The unlabeled sensing problem is to solve a noisy linear system of equations under unknown permutation of the measurements. We study a particular case of the problem where the permutations are restricted to be r-local, i.e. the permutation matrix is block diagonal with \( r \times r \) blocks. We propose a proximal alternating minimization algorithm that provably converges to a first order stationary point. We validate the algorithm on synthetic and real datasets. We also formulate the 1-d unassigned distance geometry problem as an unlabeled sensing problem with a structured measurement matrix.

**Applications**

1. **Unassigned Distance Geometry Problem**
   - The 1-d unassigned distance geometry problem (uDGP) is to recover the point coordinates \((0, 3, 7, 9)\) from their unlabeled pair-wise distances \([3, 2, 4, 6, 7, 9]\). uDGP can be formulated as an unlabeled sensing problem with a deterministic measurement matrix.

2. **Scrambled Image Recovery**
   - Given the scrambled image, the problem is to recover the original image.

3. **Jittered Sampling**
   - The jittered sampling method is used to improve the uniformity of the samples.

**Contribution**

- We propose a new algorithm for the r-local unlabeled sensing problem that outperforms existing algorithms.
- We explore the second-order convergence properties of the proposed algorithm.
- We analyze the performance of the algorithm under different parameter settings.

**Future Work**

- Explore the performance of the algorithm under different parameter settings.
- Investigate the scalability of the algorithm with larger datasets.
- Extend the approach to higher-dimensional problems.

**References**