Capstone Design 2

Flare Reduction through Flare Simulation

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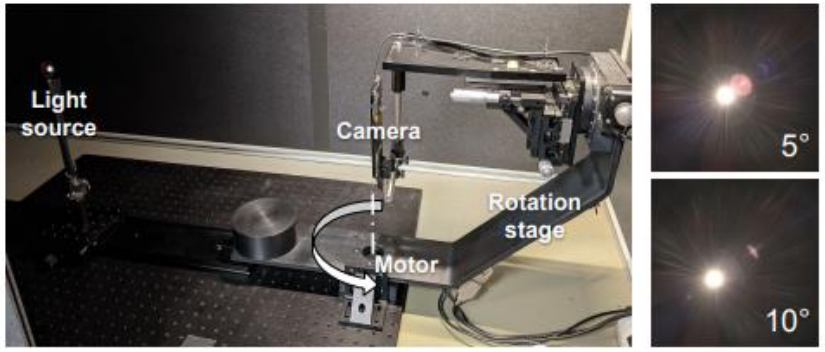
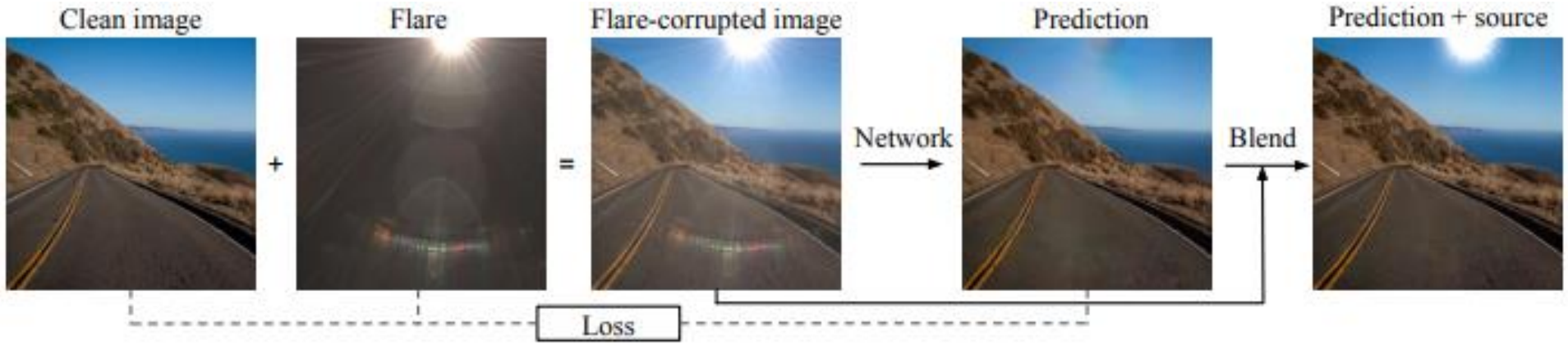
Existing Research

- How to Train Neural Networks for Flare Removal (arXiv:2011.12485v4 [eess.IV] 8 Oct 2021)

- Simulates flare by real flare image.



(a) Capture setup (b) Real flare



Ghosting Problem

- Type of flare due to reflection of light source on lens
- More common with phone cameras (smaller lens & sensor)
- Solved with image segmentation and flare simulation?

Flare Simulation

- Basically, Data Augmentation
- Most light sources are round and slanted -> Oval Shape(Ellipse)
- ‘viridis’ color

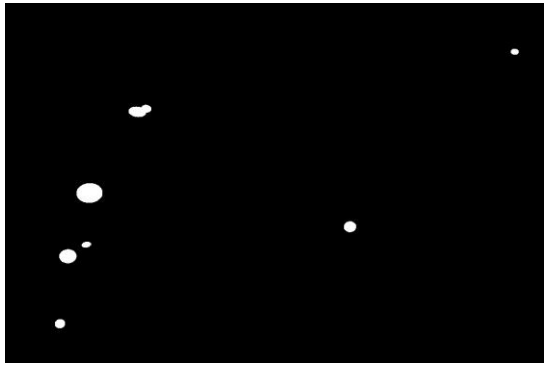
Dataset

- Kaggle Landscape Pictures (4,000 image files)

- Images go through transformations (resize, flip, …)
- Target needs to be a binary image

Original Image

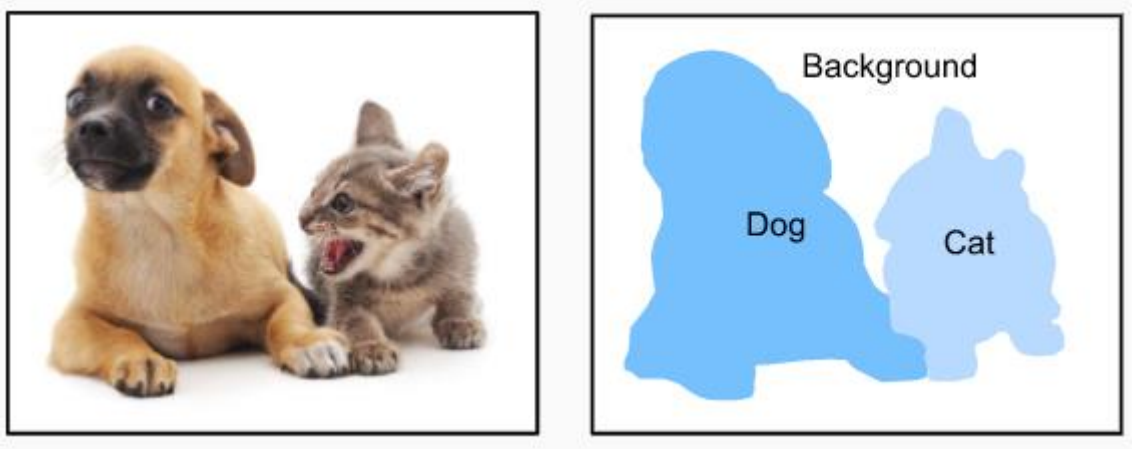
Input



Target

U-Net

- Widely used for Image Segmentation
- Trained to separate background(0) and flare(1)



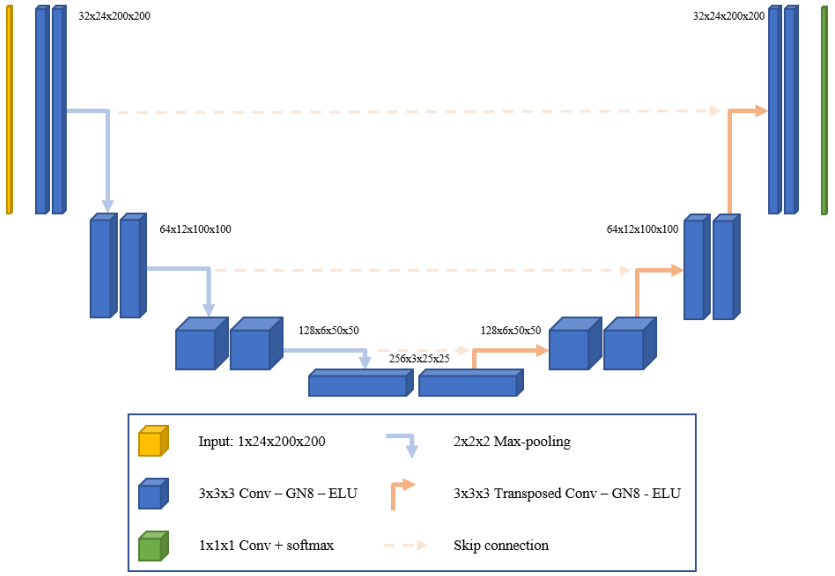
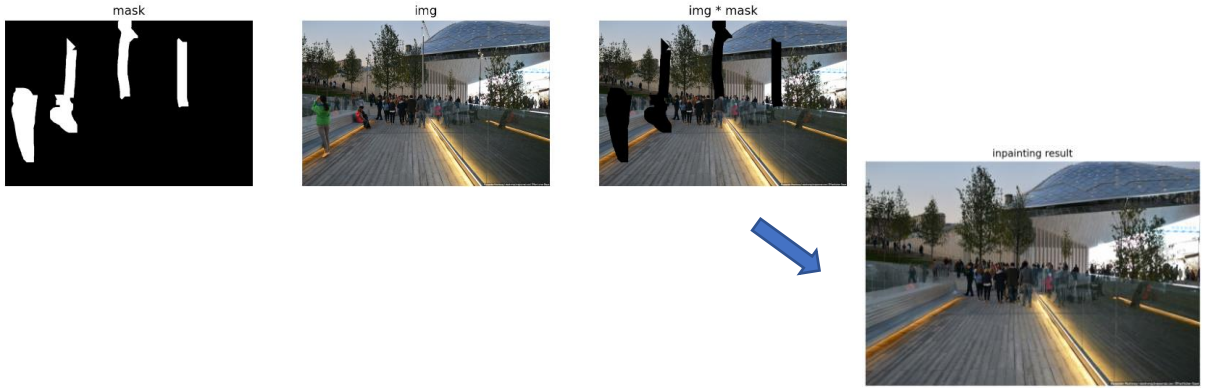


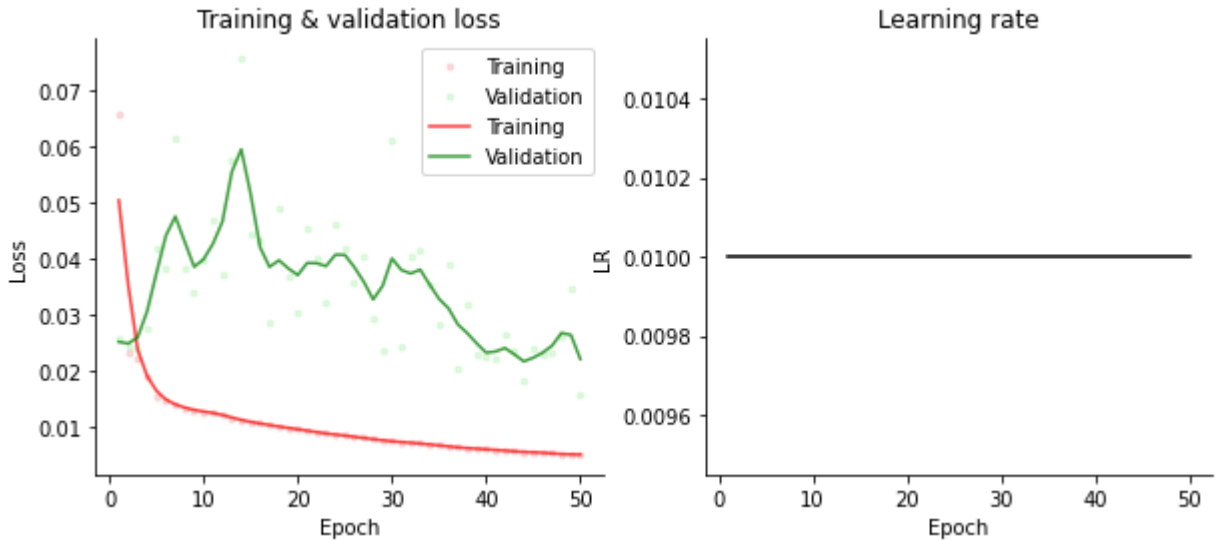
Image Inpainting

- Fills empty parts of an image through various methods
- Resolution-robust Large Mask Inpainting with Fourier Convolutions - LaMa
- CV2 Inpainting method (simple)



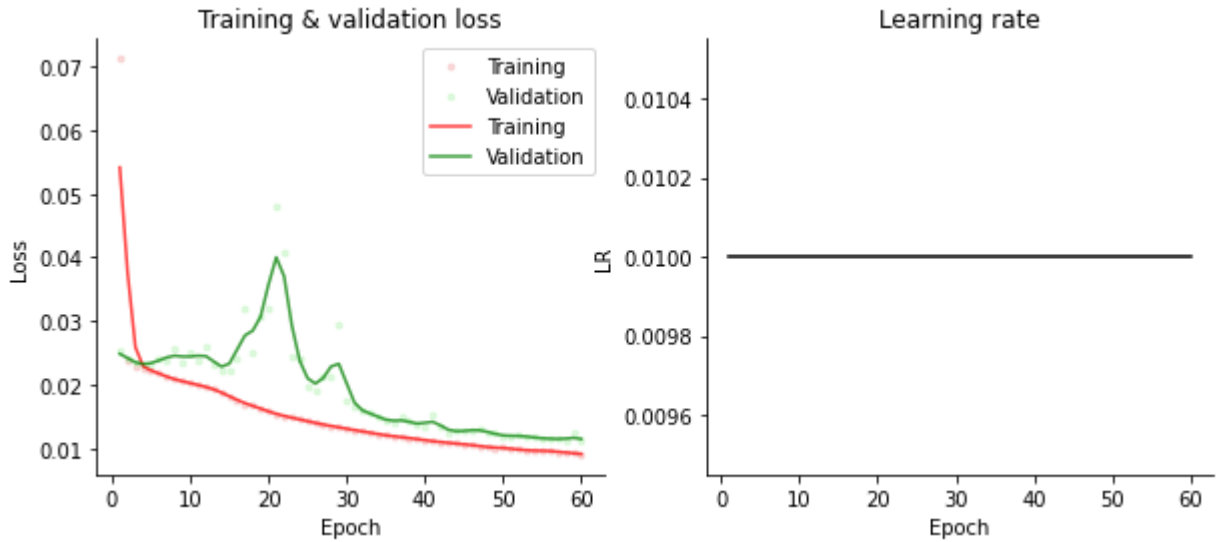
Results

- 128x128 image
- Single colored flare(green)
- Wrongly implemented target



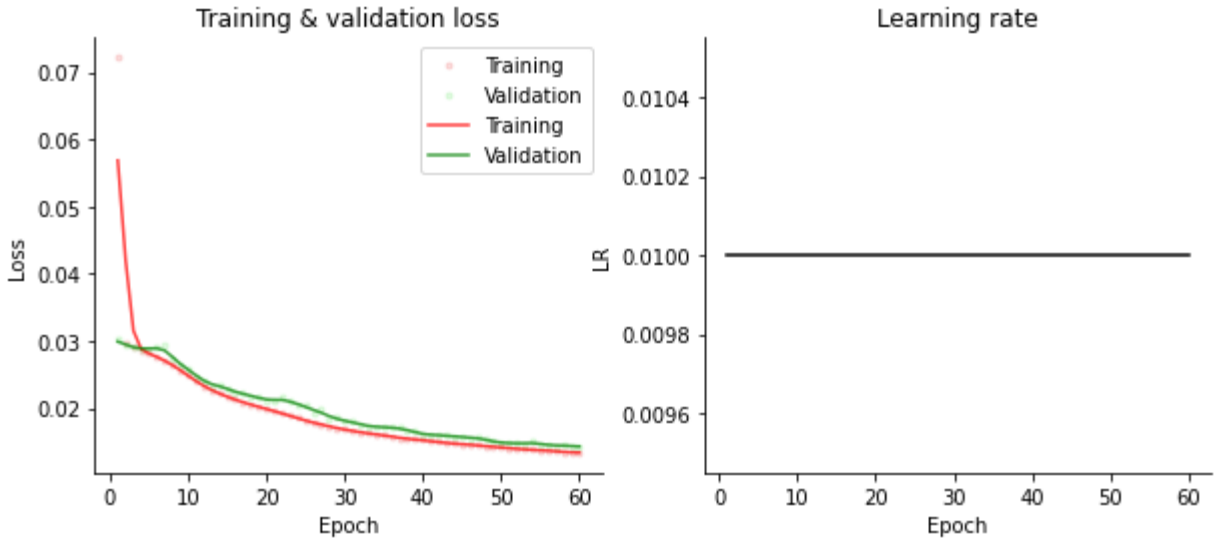
Results

- 256x256 image
- ‘viridis’ color
- Random size flare
- Fixed target image

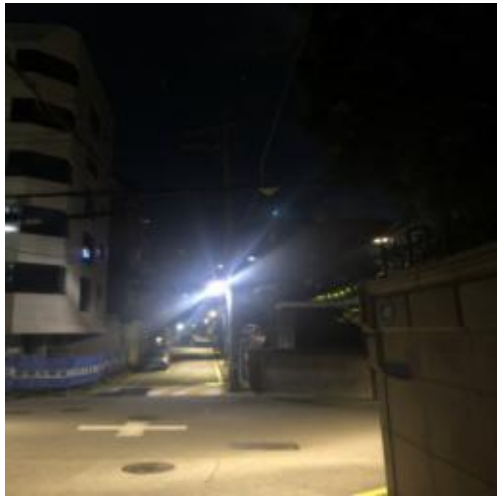


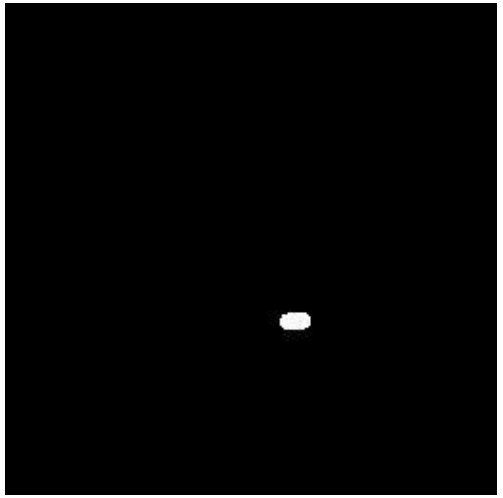
Results

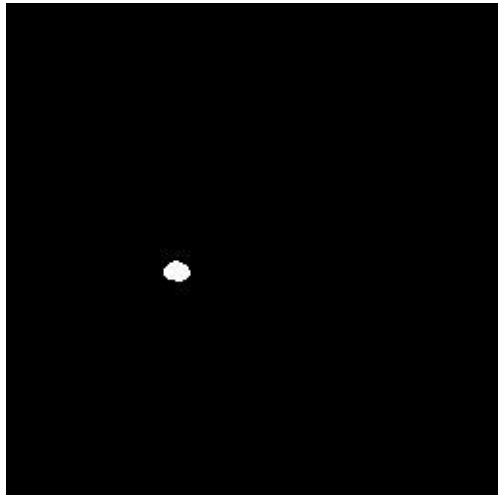
- 256x256 image
- ‘viridis’ color
- Random size flare
- Fixed target image
- Random rotate flare
- Random ellipse ratio
- Random opacity
- Random number of flare



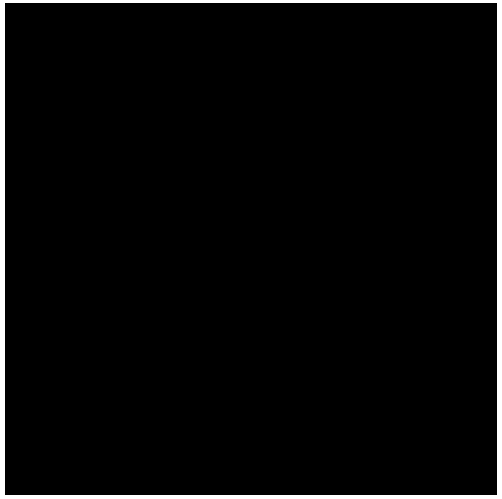
Results: Successful

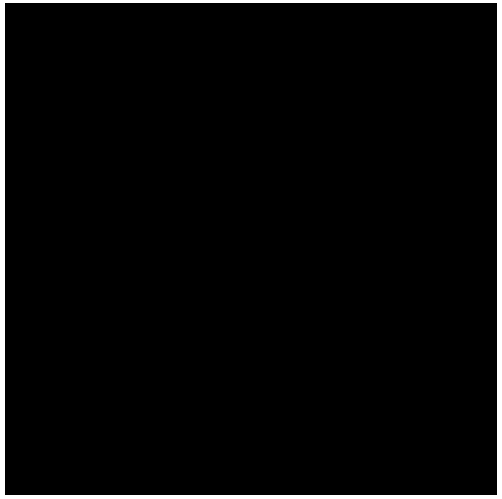







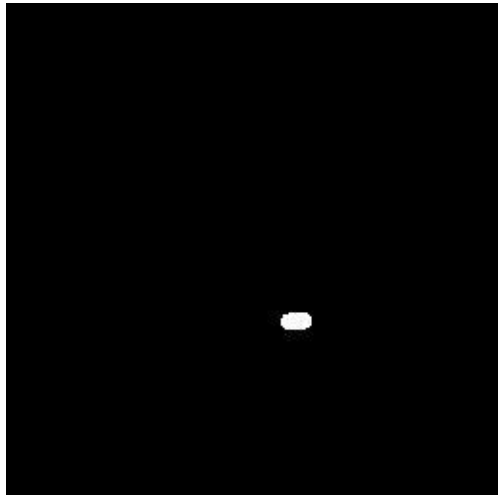
Results: Failed





Results: Inpainting

Original Image



Segmentation Mask

LaMa Inpainting

cv2 Inpainting (r=50)

Results: Comparison

Original Image

LaMa Inpainting

cv2 Inpainting (r=15)

cv2 Inpainting (r=50)

Conclusion

- Segmentation of flare(ghosting) mostly works
- Need to improve segmentation on faded flares
- Need a more accurate/larger mask for clean inpainting