



http://vision.sia.cn/our%20team/JiandongTian/JiandongTian.html

## Problem: Video Desnowing and Deraining

existing snow/rain removal methods often fail for heavy The snow/rain and dynamic scene.

- For heavy rain/snow scenes, the snow/rain in the static backgrounds can not be clearly removed.
- For the moving objects in the rain/snow scene, inaccurate detection and improper filtering will lead to artifacts.

## Our main contributions:

- We divide rain streaks into sparse ones and dense ones, and model them separately in a matrix decomposition framework. This process makes our model effective to tackle with heavy rain.
- Based on background fluctuations and flow information, we formulated the detection of sparse rain streaks and moving objects as a multi-label MRFs.
- The existing methods often cause deformations and artifacts on moving objects. To avoid this problem, we design a group sparsity term to filter rain pixels within moving objects.

## Our Model

 $I = B + F + S_s + S_d$ Low rank *B*:  $rank(B) \le \kappa$  Sparse *F* and  $S_s : ||F + S_s||_0$ Dense snow  $S_d$ :  $P(S_d) = \frac{1}{\left(\sqrt{2\pi\sigma_d}\right)^N} \exp\left(-\frac{\|S_d\|_F^2}{2\sigma_d^2}\right)$ 



Fig.1: Composition of a general snow/rain scene: Low rank backgrounds B, foregrounds F, sparse snow/rain  $S_s$ , and dense snow/rain  $S_d$ .

Filtering rain within moving objects





Moving object Dense snow Sparse snow

Fig.2 The decomposition results of two rain scenes. The sparse rain and moving objects can be detected by MRF, and Gaussian distribution can well fit small fluctuations, such as dense snow, background noise, and illumination variations, etc.

# Experimental results



Image

Tripathi [1]

[1] Tripathi, A. K., & Mukhopadhyay, S. (2012). Video post processing: low-latency spatiotemporal approach for detection and removal of rain. IET image processing, 6(2), 181-196. [2] Kim, J. H., Sim, J. Y., & Kim, C. S. (2015). Video deraining and desnowing using temporal correlation and low-rank matrix completion. IEEE Transactions on Image Processing, 24(9), 2658-2670.

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Kim [2]

Ours

Fig.3: Comparison results with other two methods under different rain/snow scenes.