

# **Nonuniformly Dehaze Network for Visible Remote Sensing Images**

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## **Problem Definition and Contribution**

**Goal:** Recovering clear image from a single visible remote sensing image with nonuniform haze.



### **Contributions:**

• We propose the NDNet for RS nonuniform haze removal, which outperforms other SOTA meth-

### **Nonuniformly Excite Module**



- ods of natural image dehazing methods and RS image dehazing methods.
- We propose a Nonuniformly Excite (NE) module for nonuniform degradation.
- We recursively embed NE modules in a multi-scale framework, which helps not only significantly reduce trainable parameters, but also fuse lower-level and higher-level features.
- In the map operation, we utilize a proposed Dual Attention Dehaze (DAD) block to extract local enhanced features.
- In the gather operation, we extract nonlocal haze-aware feature with utilize a strided deformable convolution.

### Network



### • DAD has two branches, the channel attention branch and the pixel-wise attention branch.



### **Experiments & Results**

#### **Results on Nonuniform RS Haze dataset:**

natural image dehazing method							RS image dehazing method				
Methods	DCP	DehazeN	AODN	GCANet	GDN	PFFN	DuRN	MSBDN	SateHaze	FCFTN	Ours
PSNR	17.44	22.08	22.76	33.88	33.99	28.10	35.06	35.48	24.87	29.51	36.30
SSIM	0.8217	0.8211	0.9479	0.9921	0.9929	0.9620	0.9921	0.9937	0.956	0.9832	0.9948







#### **Results on real hazy RS images:**

Methods	DCP	DehazeNet	AODNet	FCFTNet	GDN	PFFNet	DuRN	MSBDN	Ours
NIQE↓	12.21	19.24	11.91	11.97	11.75	12.24	12.10	11.80	11.62
BRISQUE↓	54.05	34.94	48.57	47.89	48.47	47.27	54.76	47.89	47.40

hazy	DCP	DehazeNet	FCFTNet	PFFNet	GDN	Ours

### **Ablation study on DAD:**

channel atten- tion branch	pixel-wise atten- tion branch	PSNR/SSIM
		33.13/0.9942
$\checkmark$		35.82/0.9945
	$\checkmark$	34.44/0.9937
$\checkmark$	$\checkmark$	36.30/0.9948
DAD	number of RDBs	PSNR/SSIM
	1	35.38/0.9943
	2	35.73/0.9947
$\checkmark$	0	36.30/0.9948

#### **Results on NHHaze2:**

Methods	AODNet	GCANet	FFANet	TDN	Ours
PSNR	13.30	18.79	20.45	20.23	21.36
SSIM	0.4693	0.7729	0.8043	0.7622	0.8472

