Controlling the Rain: from Removal to Rendering

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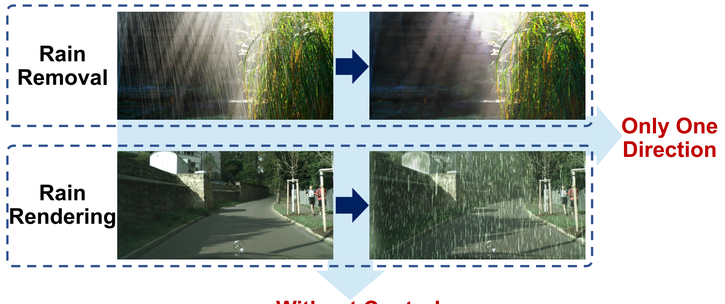
Challenge

Rain-Related Image Transformation

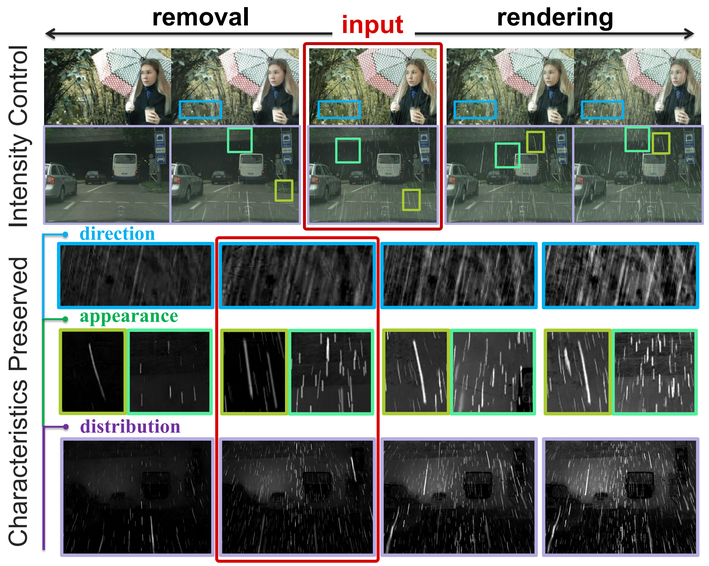


Problem statement

Can we continuously control the rain intensities bidirectionally (decreasing or increasing) with a single rain image as input?

Contribution

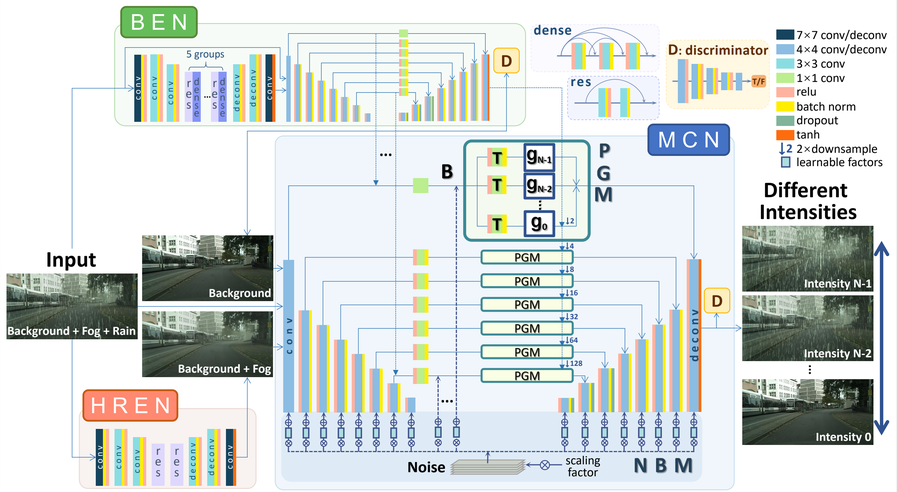
- We propose a Rain Intensity Controlling Network (RICNet) to control the rain continuously from removal to rendering.
- We can change the intensity-dependent characters (e.g., thickness of fog), while preserve the scene-specific features of input rain image (e.g., direction, appearance, and distribution).



Method

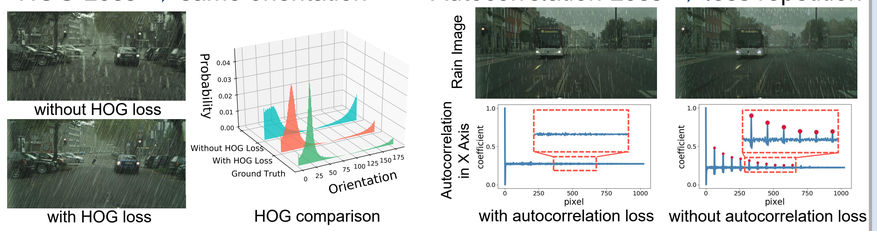
Rain Intensity Controlling Network (RICNet)

- **HREN**: High-frequency Rain-streak Elimination Network
- **BEN**: Background Extraction Network
- **MCN**: Main Controlling Network
  - **PGM**: Parallel Gating Module ➡ multi-level feature interpolation
  - **NBM**: noise boosting Module ➡ boost distribution and texture diversity



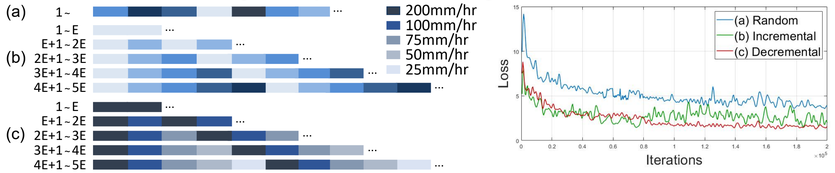
Loss Function

- HOG Loss ➡ same orientation
- Autocorrelation Loss ➡ less repetition



Training Strategy

- Decremental Learning ➡ speedup convergence



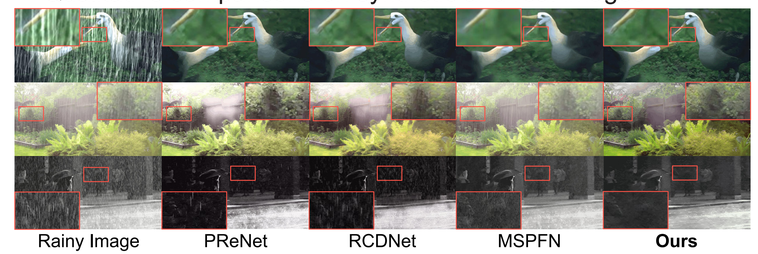
Experiments

Rain Removal

- Quantitative comparison on synthetic datasets (PSNR/SSIM).

Methods	RainLevel5	Rain12000	Rain800	Rain200H	SPAData
RESCAN	24.09/0.777	30.51/0.882	25.00/0.835	28.02/0.862	38.11/0.971
UMRL	23.13/0.804	29.77/**0.920**	24.41/0.829	27.06/0.847	35.06/0.941
PReNet	32.07/0.979	30.03/0.889	24.81/0.851	28.56/0.880	40.16/0.982
SEMI	21.08/0.727	26.05/0.822	22.35/0.788	22.17/0.719	35.31/0.941
JORDER	32.88/0.965	24.32/0.862	26.73/0.869	23.45/0.749	40.78/0.981
HRGAN	35.99/0.980	30.87/0.891	26.80/0.853	28.75/0.882	37.45/0.952
RCDNet	21.34/0.860	26.44/0.816	23.75/0.842	28.82/0.893	**41.47/0.983**
MSPFN	26.27/0.856	32.39/0.916	**27.50/0.876**	26.97/0.835	37.87/0.957
Ours	**37.81/0.985**	**32.67**/0.892	27.11/0.869	**28.84/0.893**	37.98/0.972

- Qualitative comparisons on synthetic and real images.



Rain Control