Robust Low-Rank Representation on Anchor Graph with Self-Attention

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Problems & Ideas

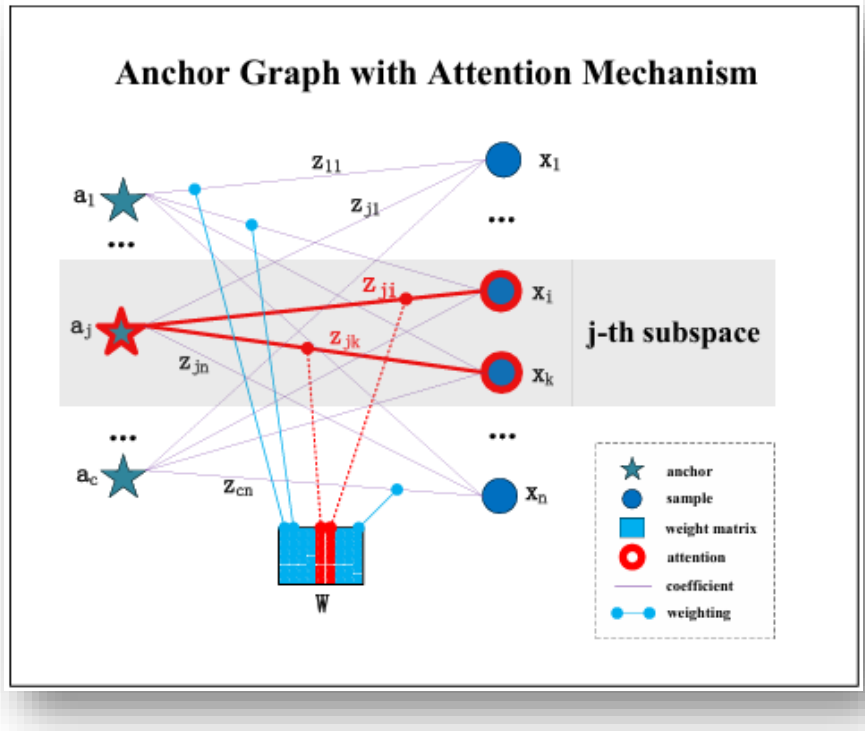
Problems of conventional Low-Rank Representation approaches:

- **Self-representation form is sub-optimal, as the original dataset may contain noise and outliers that can lead to the low-rank matrix failing to accurately reflect the true partition result when used as a dictionary for error correction.**
- **Learning a complete and effective dictionary to address the issue of dictionary redundancy is an essential problem that requires resolution.**
- **Ignoring the weights of the samples when representing data points through linear combinations of surrounding samples result in poor subspace segmentation.**

$$\min_{A,Z,E,W} Rank(W \odot Z) + \alpha||E||_1$$
$$s.t.\ X = AZ + E, A^T A = I, Rank(L_Z) = n - c, \sum_j Z_j = 1, Z \geq 0$$

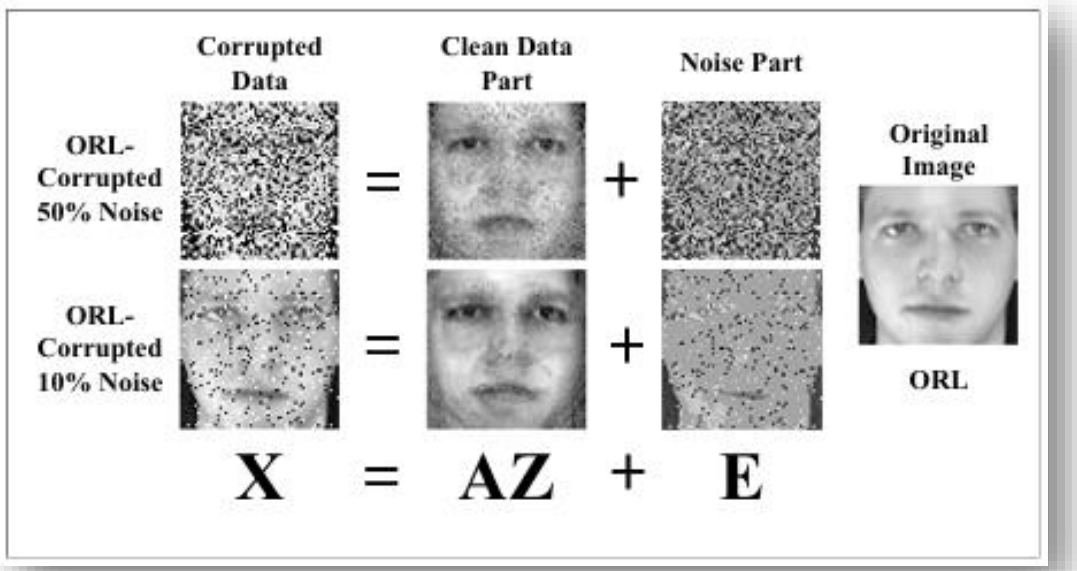
Ideas: **The proposed RLRR integrates anchor graph with attention mechanism and low-rank representation into a joint optimization framework.**

RLRR learns anchor graph with attention mechanism. The learned anchor graph is a bipartite graph where anchor points within the same subspace are as signed higher attention weights representing samples. Since coefficients are given higher attention values, the corresponding anchor points are preferentially selected to represent the sample.



Main Contributions

- ✓ The proposed low-rank representation method learns anchors as a complete-dictionary to represent the clean part of the original data, which can explicitly separate noise.
- ✓ The proposed novel self-attention mechanism adaptively weights the low-rank representation coefficients based on the subspace where the anchors and samples reside.
- ✓ The proposed novel anchor graph learning method clearly represents the connectivity between clusters and anchors.



The corrupted image X is decomposed into a noise part E and a clean data part reconstructed by the anchor matrix A and the coefficient matrix Z.