

# **LPA with ICI rule: 2D case**

**Mathematical Models and Methods for Image  
Processing**

Stefano Bertolasi

May 14th 2026

# LPA in 2D



# LPA in 2D

$N = 5, h = 5$



$N = 5, h = 10$



# LPA in 2D

$N = 5, h = 15$

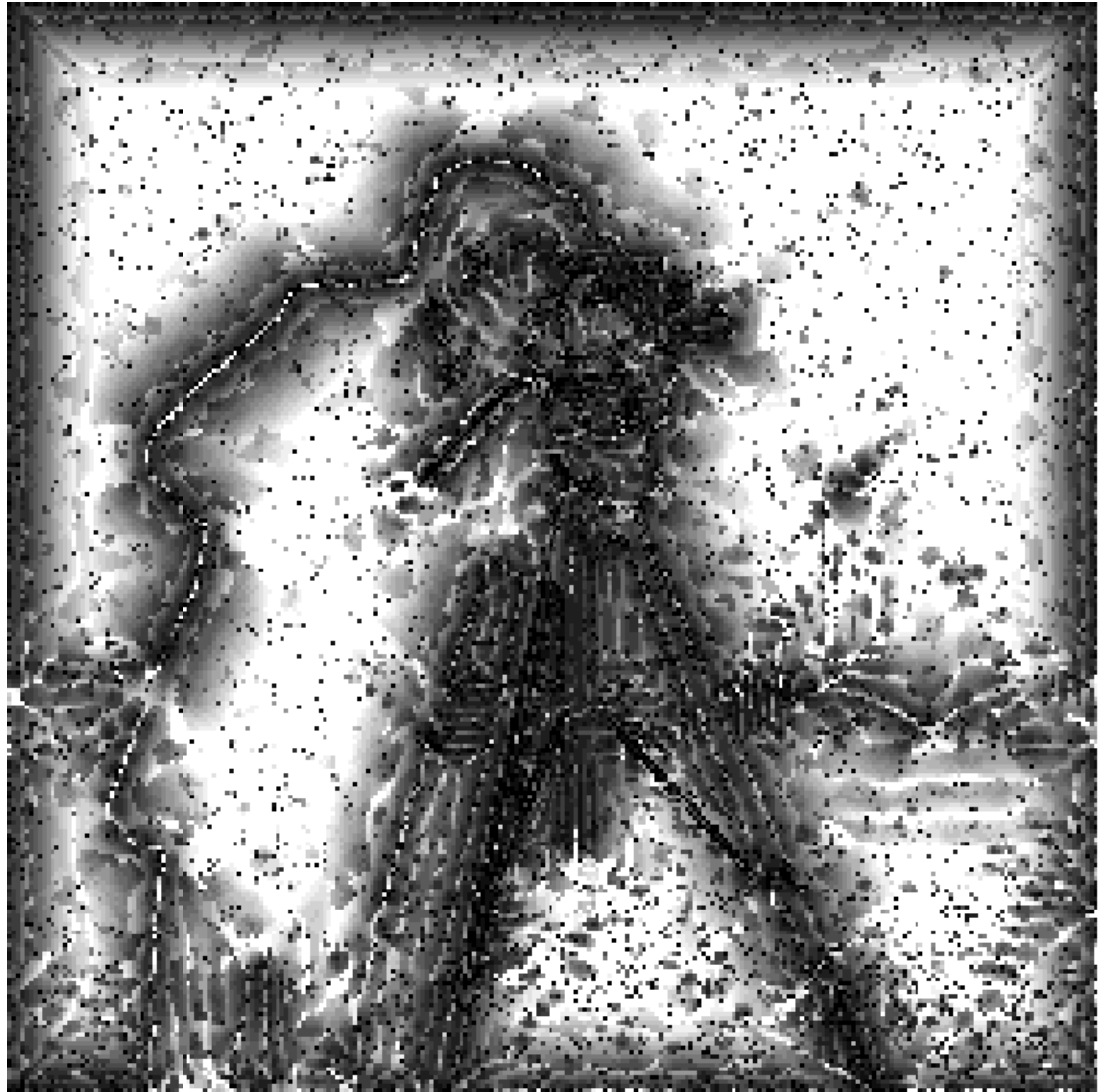


$N = 5, h = 20$

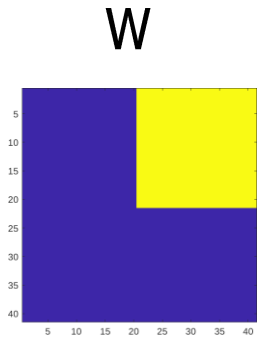


# LPA-ICI

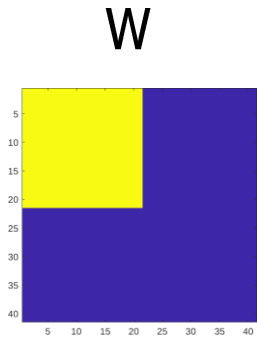
N = 5, PSNR = 24.4443



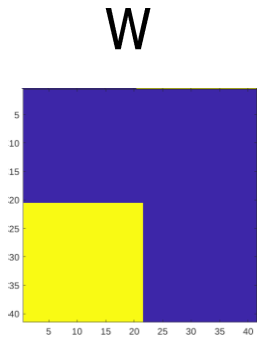
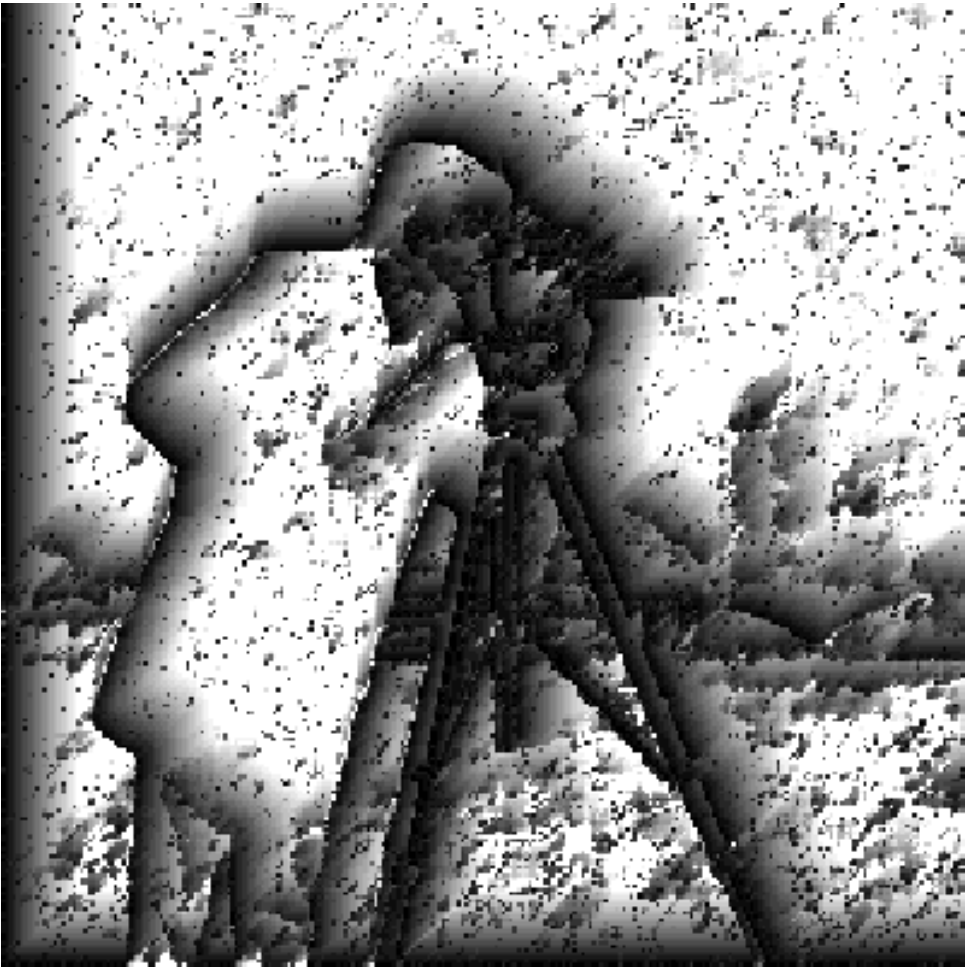
# LPA-ICI with directional kernel



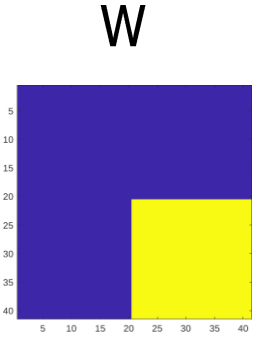
# LPA-ICI with directional kernel



# LPA-ICI with directional kernel



# LPA-ICI with directional kernel



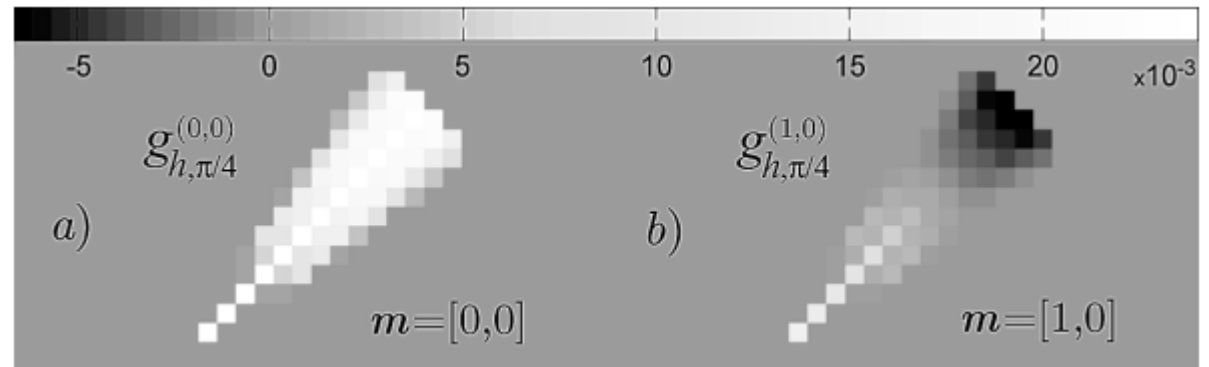
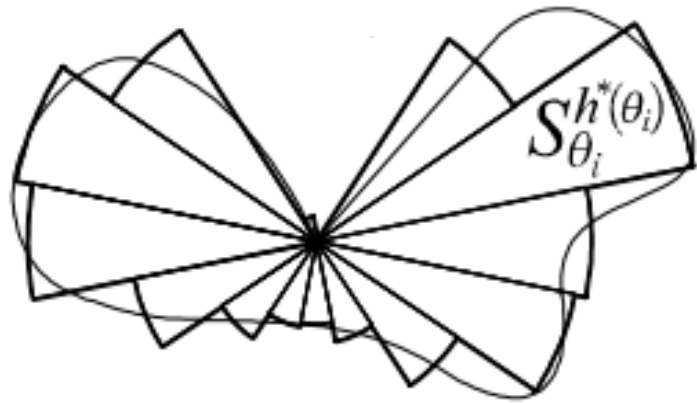
# Final Estimate

LPA-ICI estimate, PSNR = 26.38



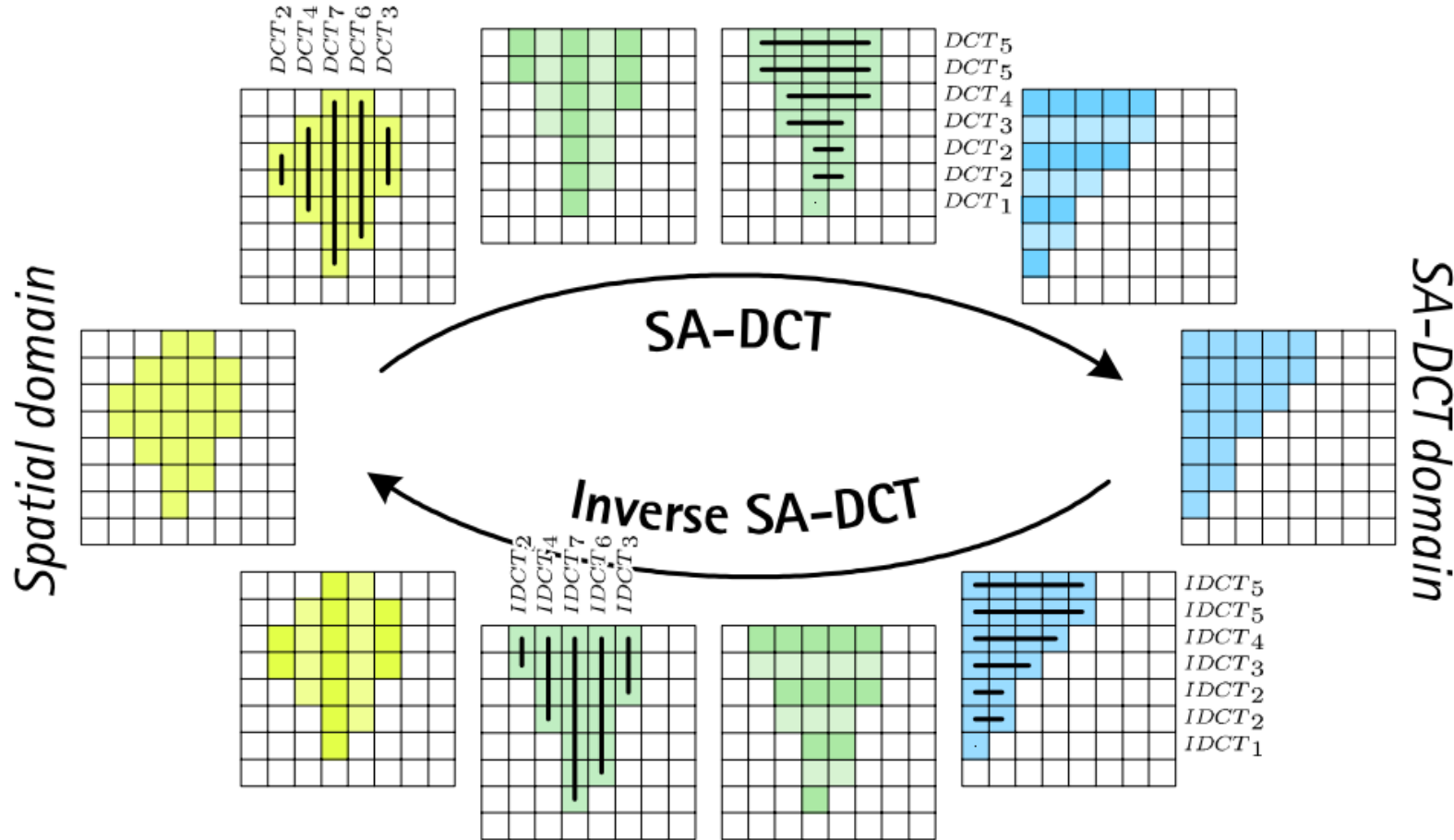
# Further Improvements

- Use better shapes for the directional kernel
- Use polynomials in polar coordinates



# Shape Adaptive DCT

Idea: use LPA-ICI to define the neighborhood of a pixel, then perform denoising in the transform domain



# Integrate Shape-Adaptive DCT in BM<sub>3</sub>D

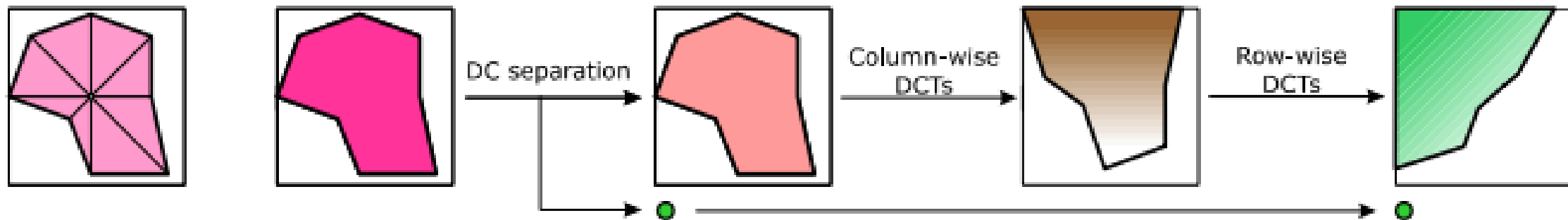
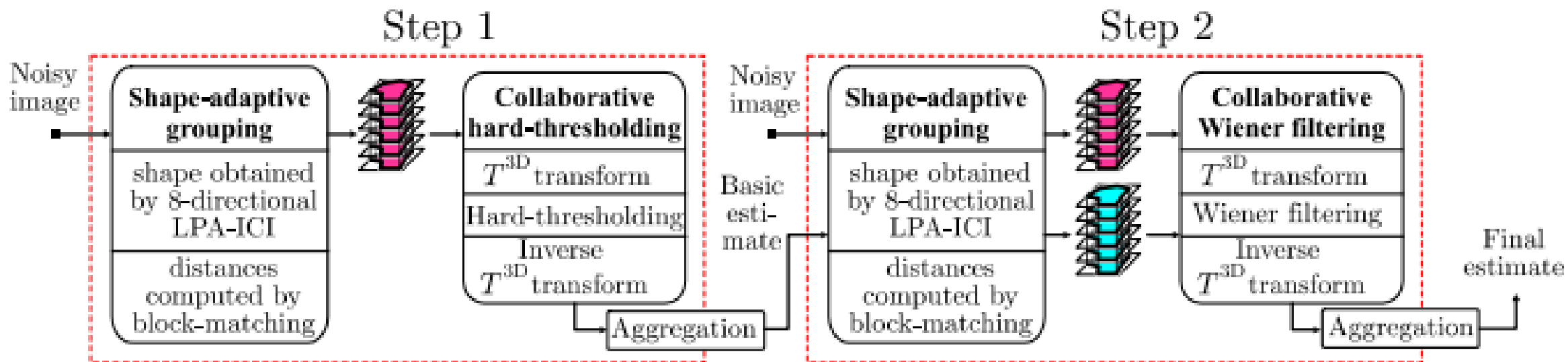


Figure 2: Illustration of the forward SA-DCT with DC-separation.



K. Dabov, A. Foi, V. Katkovnik, and K. Egiazarian, "A nonlocal and shape-adaptive transform-domain collaborative filtering", Proc. Int. Workshop on Local and Non-Local Approx. in Image Process., LNLA 2008, Lausanne, Switzerland, August 2008.

# Assignments

- Implement the LPA-ICI in the 2D case with symmetric (squared) windows
- Implement the LPA-ICI with directional kernels (defined over the quadrants)