A Closer Look at Blind Super-Resolution: Degradation Models, Baselines, and Performance Upper Bounds

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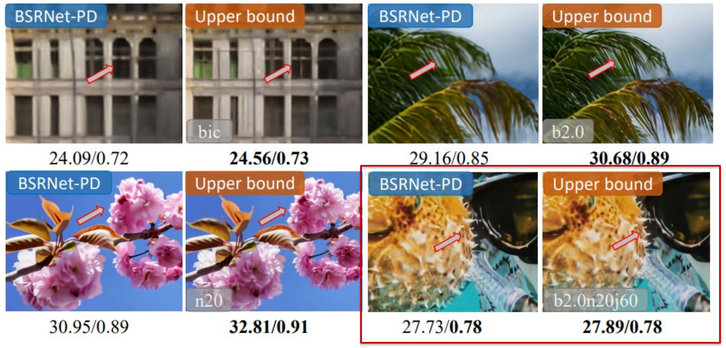
MOTIVATION

Three *key issues* not well examined in previous research**:**

1. A general degradation model that can **cover all degradation cases**
2. **Strong baselines** that can well handle most degradation cases
3. The study of **performance upper bounds** that can be used to evaluate the performance of existing blind SR methods w.r.t. distinct degradation cases



The practical degradation (PD) just achieves promising results in complex cases.

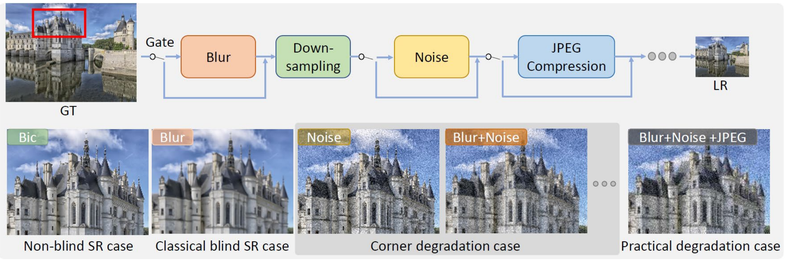
CONTRIBUTION

✓ We propose **a unified gated degradation model** that can effectively handle non-blind, classical, practical degradation cases as well as many other corner cases.

✓ We are the first to provide a comprehensive analysis of blind SR with performance **upper bounds** on both the classical and practical blind SR paradigms.

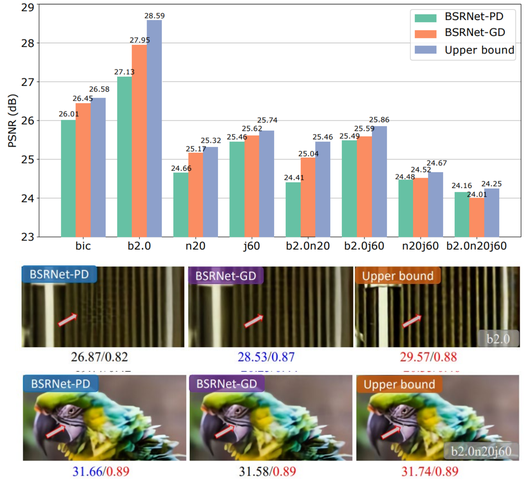
✓ We show that the **baseline** networks with the proposed GD model can achieve **superior performance** close to the upper bounds.

METHOD



- Our proposed **gated degradation model** is a unified model that encompasses non-blind SR, classical blind SR, and practical blind SR.
- The gate controller can generate **various corner degradation cases** and complex degradation cases to simulate real-world scenarios.

ANALYSIS



1) A blind SR network has a **tiny sacrifice** in the complex case.

2) The performance of corner cases can achieve obvious **improvement** compared with the PD model.

3) A blind SR network can handle **all of the degradation types** with a small performance drop compared with the upper bound

EXPERIMENTS

Dataset	Method	Degradation Types								
		bic	b2.0	n20	j60	b2.0n20	b2.0j60	n20j60	b2.0n20j60	Average
BSD100	Bicubic	24.63	25.40	21.56	24.06	21.90	24.65	21.22	21.72	23.14
	RCAN [41]	25.65	26.77	24.63	25.16	24.39	25.36	24.36	24.15	25.06
	SRResNet-FAIG [34]	25.58	26.72	24.53	25.11	24.26	25.29	24.32	24.07	24.99
	RRDBNet [29, 38]	25.62	26.76	24.58	25.13	24.33	25.32	24.34	24.11	25.02
	SwinIR [13]	25.84	27.05	24.77	25.27	24.48	25.44	24.44	24.18	25.18
	RRDBNet-GD (ours)	26.25	27.31	25.31	25.23	24.95	25.32	24.38	24.07	25.35
	SwinIR-GD (ours)	26.61	27.58	25.64	25.30	25.30	25.39	24.44	24.14	25.55
	Upper bound (RRDBNet)	26.36	27.68	25.46	25.30	25.34	25.49	24.45	24.15	25.53

Our method (GD) could generate SOTA quantitative and qualitative results

Method	Metric	Degradation Types								
		bic	b2.0	n20	j60	b2.0n20	b2.0j60	n20j60	b2.0n20j60	Average
Bicubic	NIQE	7.08	7.89	8.97	7.35	8.42	7.93	8.99	8.37	8.13
	PSNR	21.89	22.54	20.00	21.50	20.36	22.02	19.74	20.20	21.03
SRGAN [12]	NIQE	4.25	5.00	3.49	3.88	3.69	4.59	3.46	3.65	4.00
	PSNR	21.75	23.16	21.08	21.55	21.68	22.42	20.95	21.45	21.76
BSRGAN [29, 38]	NIQE	4.51	5.77	4.02	4.25	4.24	5.26	3.97	4.36	4.55
	PSNR	22.18	23.39	21.58	21.96	21.81	22.51	21.38	21.51	22.04
SwinIRGAN [13]	NIQE	4.39	5.01	4.29	4.40	4.46	4.91	4.08	4.36	4.49
	PSNR	22.92	24.10	22.10	22.48	22.18	22.84	21.82	21.83	22.53
BSRGAN-GD (ours)	NIQE	4.04	4.27	3.91	3.95	4.18	4.91	3.63	4.57	4.18
	PSNR	23.31	24.43	22.51	22.45	22.40	22.69	21.62	21.62	22.63
SwinIRGAN-GD (ours)	NIQE	4.01	4.38	4.11	4.16	4.29	4.55	4.09	4.72	4.29
	PSNR	24.24	25.20	23.28	22.98	23.13	22.94	22.17	21.86	23.23
Upper bound (BSRGAN)	NIQE	3.79	4.10	3.88	3.92	3.86	4.00	3.73	3.87	3.89
	PSNR	23.66	25.17	22.58	22.58	22.41	22.51	21.77	21.52	22.78