

GLARE

Research Notes

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1 Paper Summaries

1.1 Single Image Reflection Removal Using Deep Encoder-Decoder Network [1]

Link [1] <https://arxiv.org/abs/1802.00094>

Idea End-to-end SIRR using UNet-like CNN

Results PSNR: 29.08 (val), 18.70 [2]

Dataset $\{(I, \alpha T)\} : I = \alpha T + \beta R * G * K$

where T - transmission, α - transmission coefficient; R - reflection, G, K - gaussian blurs, simulating the defocus effect (G) and double reflection (K). T, R taken in true intensity values (reversing γ -compression).

Architecture $ccccc \rightarrow \searrow cc \searrow cc \searrow cddd \nearrow dd \nearrow dd \nearrow \rightarrow dddddd$

Feature Extraction CNN \rightarrow Reflection Removal UNet \rightarrow Transmission Restoration CNN

All (*de*)conv layers are non-padded, 64-filter, 5x5 (except first 2 and last 2 which are 9x9), followed by ReLU. The CNN parts each have 6 (*de*)convs. The UNet part consists of 6 convs and 6 deconvs arranged in 3 levels - skip connections are every 2 convs on the way "down". Skip connection additions are performed on feature maps before ReLU. No pooling layers are used, convolutions are not padded.

Loss Function $L = L_{l_2} + \lambda L_{VGG}$

$L_{l_2} = \|F(I) - \alpha T\|_2^2$, $L_{VGG} = \sum_{i=1}^M \frac{1}{H_i W_i} \|\phi_i(F(I)) - \phi_i(\alpha T)\|_2^2$, ϕ_i is the feature map obtained by the i -th convolution after activation within VGG19.

Training

Dataset (66k/22k train/test) Images: 2.3k [3] + 2.6k [4], reflections - natural landscapes and malls. T is resized 128x128, R is cropped and resized 128x128. $\gamma = 2.2$, $\alpha \sim U[0.75, 0.8]$, $\beta = 1 - \alpha$, $\sigma(G) \sim U[1, 5]$, K = kernel with 2 non-zero elements: $1 - \sqrt{\alpha}$, $\sqrt{\alpha} - \alpha$.

Optimization $\lambda = 10^{-3}$, epochs=150, batch=64, Adam($\eta = 10^{-4}$, $\beta_1 = 0.9$)

Specs Nvidia Titan X GPU, Tensorflow

Extra Notes No domain shift needed - sythetic data is enough for irl

2 Ideas

- learn about optical flow in ML
- search for more glare-related papers

3 Backlog

3.1 Things to read

1. Name: Learning to See Through Obstructions
Link: <https://arxiv.org/abs/2004.01180>
Note: Учимся на синтетике, теперь видео, удаляем гораздо более сложные вещи
2. Name: PhotoScan: Taking Glare-Free Pictures of Pictures
Link: <https://ai.googleblog.com/2017/04/photoscan-taking-glare-free-pictures-of.html>
Note: старая статья про удаление отражений с глянца

References

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- [2] R. Wan, B. Shi, L.-Y. Duan, A.-H. Tan, and A. C. Kot, “Benchmarking single-image reflection removal algorithms,” in *International Conference on Computer Vision (ICCV)*, 2017. [Online]. Available: <https://sir2data.github.io/>
- [3] A. Quattoni and A. Torralba, “Recognizing indoor scenes,” *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2009. [Online]. Available: <http://web.mit.edu/torralba/www/indoor.html>
- [4] L. Jokinen and K. Sampo, “Hel looks.” [Online]. Available: <https://www.hel-looks.com/>