Retinexnet

Dataset :- Low-Light dataset (LOL)

low/normal-light image pairs

Retinexnet

Decom-Net

for decomposition

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This network is learned with only key constraint including the consistant reflectance shared by paired low/normal-light images and the smoothness of illumination.

Enhance-Net

for illumination adjustment

Based on the decomposition subsequent lightness enhancement is conducted on illumination by enhancement network.

for joint denoising operation on reflectance

Previous work:

De-hazing based method :- Utilizes the inverse connection between the image with insufficient and those in hazy environment.

loco-light enhancement based on Retinex theory

Observed color image

reflectance

illumination

Single scale Retinex (SSR) :- smooth by gaussian filter

Multi-scale Retinex (MSR) – multi-scale gaussian filter and color restoration.

SRIE :- Estimate reflectance and illumination simultaneously using weighted variation model.

LIME :- Only estimate illumination with structure prior and use reflection as final enhance result.

LLNet :-

Retinex-Net :-

1 → Decomposition → Dcom-Net → image → reflectance, illumination

2 → Adjustment → Enhance Net → bright up illumination

3 → Reconstruction → we reconstruct the adjustment illumination and reflectance to get enhance result.

→ Reflectance describe the intrinsic property of the captured objects, which is considered to be consistent under any lightness conditions.

→ Illumination represents the various lightness on objects on low-light images, it usually suffer from darkness and unbalanced illumination distributions.

→ It is not easy to design a proper fun adaptive to various scenes.

Loss :-

$$L = L_{recons} + \lambda_{ir} L_{ir} + \lambda_{is} L_{is}$$

• Based on the assumption

$$L_{recons} = \sum_{i \in low, normal} \sum_{j \in low, normal} \lambda_{ij} \| R_i \circ I_j - S_j \|_1$$

Invariable reflectance Loss., L_{ir}

$$L_{ir} = \|R_{low} - R_{normal}\|_1$$

Illumination smoothness loss, L_s

$$L_{is} = \sum_{i=low,\,normal} \|\nabla L_i \circ \exp(-\lambda_g \nabla R_i)\|$$

Loss- fun of Enhance-Net

$$L_{recons} = \|R_{low} \circ \hat{I} - S_{normal}\|_1$$

L_{is} is same as previous.

Structure- Aware Smoothness Loss:-

Total variation minimization, which minimize the gradient of whole image, is often used as smoothness prior for various image restoration tasks.

$$L_{is} = \sum_{i=low,\,normal} \|\nabla I_i \circ \exp(-\lambda_g \nabla R_i)\|$$

∇ denotes the gradient including ∇_h (horizontal) and ∇_v (vertical) and λ_g denote the coefficient balancing the strength of structure awareness.