



LVRNet: Lightweight Image Restoration For Aerial Images Under Low Visibility

Esha Pahwa^{*1}, Achleshwar Luthra^{*1,2}, Pratik Narang¹

¹BITS Pilani

²Carnegie Mellon University

* denotes equal contribution

Table of Contents

- 1 Motivation
- 2 New Dataset
- 3 Proposed Method
- 4 Results

Motivation

TODAY IN HISTORY

September 26, 1997: Ship sinks after collision in hazy straits

Cargo ship went missing after it sank in a collision with another cargo vessel in the busy and smog-covered Strait of Malacca

Newsweek

NEWS

Cruise Ship Collides With Another Vessel After Getting Caught in Heavy Fog

BY CHLOE MAVER ON 9/12/22 AT 5:40 AM EDT

September 12, 2022

The Indian EXPRESS

Mumbai: Body of third youth who drowned during idol immersion at Versova beach found

The body of the third youngster who drowned during the immersion of a Ganesh idol at Versova beach **Sunday night was found Monday night** said Versova police.

The deceased has been identified as 19-year-old Vijay Patil.

9NEWS

'Just horrendous': Three people drown after being knocked into surf at Port Kembla

Police are continuing their search of the Port Kembla foreshore in the Illawarra region of NSW after three men were swept into the sea and **drowned overnight.**

"There were number of families out there, just enjoying their fishing, a rogue wave came through and three lost their lives ... it was a very **distressing scene last night,** NSW Ambulance Norm Reese said.

Motivation

- Lack of methods tackling more than one adverse weather condition (eg: during a storm, it can be both **low-light and hazy**)
- Available methods require considerable amount of resources
- Lack of datasets that contain more than one degrading factor **within same images**



DATASET

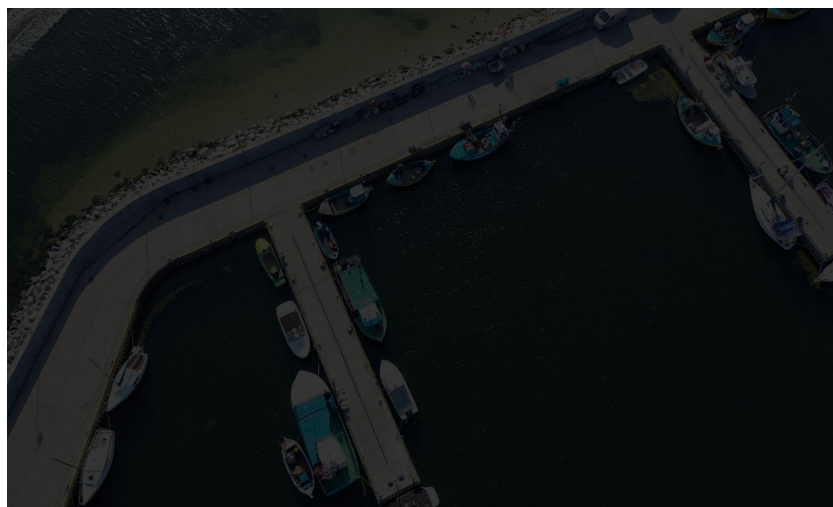
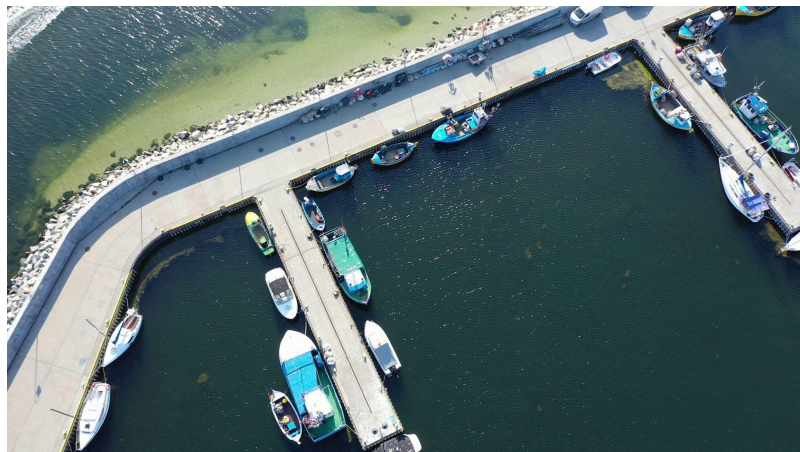
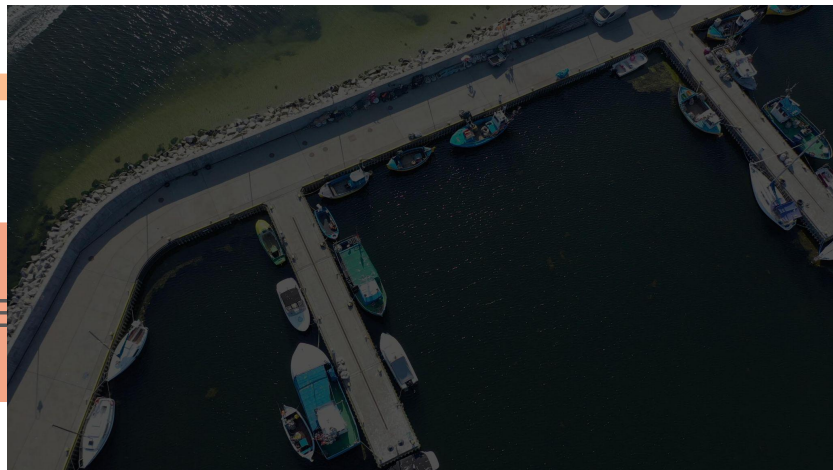
Dataset: LowVis AFO



AFO

Haze Effect
Using Imgaug¹

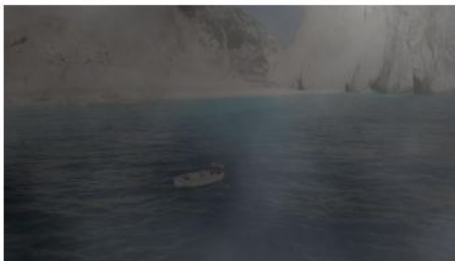
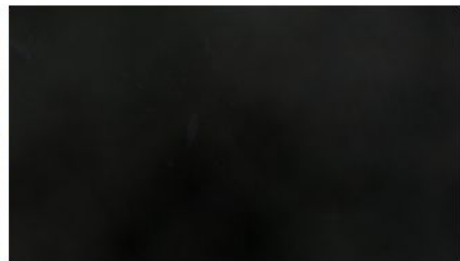
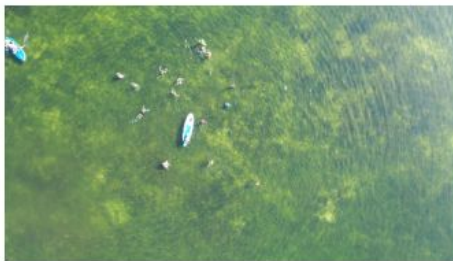
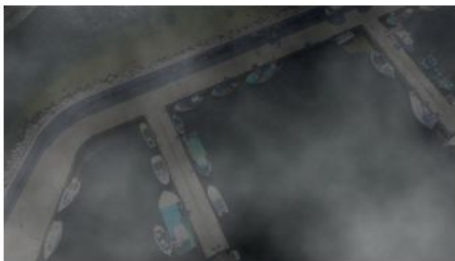
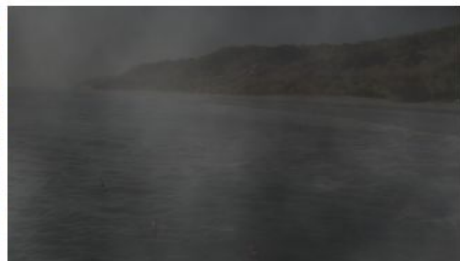
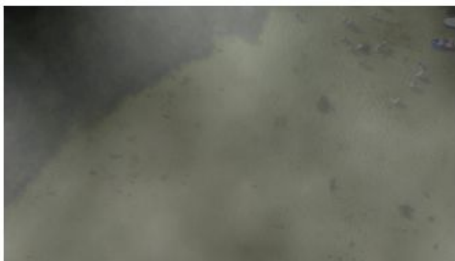
E



¹<https://github.com/aleju/imgaug>

²Cui et al. Multitask AET with orthogonal tangent regularity for dark object detection. ICCV 2021

Dataset: LowVis AFO



Ground Truth Images

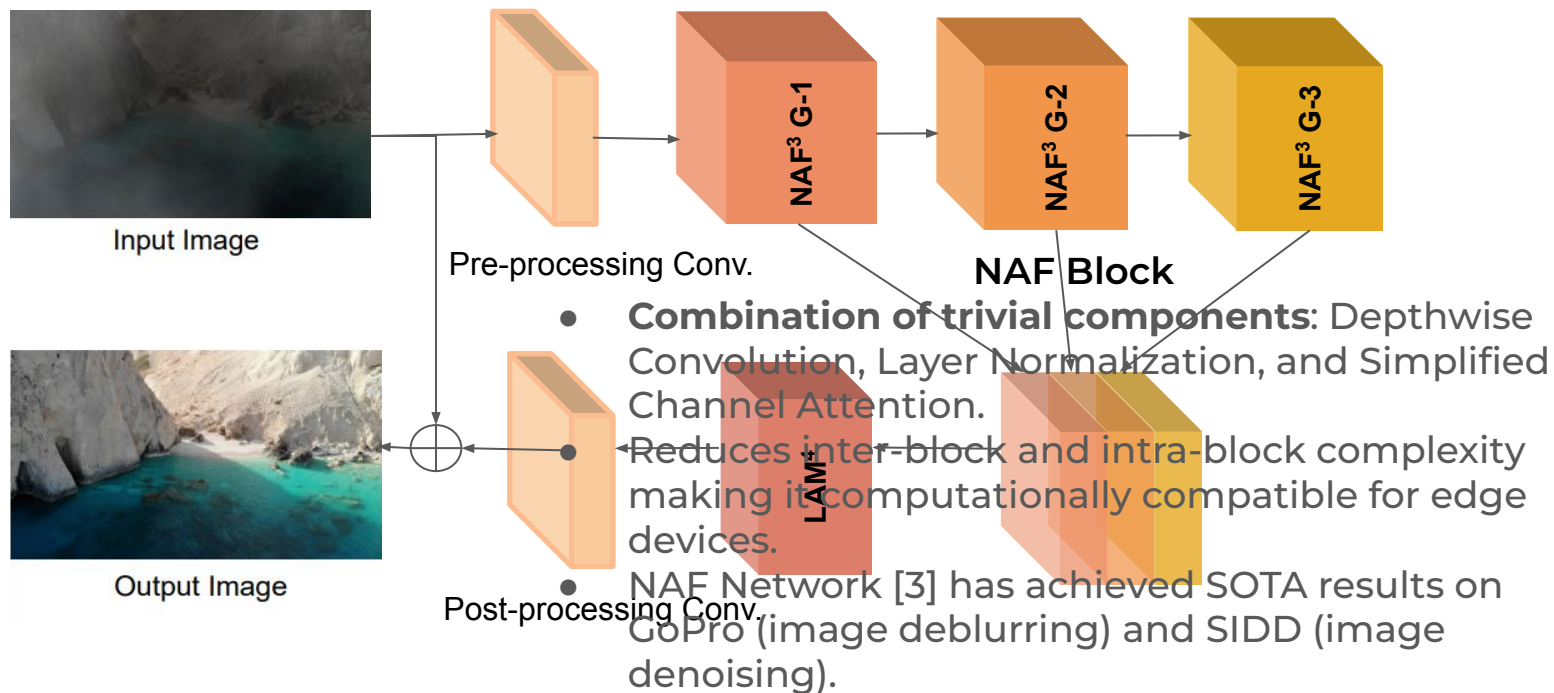
Generated Images

Ground Truth Images

Generated Images

METHOD

Proposed Methodology



³Chen, L. et al; *Simple baselines for image restoration*

⁴Zhang, Kaihao, et al. "Benchmarking Deep Deblurring Algorithms: A Large-Scale Multi-Cause Dataset and A New Baseline Model."

NAFNet & Level-Attention Module

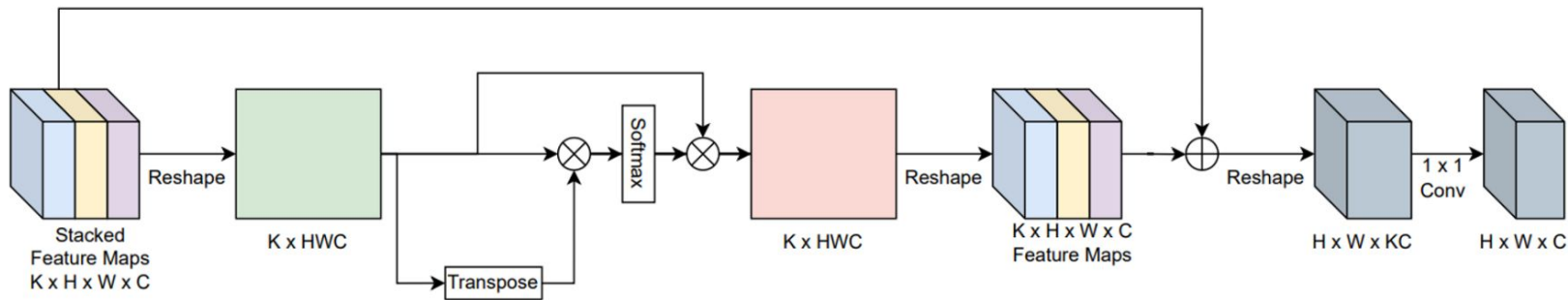
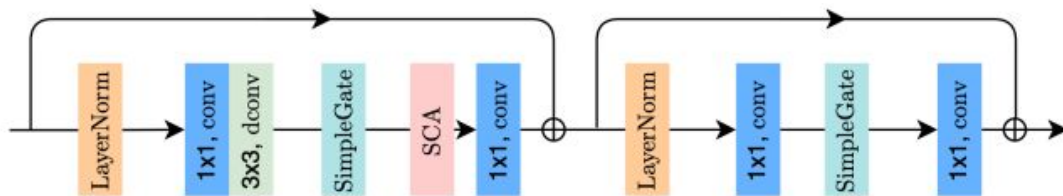


Figure 7. Visual illustration of operations performed by Level Attention Module.

RESULTS

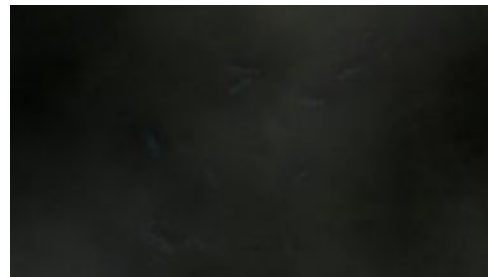
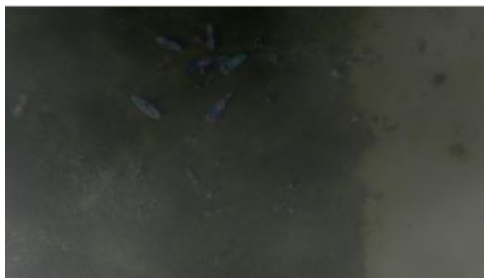
Results (Quantitative)

Method	Year	PSNR	SSIM
Zero-DCE[13]	2020	12.323	0.529
SGZNet[49]	2022	12.578	0.519
BPPNet[39]	2022	15.507	0.755
DehazeNet[3]	2016	15.710	0.391
Star-DCE[47]	2021	16.651	0.539
FFANet[7]	2020	15.050	0.582
MSBDN-DFP[16]	2020	16.686	0.689
LVRNet (Ours)	2022	25.744	0.905

All the above-mentioned methods have been cited in the

Results (Qualitative)

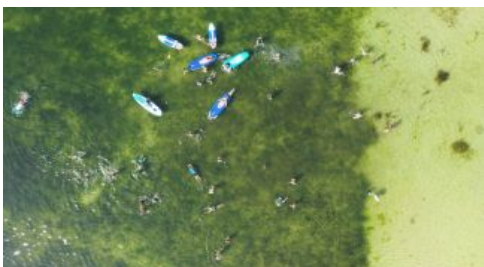
Input



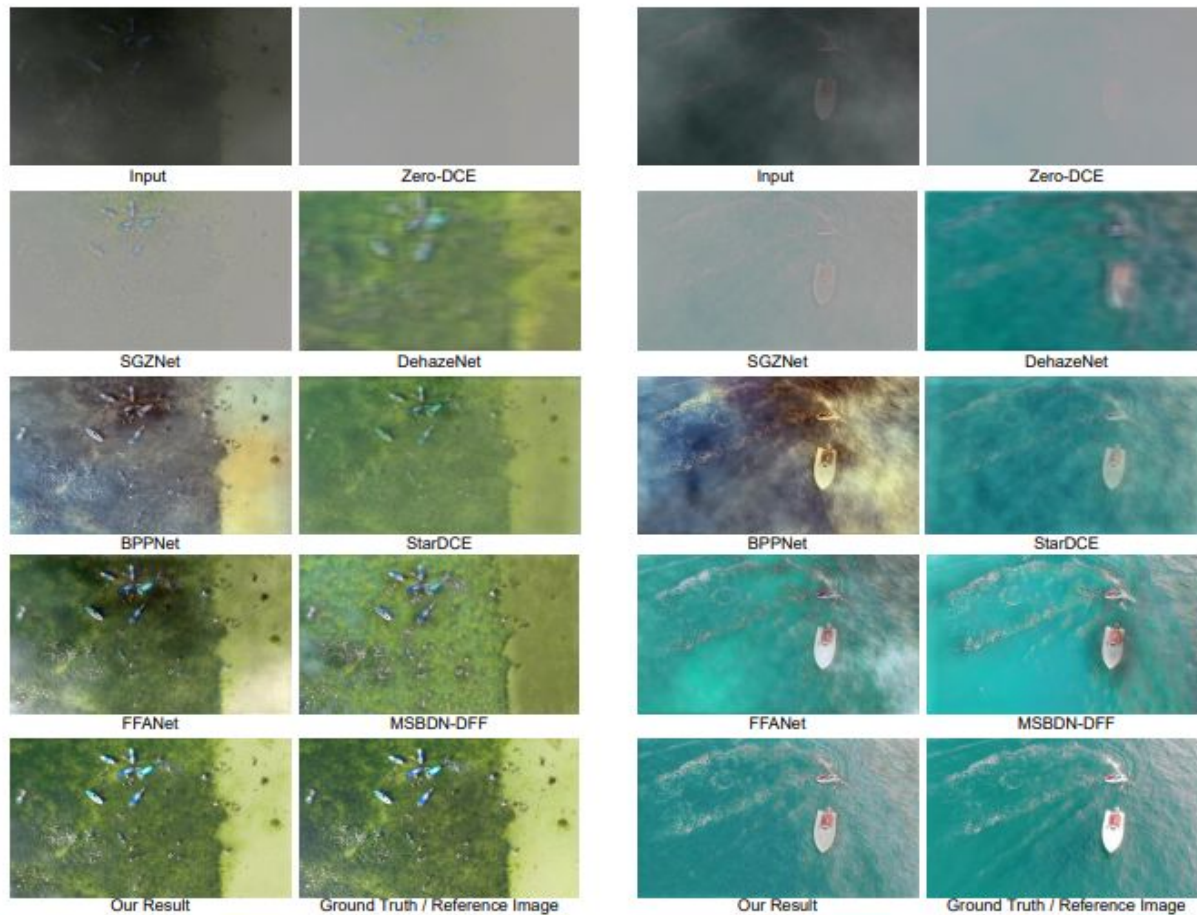
Output



GT



Results (Qualitative)



Ablation Exps



- ✓ Used different combinations of loss functions - best result obtained on using a weighted sum of L1 loss, Perceptual loss, Edge loss and FFT Loss
- ✓ Trained the model with lesser number of NAF blocks - achieved significantly higher value of PSNR as compared to previous methods

Results with detailed analysis are provided in the arXiv preprint!

Questions?



Esha Pahwa

f20180675@pilani.bits-pilani.ac.in



Achleshwar Luthra

achleshl@andrew.cmu.edu



Pratik Narang

pratik.narang@pilani.bits-pilani.ac.in