The Half-quadratic Splitting (HQS) Method for Shadow Removal
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Motivation
- Shadows
  - caused by uneven illumination, can degrade image quality by reducing visibility and introducing unwanted artifacts.
  - make it more difficult to implement image segmentation, object recognition and other basic tasks for computer vision.
- Goal
  Develop a solution for shadow removal using the thought of inverse problem.
  \[ b = A(x) + \eta \]

Dataset
- ISTD-The Image Shadow Triplets dataset

Related Work
- HQS for Deconvolution
- Shadow Detection and Removal Based on YCbCr

Method
- Idea: Think of shadow as Gaussian noise in the Y (luminance) channel
  - Problem Formation
    \[ b_i = x + \eta \]
  - MAP Solution
    \[ x_{MAP} = \arg \min_{x} \|x - y \|_2^2 + \frac{1}{2\alpha} \|Dx - y \|_2^2 \]
  - HQS With TV
    \[ x_{HQS} = \arg \min_{x} \|x - y \|_2^2 + \frac{\lambda}{2} \|Dx - y \|_2^2 \]

Experimental Results
- Qualitative
  - shadow image
  - shadow-free image (HQS)
- Quantitative (\(\rho\))

Discussion
- We developed a solution to remove shadow in an image using the HQS method.
- Pros: simple framework, efficient, acceptable result
- Cons: poor performance with dark shadow (hard/Umbra), params tuning required for each image
- Future work
  - automatic shadow detection
  - removal method for dark shadow
  - Improve performance by adjusting chroma channels

References