Exposure Correction Model to Enhance Image Quality

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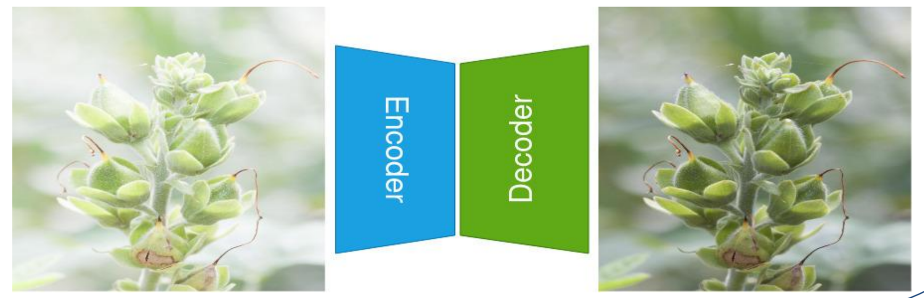
GitHub page:

Introduction

- Adjust the exposure value of an image to improve the visibility
- Useful for increasing understandable of an image or video
- Increase the performance of CV models for other tasks

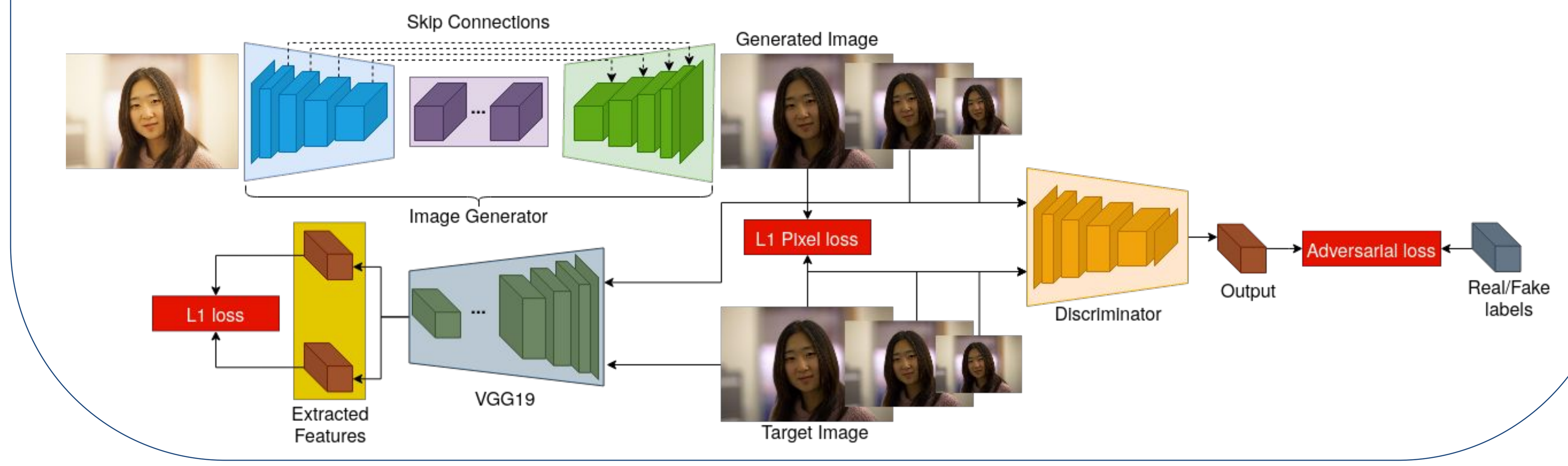
- The same image with different Exposure Values: -1.5, -1, 0, +1, +1.5 respectively.
- **Task definition:** Adjust only the exposure value of the input



Methodology

- End-to-end model
- Pixel loss, perceptual loss (feature from pretrained VGG19), feature matching loss (features from discriminator layers)
- 1024 x 1024 resolution
- Multi-scale discriminator
- Three-crucial points:
  - Content should be preserved.
  - The model must correct both cases, over- and underexposed images, without prior knowledge.
  - The model must not change anything if EV of the input is correct.

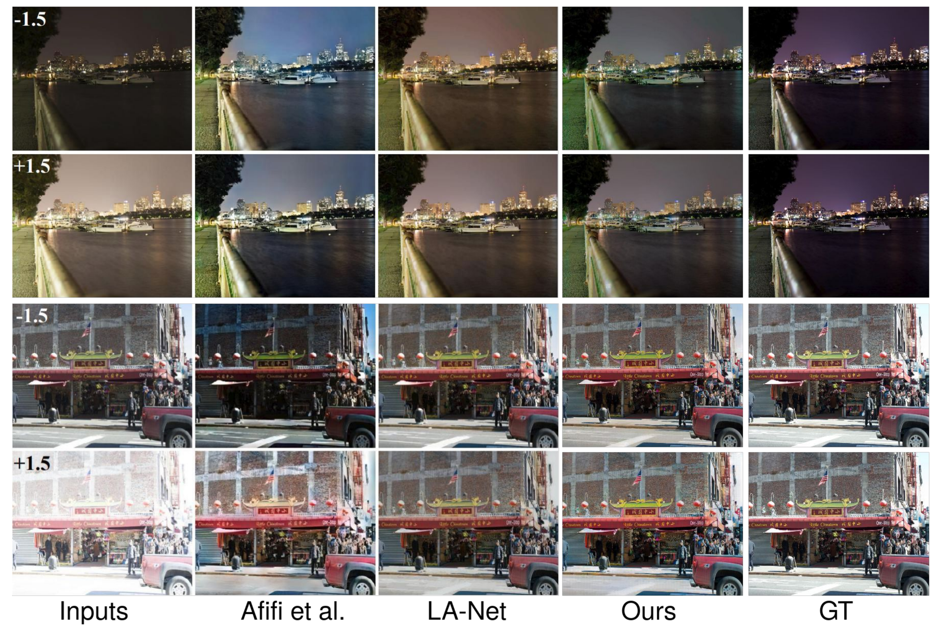
$$L = L_{GAN}(G,D) + \lambda L_{pixel}(G) + BL_{per}(G)$$

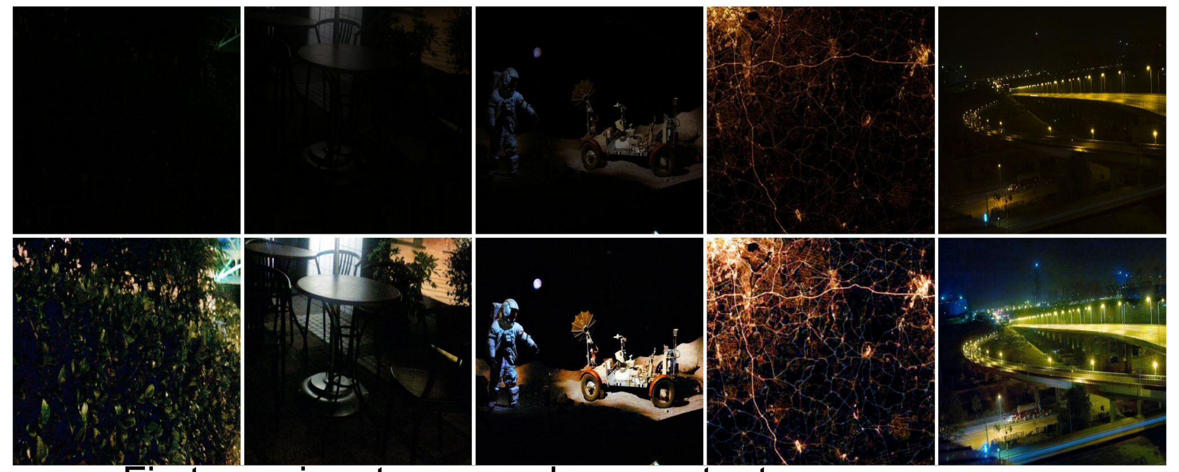


Experimental Results

Datasets:

- Exposure correction dataset[1]: 3 cases; well- (0 EV), over- (P1, P1.5 EVs), underexposure (N1, N1.5 EVs)
- Low-light image datasets to evaluate the generalization: LIME, NPE, VV, DICM
- Achieved SOTA results on exposure correction dataset.
- Achieved well performance on low-light image datasets.



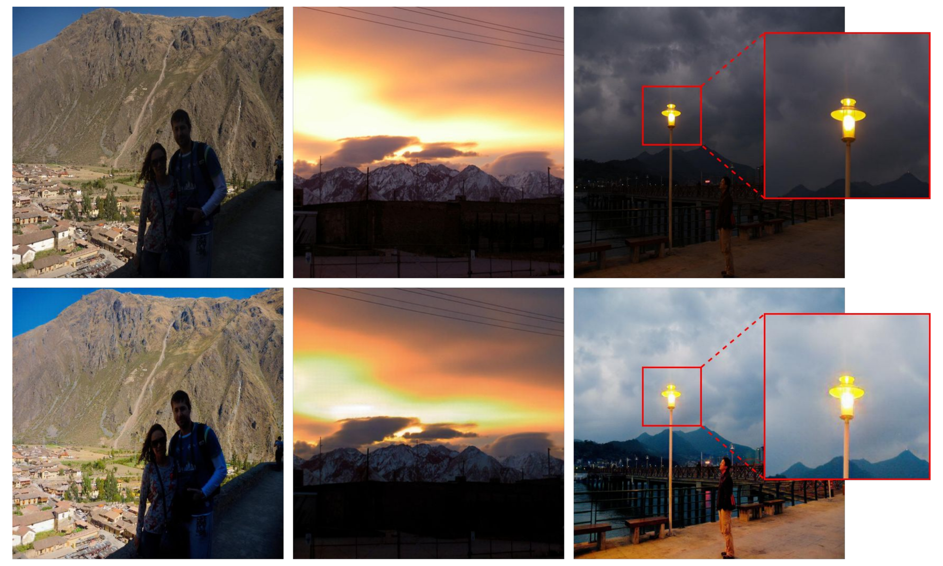


First row: inputs, second row: outputs

Method	PSNR	SSIM	PI
Afifi et al.[1]	19.37	0.73	**2.24**
LA-Net [2]	20.70	0.81	2.35
FCN MEF [3]	20.81	0.84	-
Ours	**20.87**	**0.87**	**2.24**

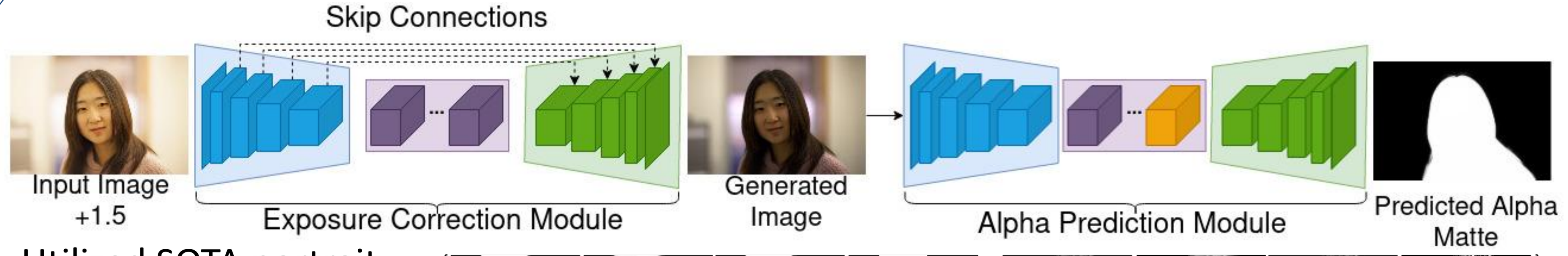
Limitations / challenges:

- When under- and overexposure together, sometimes the model is not able to solve both problem. One still exists after correction (first and second columns).
- Sometimes artifacts around the light source (last columns)

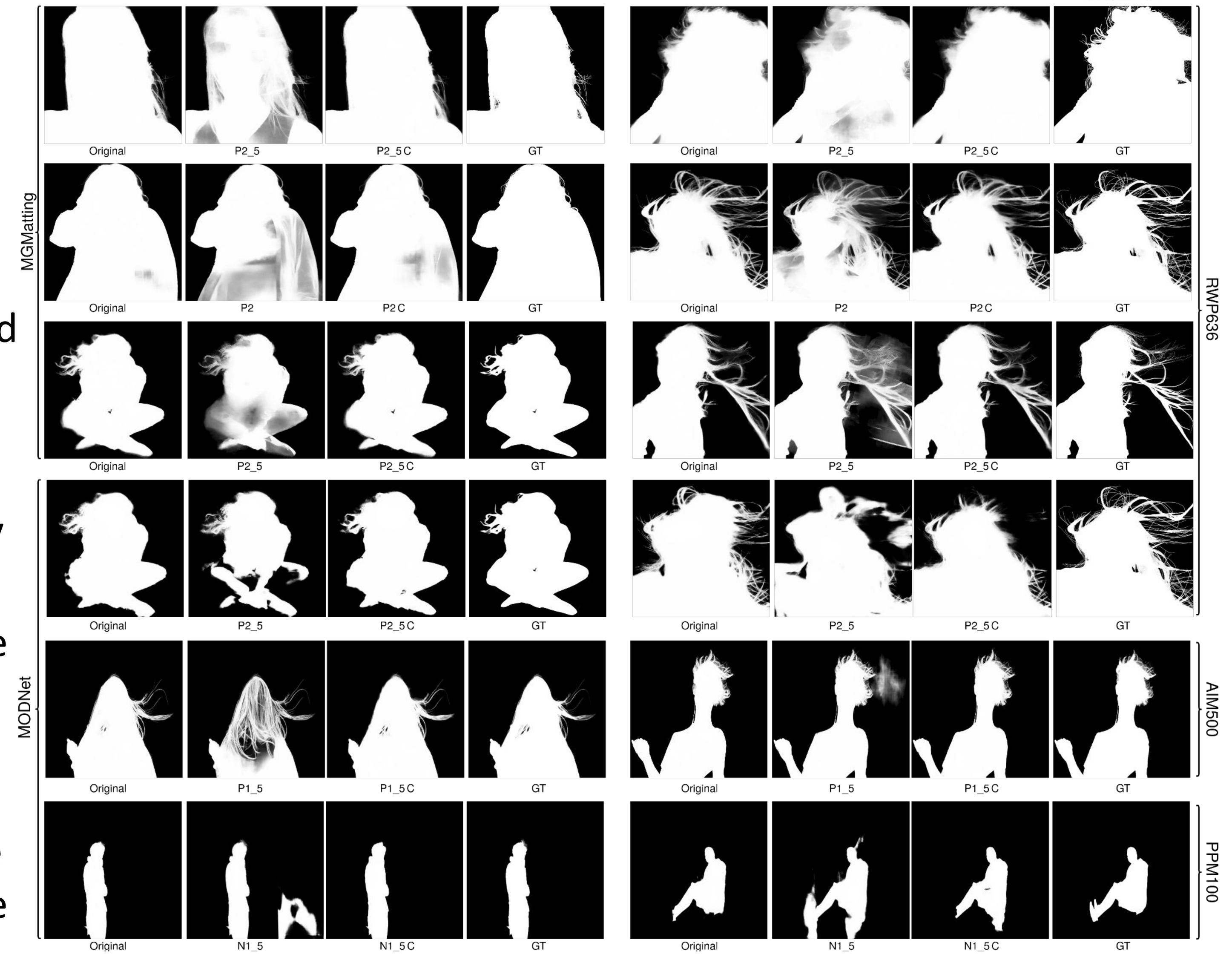


First row: inputs, second row: outputs

Application: Portrait Matting



- Utilized SOTA portrait matting models
- First, perform alpha matte generation with the wrong EV settings.
- Second, perform exposure correction and generate alpha matte with the corrected images.
- Results show that as EV increases, alpha matte prediction performance decreases.
- Results also indicate that after exposure correction, alpha matte prediction performance increases.



Conclusions

- We proposed a GAN-based model to address both under- and overexposure problems with a single model without prior knowledge.
- SOTA results obtained on exposure correction benchmark.
- Portrait matting performance is correlated with exposure setting of an image. We showed that wrong EV setting causes worse alpha matte prediction and our exposure correction approach helped to improve matting performance when we used it as a preprocessing step.

Acknowledgement

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References

[1] Mahmoud Afifi, et al. Learning multi-scale photo exposure correction. CVPR 2021
[2] Kai-Fu Yang, et al. Learning to adapt to light. arXivpreprint arXiv:2202.08098, 2022
[3] Jin Liang, et al. Fusion-correction network for single-exposure correction and multi-exposure fusion. arXiv preprint arXiv:2203.03624, 2022.