

Extreme Low-Light Image Denoising

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Proposal

Low-Light Image Denoising, as we have learned in the course, is a challenging task and an active field of research. Traditional image denoising techniques fail for extremely low light images with dominant signal dependent poisson-distributed noise. Various denoising methods discussed in our course are based on mathematical modeling of image noise with some prior. In recent years, burst denoising techniques like HDR+ and several deep learning schemes like CNNs have been implemented to achieve state of art results. The goal of this project is to study these modern denoising techniques and create one such image processing pipeline which can achieve good qualitative and quantitative performance in extremely low light. The model selection will be decided based on the case study of several research papers in this domain and will start by implementing one of the papers out there, followed by attempts to improve the results by using some priors or hyperparameter tuning.

Milestones and Timeline

week 1: Read through the papers in depth and finalize on the model

week 2: Assemble data set and implement the model

week 3: Testing the model on the data set and run experiments to improve the results

week 4: Run final experiments, assemble poster/paper and submit results

References

[1] Deep Learning for Image Denoising A Survey Chunwei Tian and Yong Xu and Lunke Fei and Ke Yan 2018

[2] Chen, Chen, Koltun & Xu. "Learning to See in the Dark". May 2018.

[3] Improving Extreme Low-Light Image Denoising via Residual Learning Paras Maharjan¹, Li Li¹, Zhu Li^{1,2}, Ning Xu³, Chongyang Ma⁴, Yue Li⁵

[4] NODE: Extreme Low Light Raw Image Denoising using a Noise Decomposition Network

[5] Burst photography for high dynamic range and low-light imaging on mobile cameras [Google Research]

[6] Burst Denoising with Kernel Prediction Networks. Ben Mildenhall, Jon Barron, Jiawen Chen, Dillon Sharlet², Ren Ng, Robert Carroll²