Detail Preserving Contrast Reduction for still cameras

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October 11, 2006

It was a landscape with an ominous shadow

God said, “Let there be light”, and there was light !!

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1. Existing Techniques

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2. Proposed Framework

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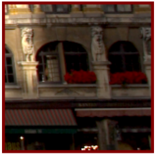
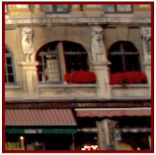
1. Existing Techniques
2. Proposed Framework
3. Results

Existing Techniques *Original Image*



Original | Photoshop Shdw/Hlite | Retinex | Shadow Illuminator | Proposed Framework

Existing Techniques *Photoshop Shadow/Highlight Plugin*



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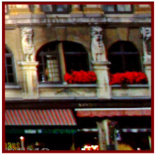
Existing Techniques *Photo Flair (Retinex)*



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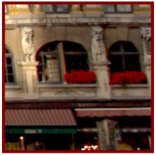
Existing Techniques *Shadow Illuminator*



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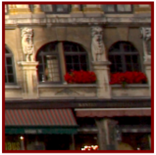
Existing Techniques *Proposed Framework*



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  - CCD imaging sensors are linear devices
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- Image Enhancement Model
  - Enhance the visibility of *shadow detail* by reducing the contrast in the Illumination component
  - Reintroduce the lost *highlight detail* using the Reflectance component

Estimating the Illumination and Reflectance

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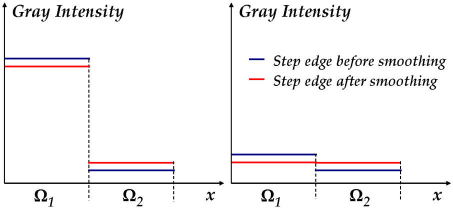

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We solve for $L(x, y)$ as

$$L = \arg\min_{L^n} \int_{\Omega} \left[\lambda (L^n - I)^2 + |\nabla L^n| \right] d\Omega$$

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Gradient Descent Scheme

$$L_{t+1}(x, y) = L_t(x, y) + \Delta t \left[2\lambda (I(x, y) - L_t(x, y)) + \nabla . \left(\frac{\nabla L_t(x, y)}{|\nabla L_t(x, y)|} \right) \right]$$

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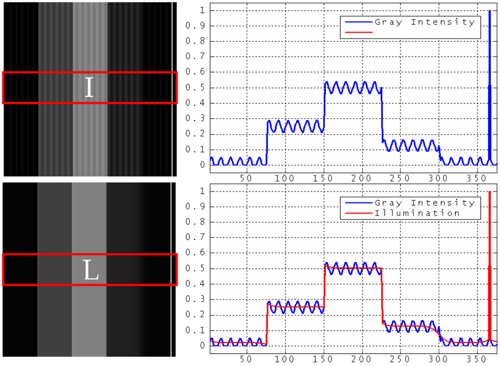

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Sunset	M	L	M
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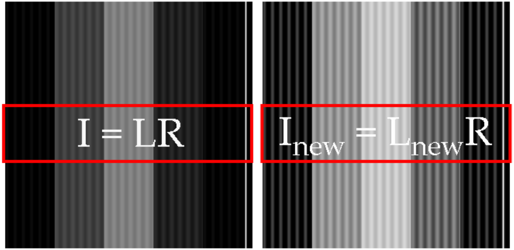
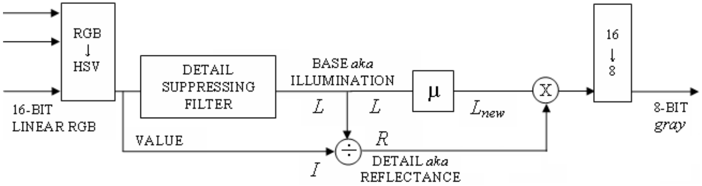
- Ideal Recombination Strategy



Detail Preserving Contrast Reduction for Gray Images



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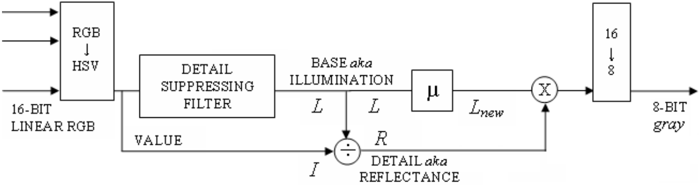

Original Image *Illumination* *Reflectance* *New Illumination* *Enhanced Image*

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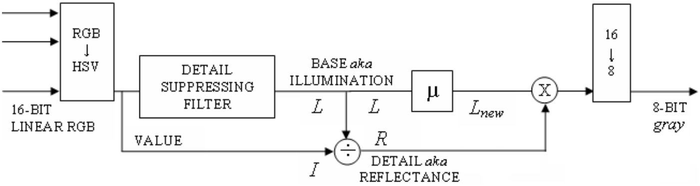

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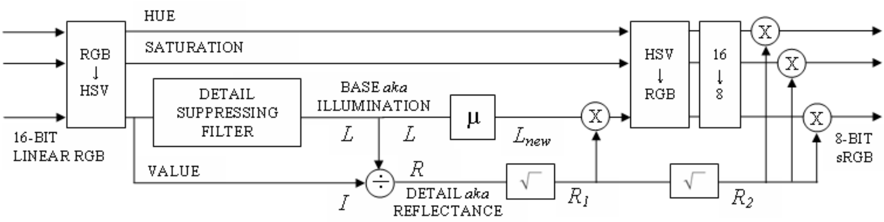
- Enhanced visibility of *shadow* detail
- But, *highlight* detail may appear washed out

Detail Preserving Contrast Reduction for Color Images



- Reintroduce the lost detail in the *highlight areas* using the estimated Reflectance

Original Image

Original Image | Enhanced Image PA | Enhanced Image SI | Enhanced Image PF | Next Image

Enhanced Image using the Proposed Approach

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Enhanced Image using Shadow Illuminator (*8b DPCR*)

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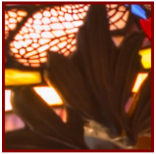
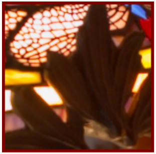


Enhanced Image using Shadow Illuminator (*8b DPCR*)



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Enhanced Image using Photo Flair (*Retinex*)

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Conclusions

The proposed DPCR scheme

- succeeds in reducing contrast while still preserving detail
- produces an aesthetically pleasing image *and*
- does not induce color shifts