An online robust-PCA based method for signal separation and its applications in video processing

In the first part of this work, we study one practical online algorithm call Practical Recursive Projected Compressive Sensing (prac-ReProCS) for recovering a time sequence of sparse vectors St and a time sequence of dense vectors Lt from their sum, Mt:= St + Lt, when Lt’s lie in a slowly changing low-dimensional subspace of the full space. A key application where this problem occurs is in real time video layering where the goal is to separate a video sequence into a slowly changing background sequence and a sparse foreground sequence that consists of one or more moving regions/objects on-the-fly. Via experiments we show that prac-ReProCS has significantly better performance compared with other state-of-the-art robust-pca methods when applied to video foreground-background separation.

In the second part of this work, we study the problem of video denoising. We apply prac-ReProCS to video denoising as a preprocessing step. We develop a novel approach to video denoising that is based on the idea that many noisy or corrupted videos can be split into three parts – the “low-rank layer”, the “sparse layer” and a small residual which is small and bounded. We show using extensive experiments, layering-then-denoising is a effective, especially for long videos with small-sized images that those corrupted by general large variance noise or by large sparse noise, e.g., salt-and-pepper noise.