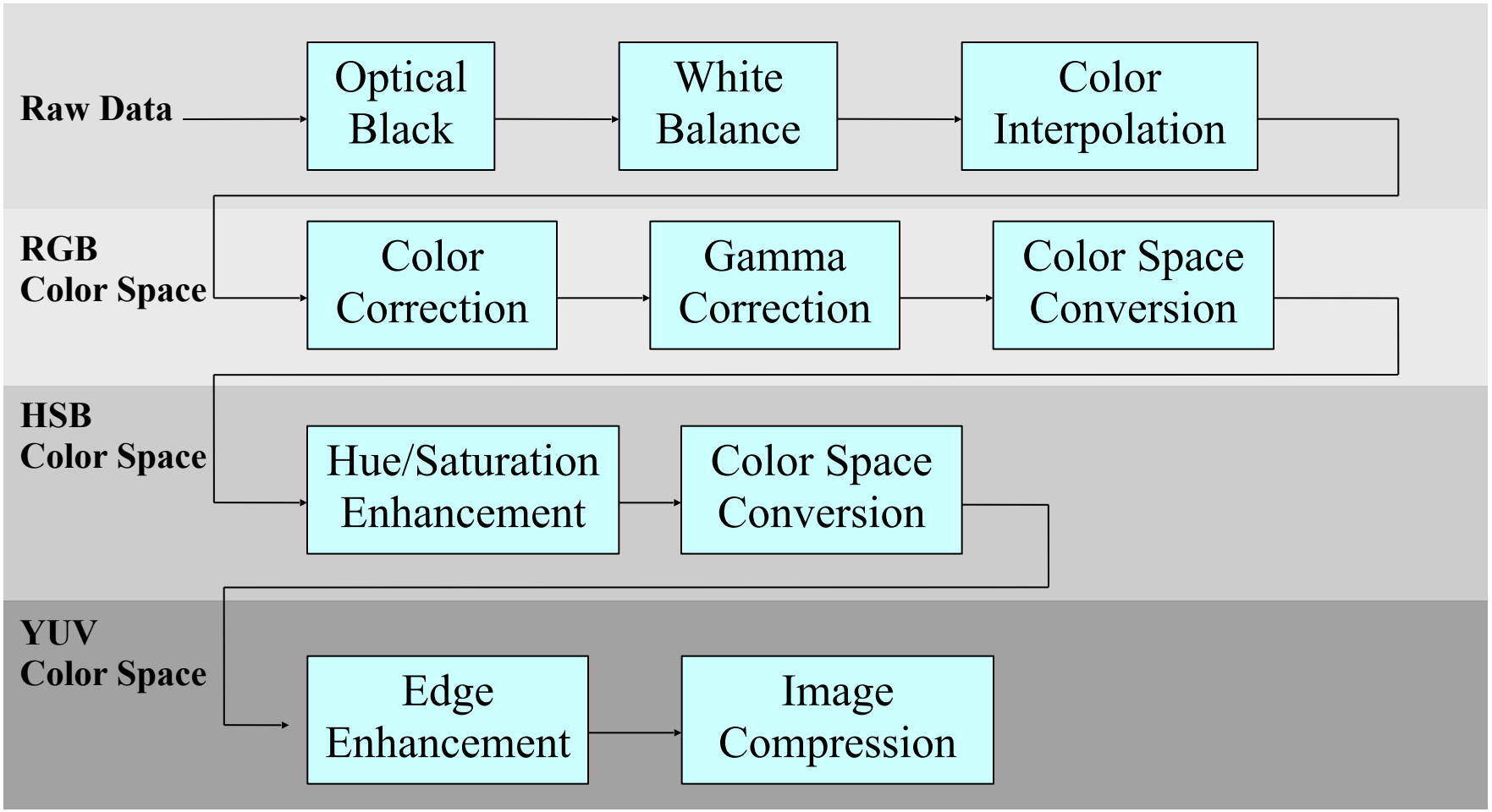
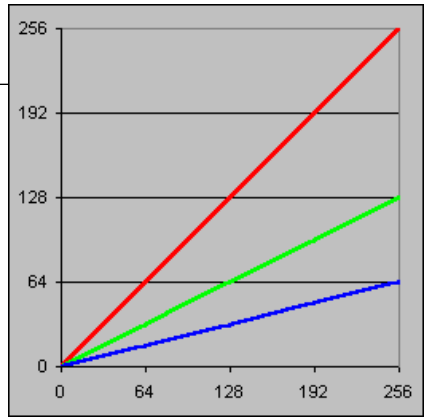
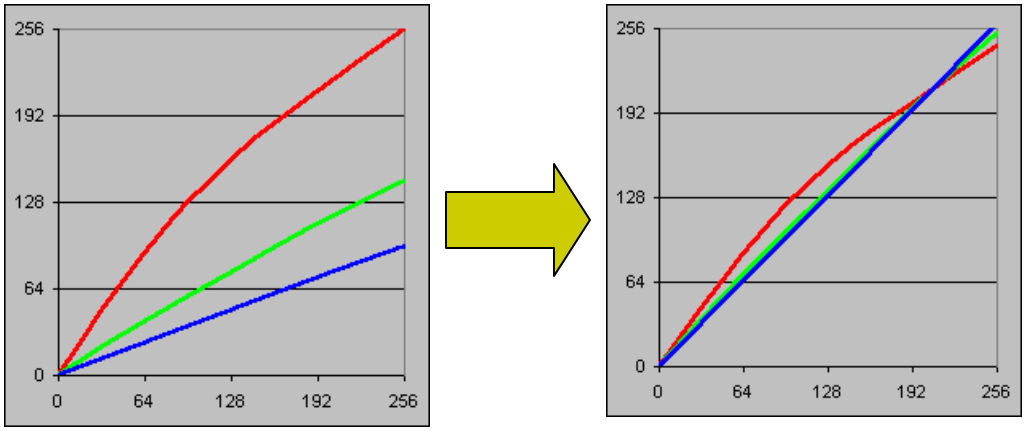
Image Pipeline Steps

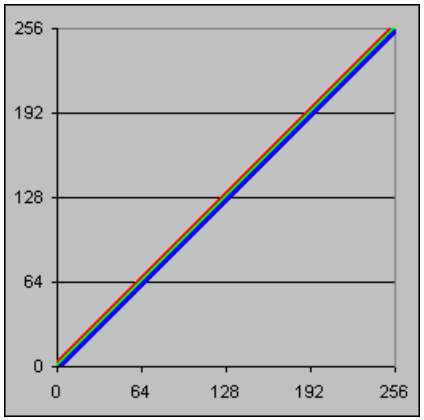


White Balance

- To simulate human eyes white balance
- Adjustable channel gain for each color channel
- General approaches
  - Gray world assumption
  - Perfect reflector assumption
  - Calibration based approaches
- What if data are nonlinear?







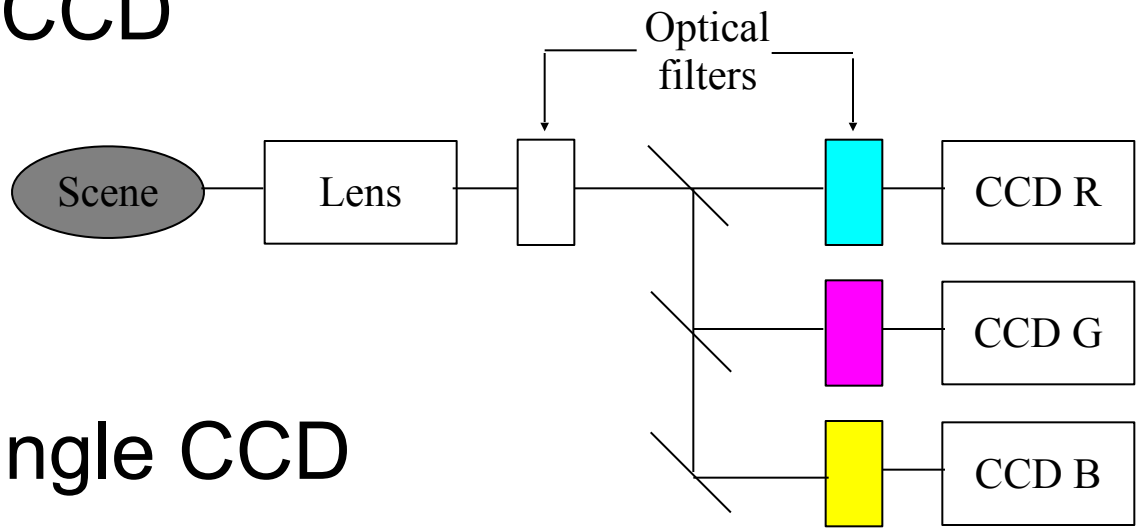
Effect of Color Temperature over the Captured Scene

Low color temperature → High color temperature

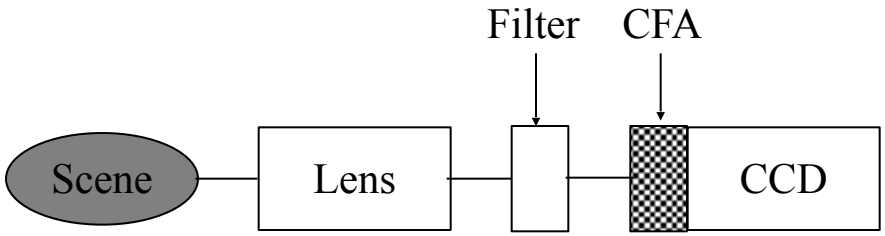
Reddish cast White balanced Bluish cast

3 CCD versus Single CCD

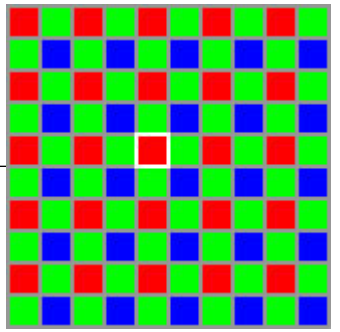
- 3 CCD



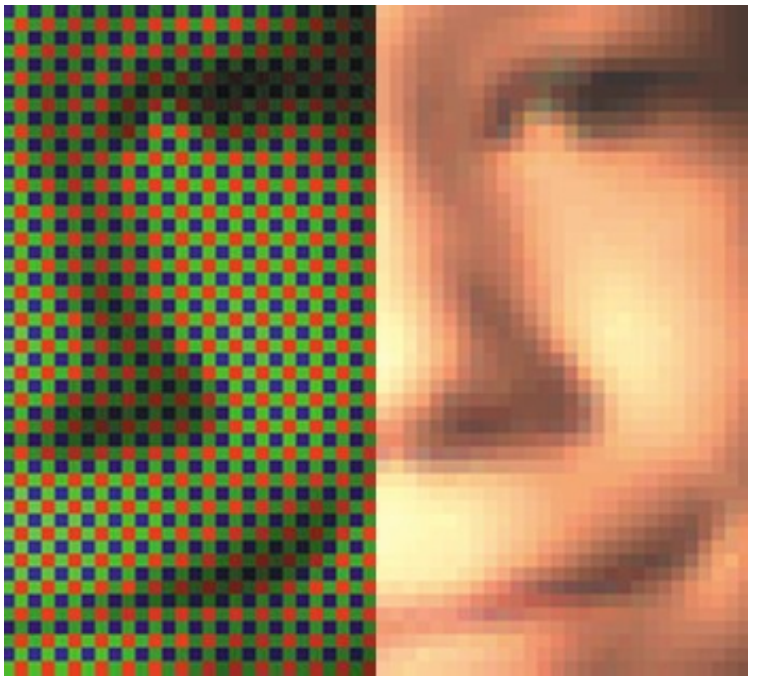
- Single CCD



Color Interpolation

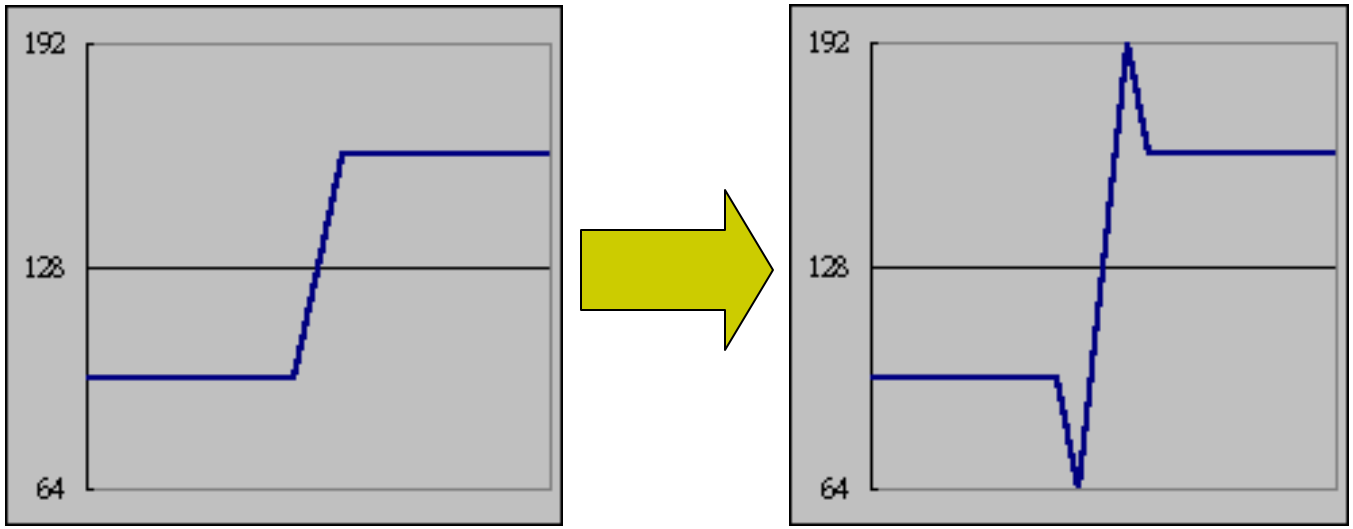


- Also called de-mosaic / raw2rgb...
- Guess missing channels for each pixel by the following:
  - Neighbor pixels
  - Edge
  - Gradient
  - ...
- Avoid zigzag and false color artifacts



Edge Enhancement

- A must - all cameras add edges
- General approaches
  - Edge filter: NxN, 1xN+Nx1
  - Edge gain control
  - Edge detection module
- Noise should not be enhanced



Edge Enhancement

- Normal and strong edge enhancement

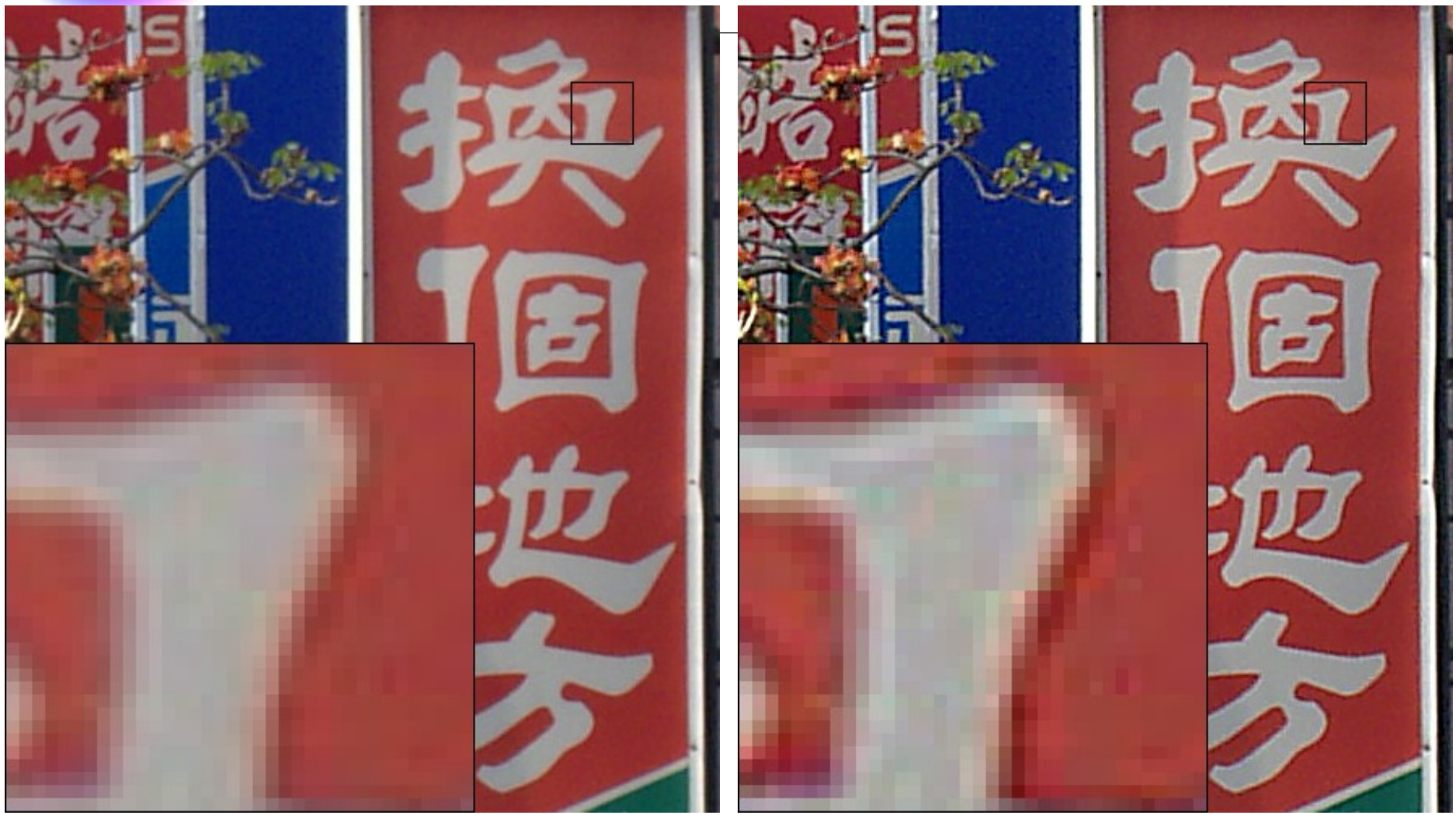
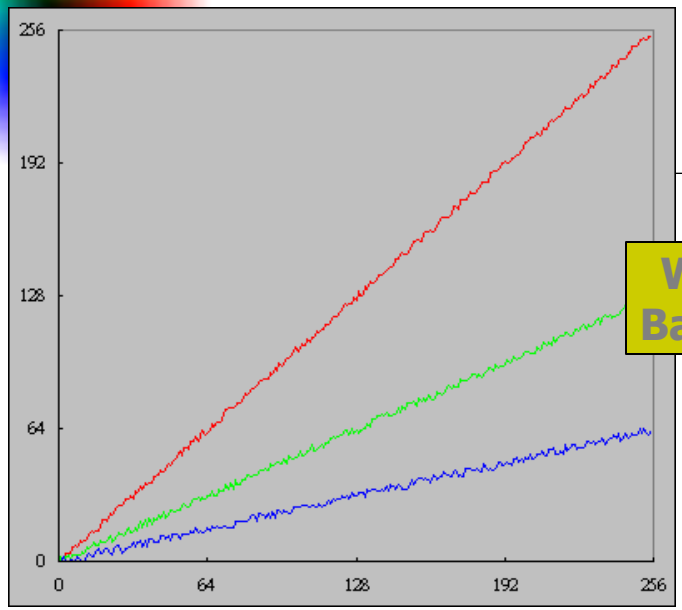
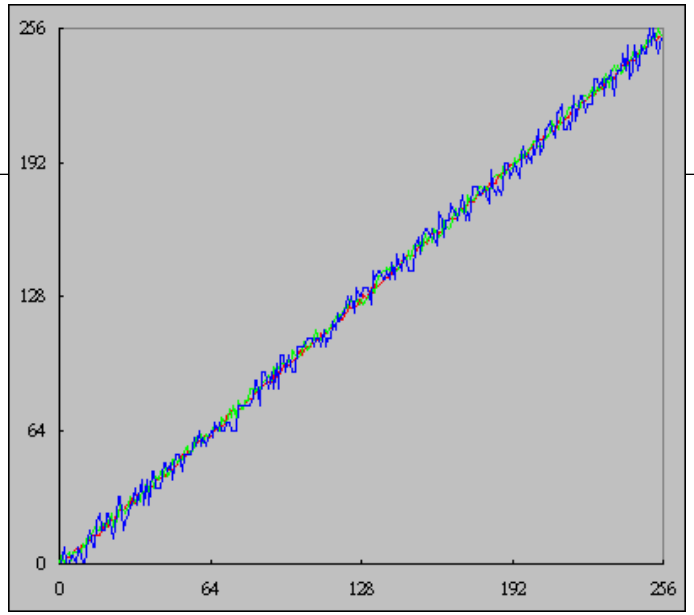


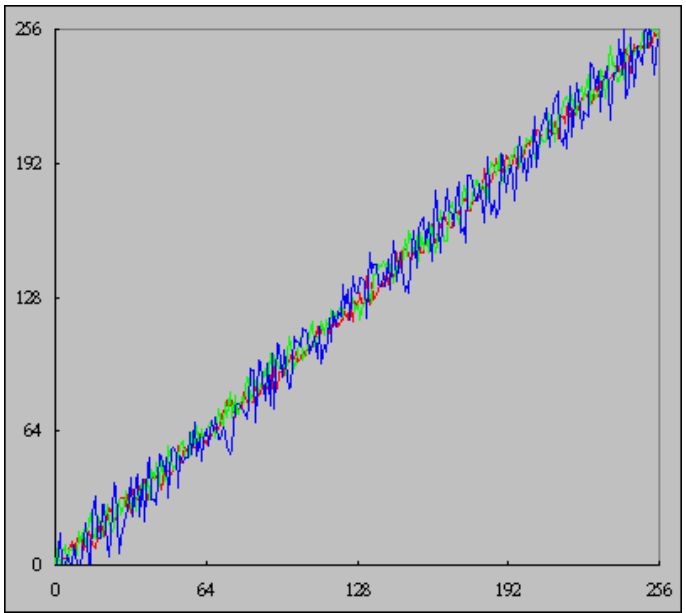
Image Pipeline Noise (8-bit, δ=4)



White Balance



Matrix



Gamma