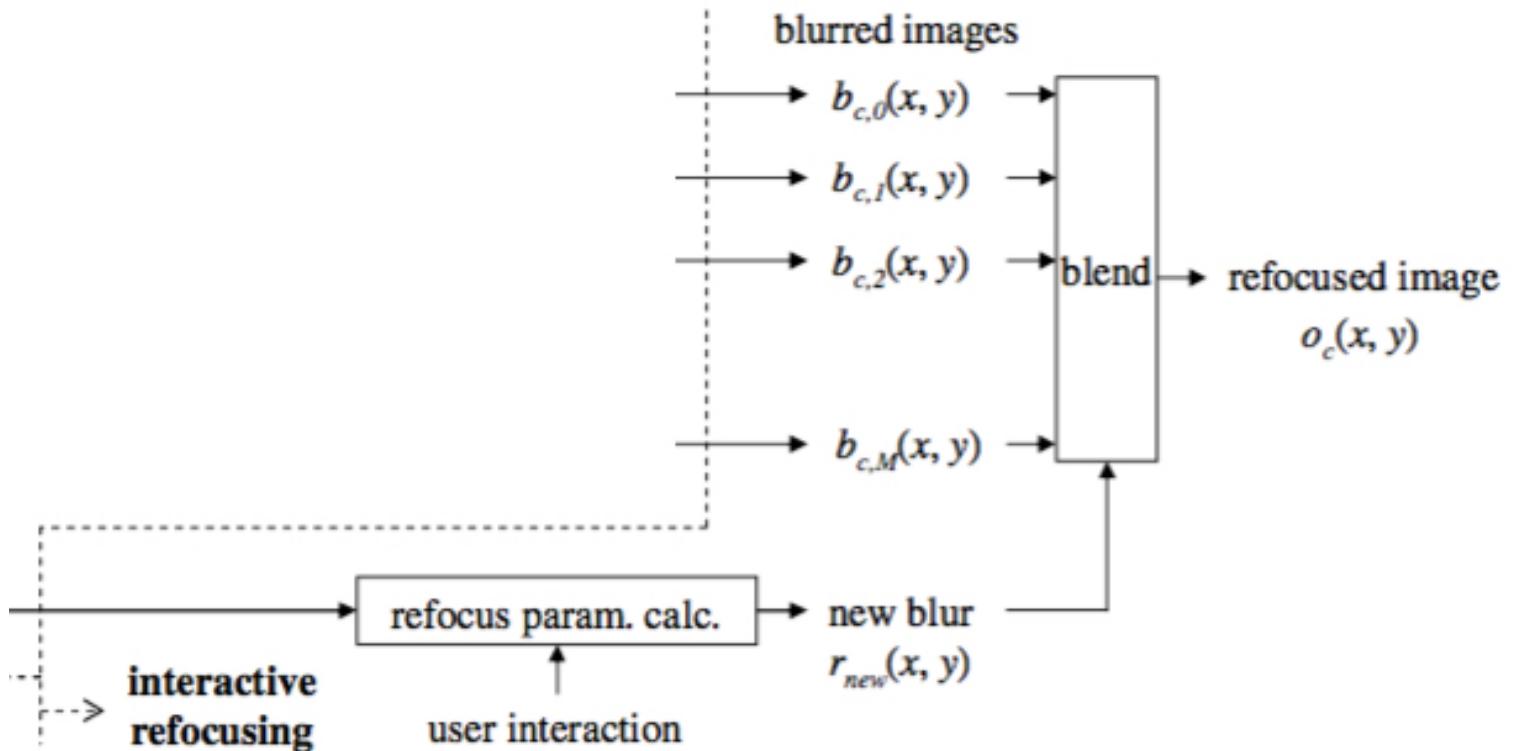
$$\mathbf{g}_x = \mathbf{Hd}_x + \mathbf{n}_x, \quad \mathbf{g}_y = \mathbf{Hd}_y + \mathbf{n}_y.$$

Equação de Deconvolução no gradient domain, FFT

$$G(\omega) = \text{sinc}(r\omega)D(\omega) + N(\omega)$$

Equação de Deconvolução no dominio da frequencia.

Estágio 2 – Interactive Refocussing



Estágio 2 – Interactive Refocussing

$$z(x,y) = \frac{F_0 v_0}{v_0 - F_0 - q_{org}(x,y)f_0} \quad \text{Mapa de profundidade} = r_{org}(x,y)$$

$$q_{new}(x,y) = (v_r q_{org}(x,y) + A_0(v_r - 1))/f_r, \quad \text{Mudança de Foco}$$

$$q_{new}(x,y) = (q_{org}(x,y) + q_{ofs})/f_r, \quad \text{Manipula Borramento}$$

$$q_{new}(x,y) = (u_r q_{org}(x,y) + q_{max}(1 - u_r))/f_r, \quad \text{Refocar objetos}$$

EXIF

Operações Interativas

- Mudar o campo de profundade
- Mudar o foco
- Auto focar – Ponto a focar

Estágio 2 – Interactive Refocussing

Exif data

Camera	Pentax K200D
Exposure	0.006 sec (1/180)
Aperture	f/11.0
Focal Length	300 mm
Focal Length	300.0 mm
ISO Speed	100
Exposure Bias	-2 EV
Flash	On, Fired
X-Resolution	0 dpi
Y-Resolution	0 dpi
Orientation	Horizontal (normal)

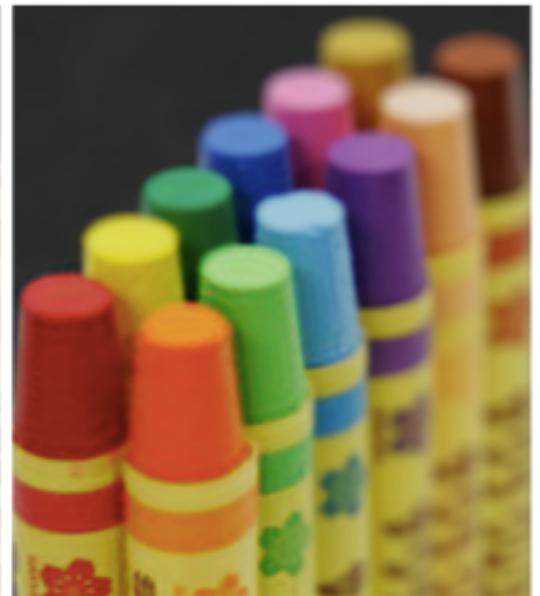
Estágio 2 – Interactive Refocussing



Imagen Original



Definindo profundidade



Mudança de Foco

Estágio 2 – Limitações



Resultado do desembassamento de uma imagem saturada.

Experimentos e Resultados

Experiências e Resultados



BANDO Method



Experimentos e Resultados

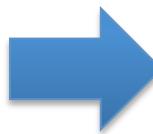
Métodos Analisados

- Regularized Deconvolution
- Richard-Lucy
- Wiener
- BANDO

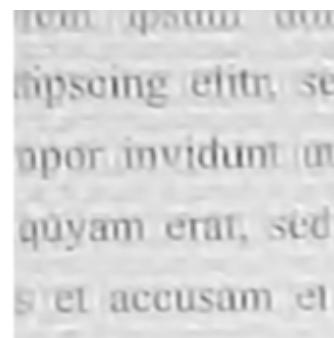
Experimentos e Resultados



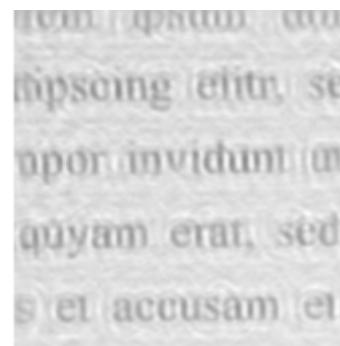
Imagen de entrada
170x170 pixels,
escala cinza



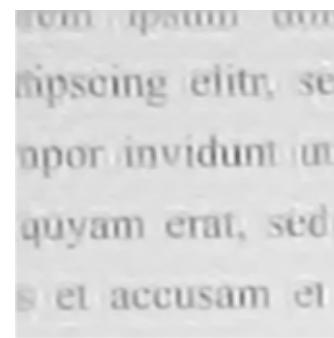
a - Regularized-Decon
(ssim = 0.5612)



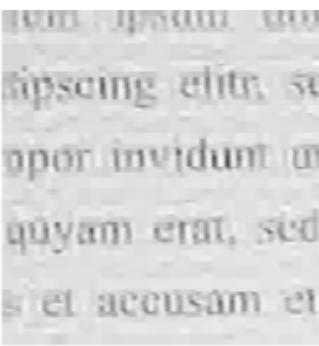
c - Wiener
(ssim = 0.5841)



b - Richardson-Lucy
(ssim = 0.5792)



d - BANDO
(ssim = 0.6835)



Experimentos e Resultados - SSIM

Structural SIMilarity (SSIM)				
Imagen / Técnica	Regularized Deconvolution	Richard-Lucy	Wiener	BANDO
girl	0.7133	0.7199	0.7781	0.7897
caracteres	0.5612	0.5792	0.5841	0.6835
lena	0.1177	0.6325	0.628	0.6285
cameraman	0.0529	0.5145	0.5358	0.5311
média	0.3613	0.6115	0.6315	0.6582

Experimentos e Resultados - PSNR

Peak signal-to-noise ratio - PSNR (dB)				
Imagen/ Tecnica	Regularized Deconvolution	Richard- Lucy	Wiener	Bando
girl	14.37	21.14	22.09	21.51
caracteres	26.03	24.17	24.15	25.81
lena	25.77	25.47	26.89	26.48
cameraman	12.90	17.89	18.36	17.61
média	19.77	22.17	22.87	22.85

Conclusão

- Limitações
- Dificuldades e aprendizado – Base; Códigos
- Implementação dos Metodos do Artigo
- Uso de metrica objetiva para validação dos dados

Referencias

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Perguntas?

Obrigado!!!!