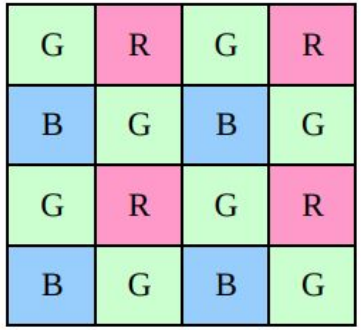
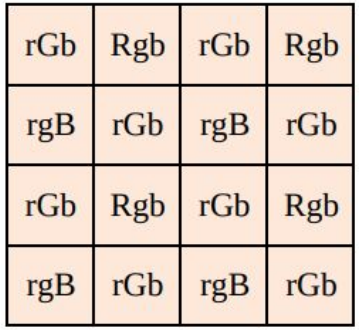
Color image demosaicing

A special case of *super-resolution*, which is used daily in most digital still cameras, is the process of *demosaicing* samples from a *color filter array (CFA)* into a full-color RGB image.

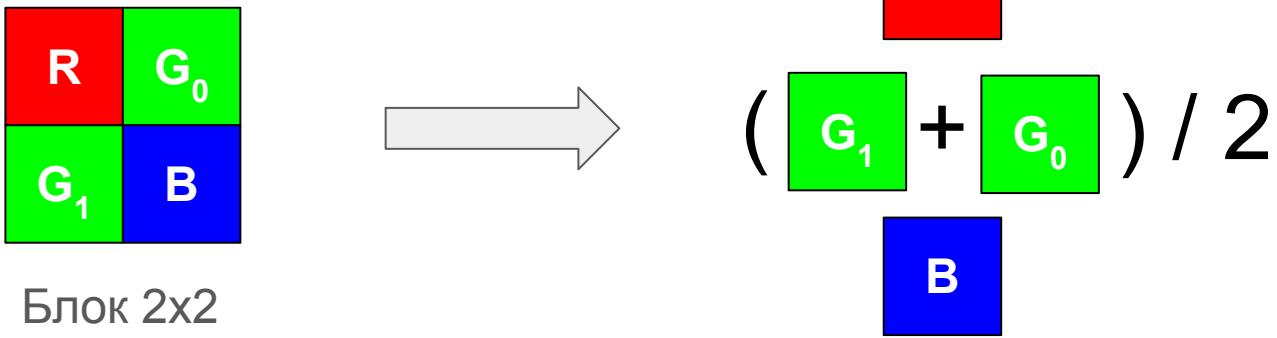




Источник: [Computer Vision: Algorithms and Applications, 2nd ed.]

Простейший подход

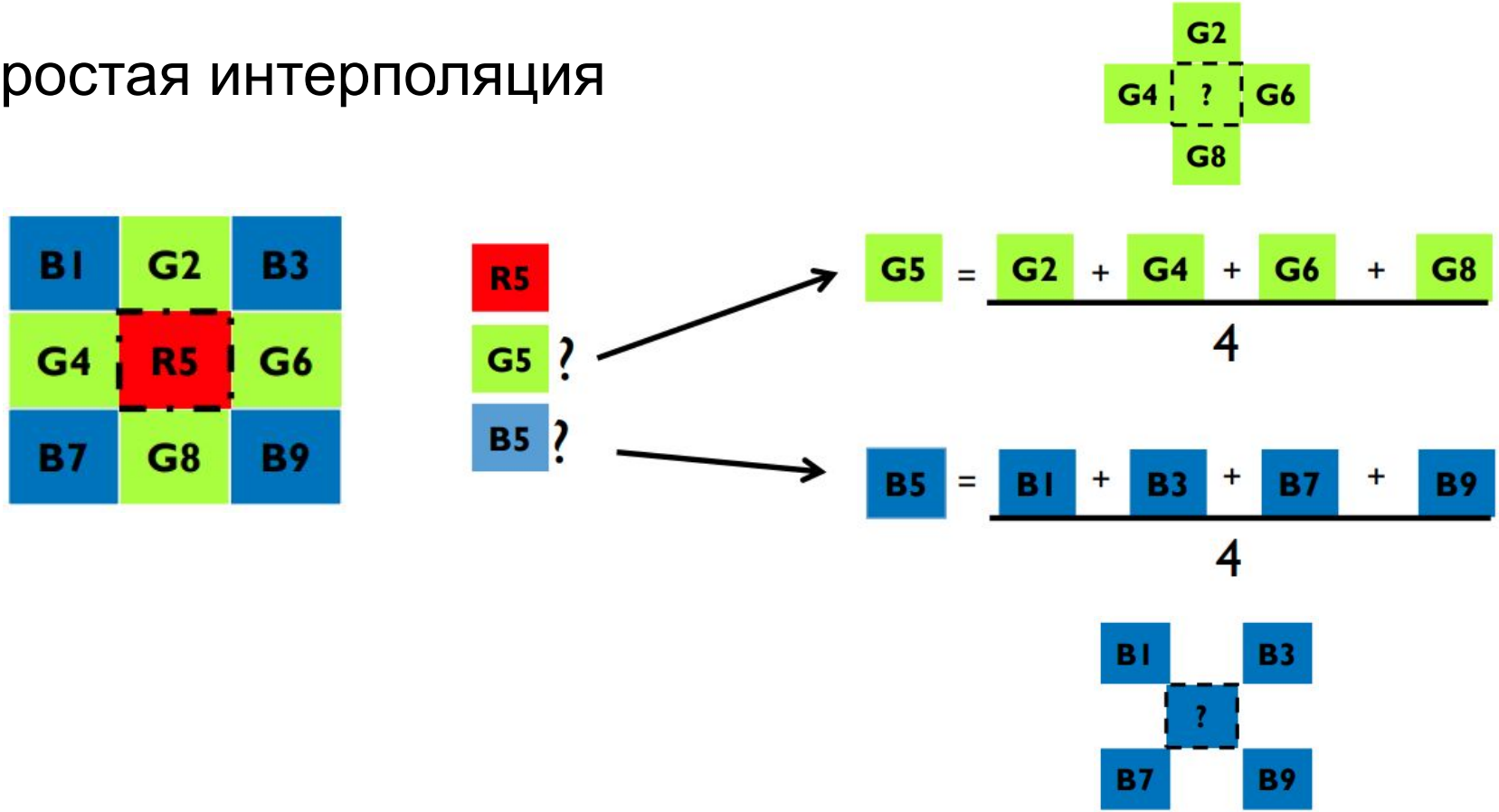
Усреднение блока из 4-х пикселей:



Блок 2x2

1 RGB
пиксель

Простая интерполяция



Источник:
[ICCV 2019 Tutorial: Understanding Color and the In-Camera Image Processing Pipeline for Computer Vision]

Простая интерполяция с учетом “границ”

If (|G2–G8) && |(G4-G8)| both < Thres):

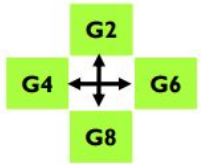
$$G5 = \frac{G2 + G4 + G6 + G8}{4}$$

elseif (|G2-G8| > Thres):

$$G5 = \frac{G4 + G6}{2}$$

else:

$$G5 = \frac{G2 + G8}{2}$$



Case 1

All about the same.

Case 2

G2 and G8 differ – ignore them in the interpolation

Case 3

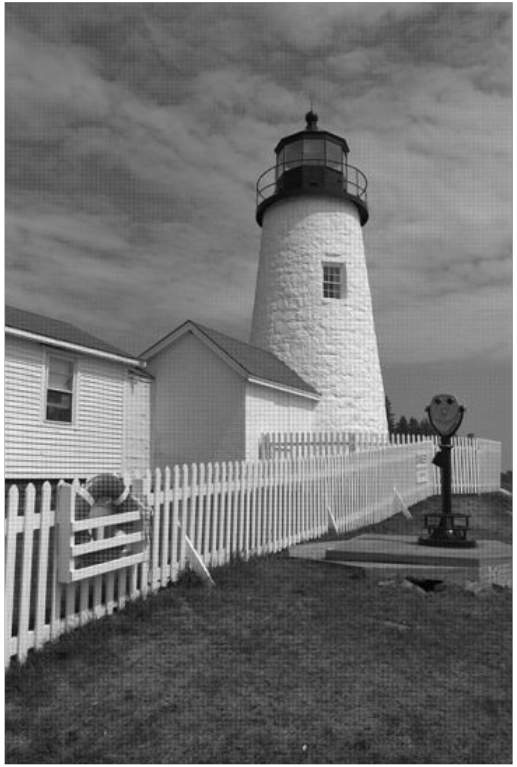
G2 and G8 differ – ignore them in the interpolation

Источник:
[ICCV 2019 Tutorial: Understanding Color and the In-Camera Image Processing Pipeline for Computer Vision]

Пример

Original RGB image

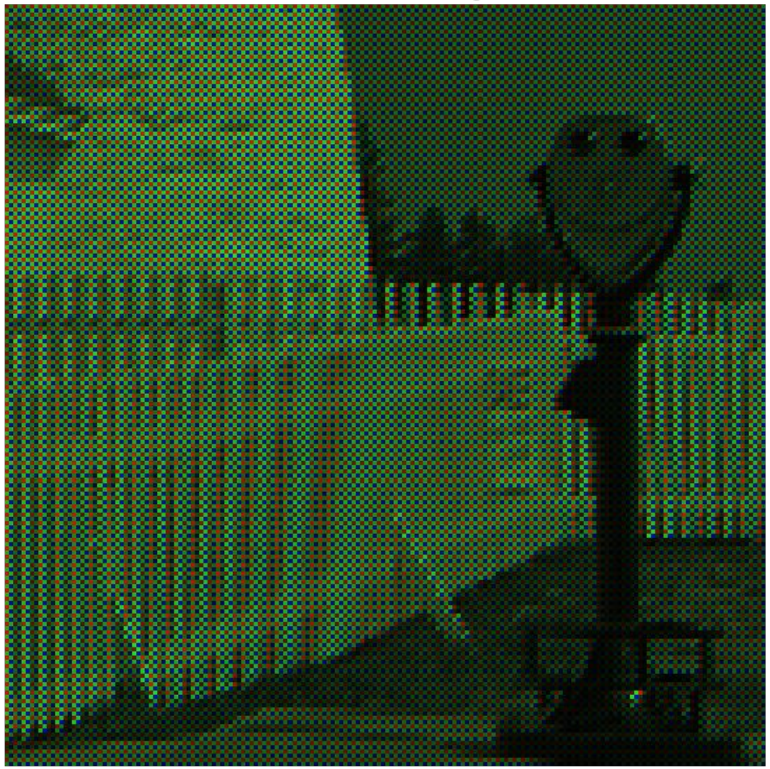
Mosaiced image



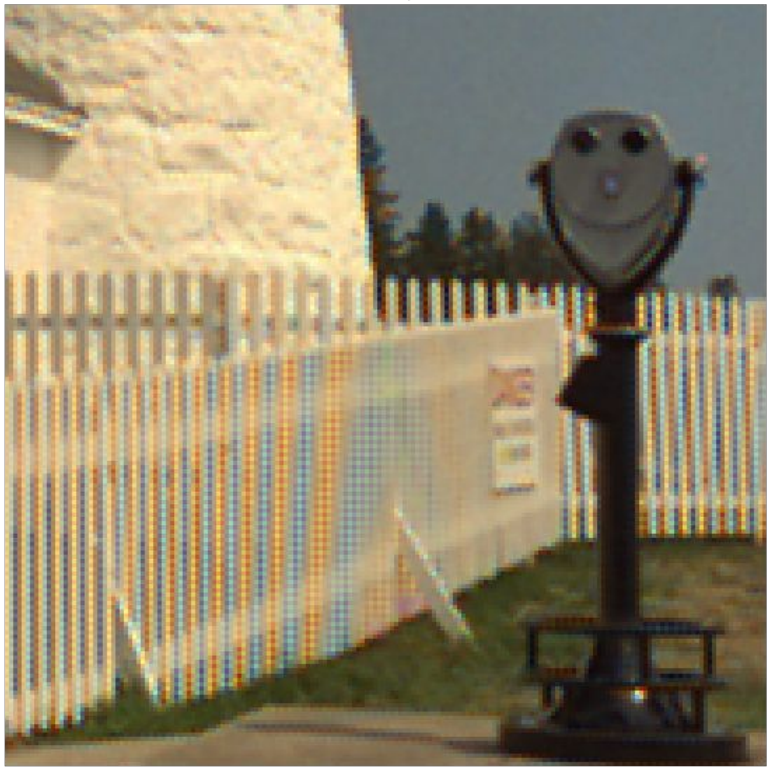
Mosaiced image

Пример - Bilinear interpolation

Zoom-in mosaiced image



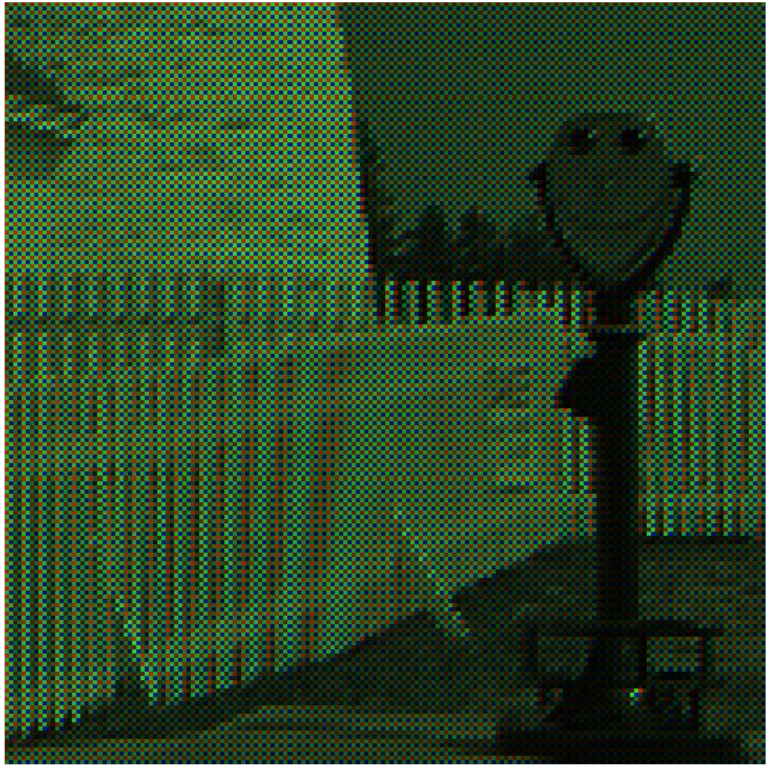
Bilinear interpolation



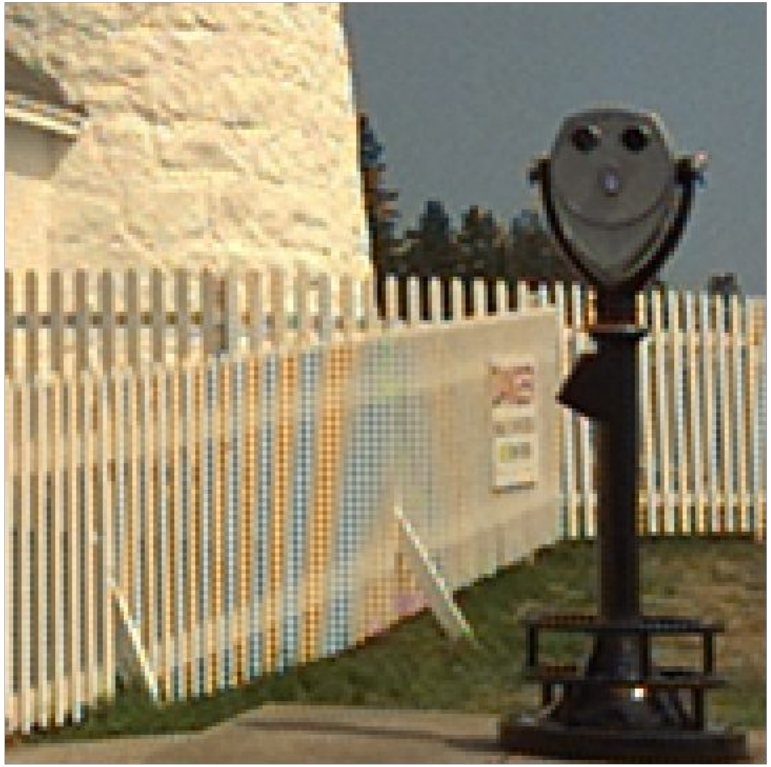
Malvar, Henrique S., Li-wei He, and Ross Cutler. "High-quality linear interpolation for demosaicing of Bayer-patterned color images." *2004 IEEE International Conference on Acoustics, Speech, and Signal Processing*. Vol. 3. IEEE, 2004.

Пример - Malvar (2004)

Zoom-in mosaiced image



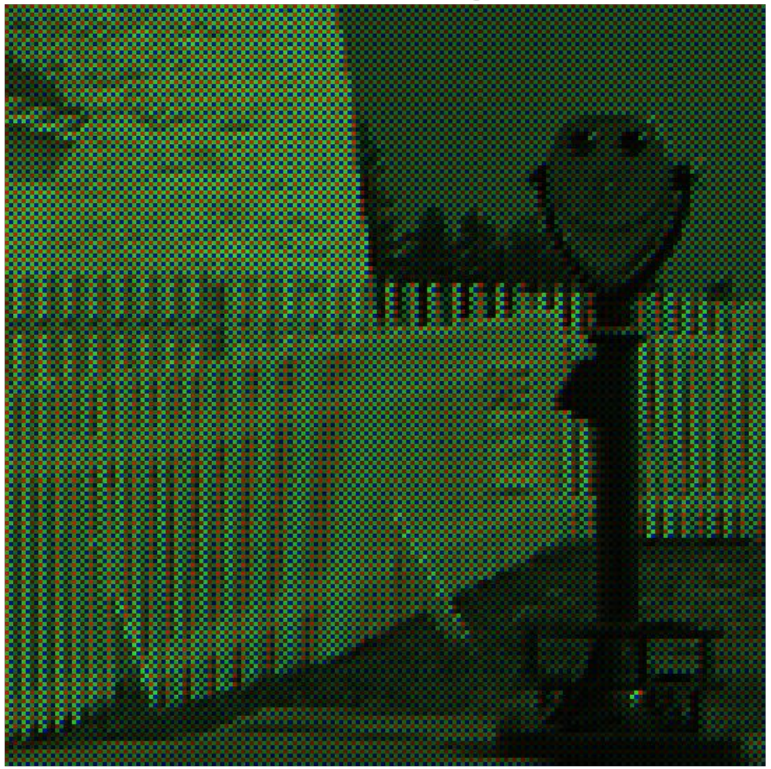
Malvar (2004)



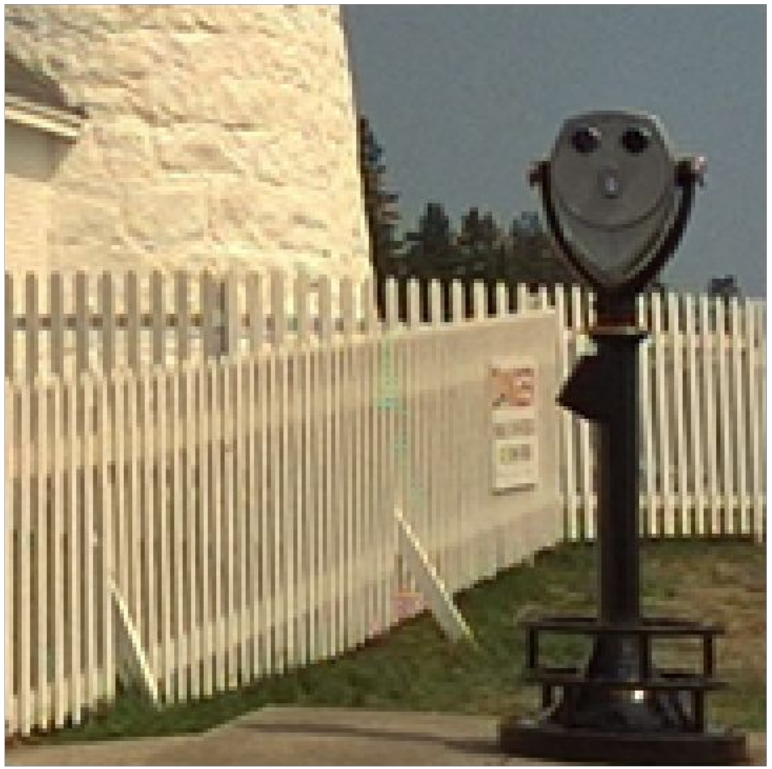
Menon, Daniele, Stefano Andriani, and Giancarlo Calvagno. "Demosaicing with directional filtering and a posteriori decision." *IEEE Transactions on Image Processing* 16.1 (2006): 132-141.

Пример - Menon (2006)

Zoom-in mosaiced image



Menon (2007)



Источники

- Обзор методов на 2008 год:

  Li, Xin, Bahadir Gunturk, and Lei Zhang. "Image demosaicing: A systematic survey." Visual Communications and Image Processing 2008. Vol. 6822. SPIE, 2008.

- Работа, объединяющая демозаикинг и многокадровое супер-разрешение (алгоритм Super Res Zoom в смартфонах Google Pixel):

  Wronski, Bartlomiej, et al. "Handheld multi-frame super-resolution." ACM Transactions on Graphics (ToG) 38.4 (2019): 1-18.

- Обзор методов, основанных на CNN:

  Syu, Nai-Sheng, Yu-Sheng Chen, and Yung-Yu Chuang. "Learning deep convolutional networks for demosaicing." arXiv preprint arXiv:1802.03769 (2018).

- Материалы туториала:

  ICCV 2019 Tutorial: Understanding Color and the In-Camera Image Processing Pipeline for Computer Vision

- Учебник Richard Szeliski:

  Computer Vision: Algorithms and Applications, 2nd ed.

- Репозиторий colour-demosaicing:

  https://github.com/colour-science/colour-demosaicing/tree/master