

# Supplementary materials for “Neuronal population reconstruction from ultra-scale optical microscopy images via progressive learning”

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## Abstract

This supplementary material document presents more results to evaluate the reconstruction performance of our PLNPR method.

### I. SUPPLEMENTARY MATERIALS FOR FIGURE 11: VISoR-40 DATASET

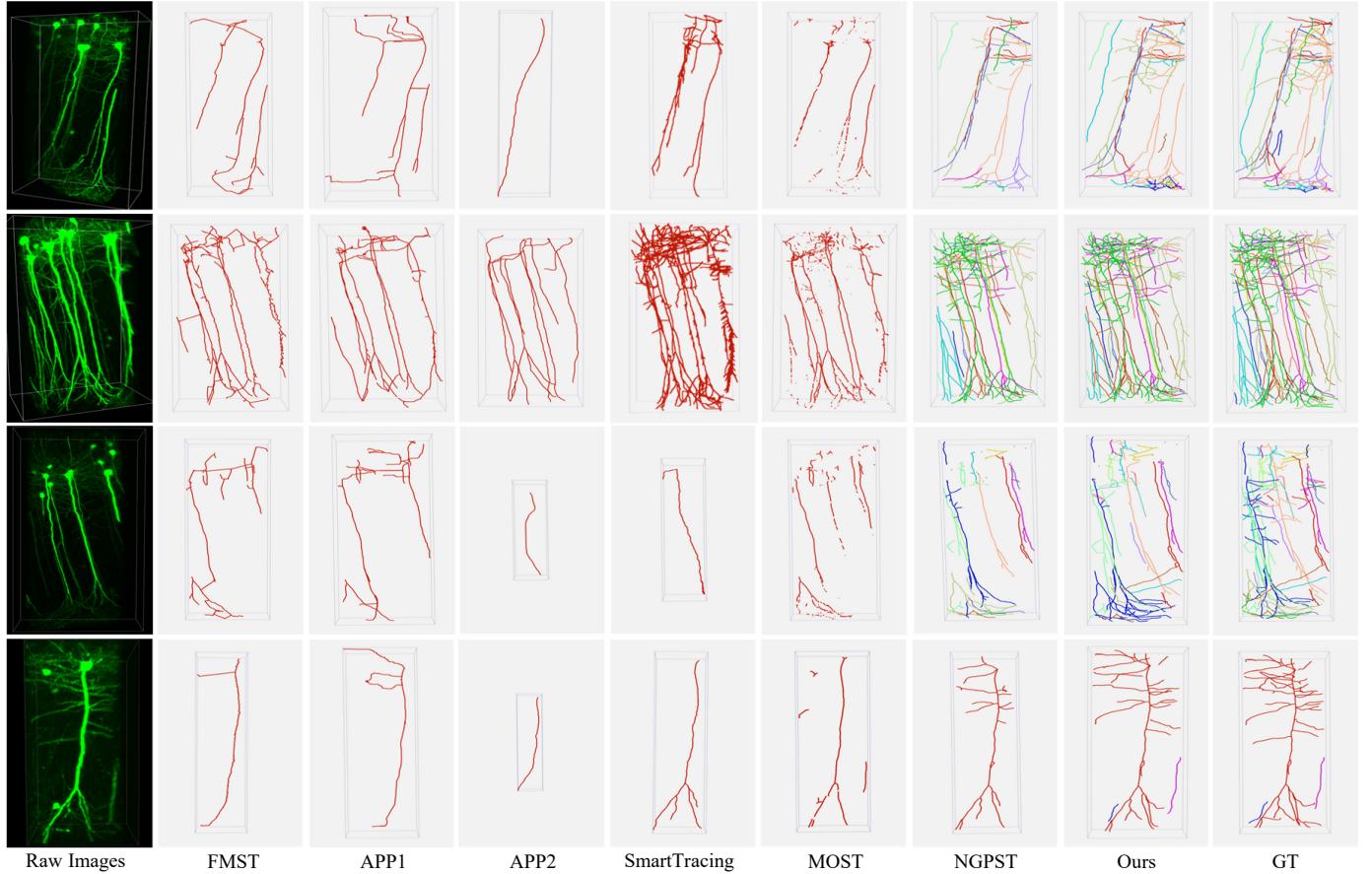


Fig. 1. Comparison of neuronal population reconstruction results generated by different methods for four test images in the VISoR-40 dataset. It can be seen that our method outperforms others in both sparse and dense neurites. FMST, APP1, APP2, SmartTracing (ST) and MOST tend to extract the main trunk of the neurites while a large portion of subtle neurites are missing. NGPST works better to identify dense neurites. However, subtle neuronal processes are still hard to extract by using hand-crafted features. In comparison, our method benefits from the progressively trained DSN, and reconstructs more complete and precise neurites for challenging OM images, even there are low contrast, noises, and blending of fluorescence in the images.

## II. SUPPLEMENTARY MATERIALS FOR FIGURE 9 (A): VISOR-40 DATASET

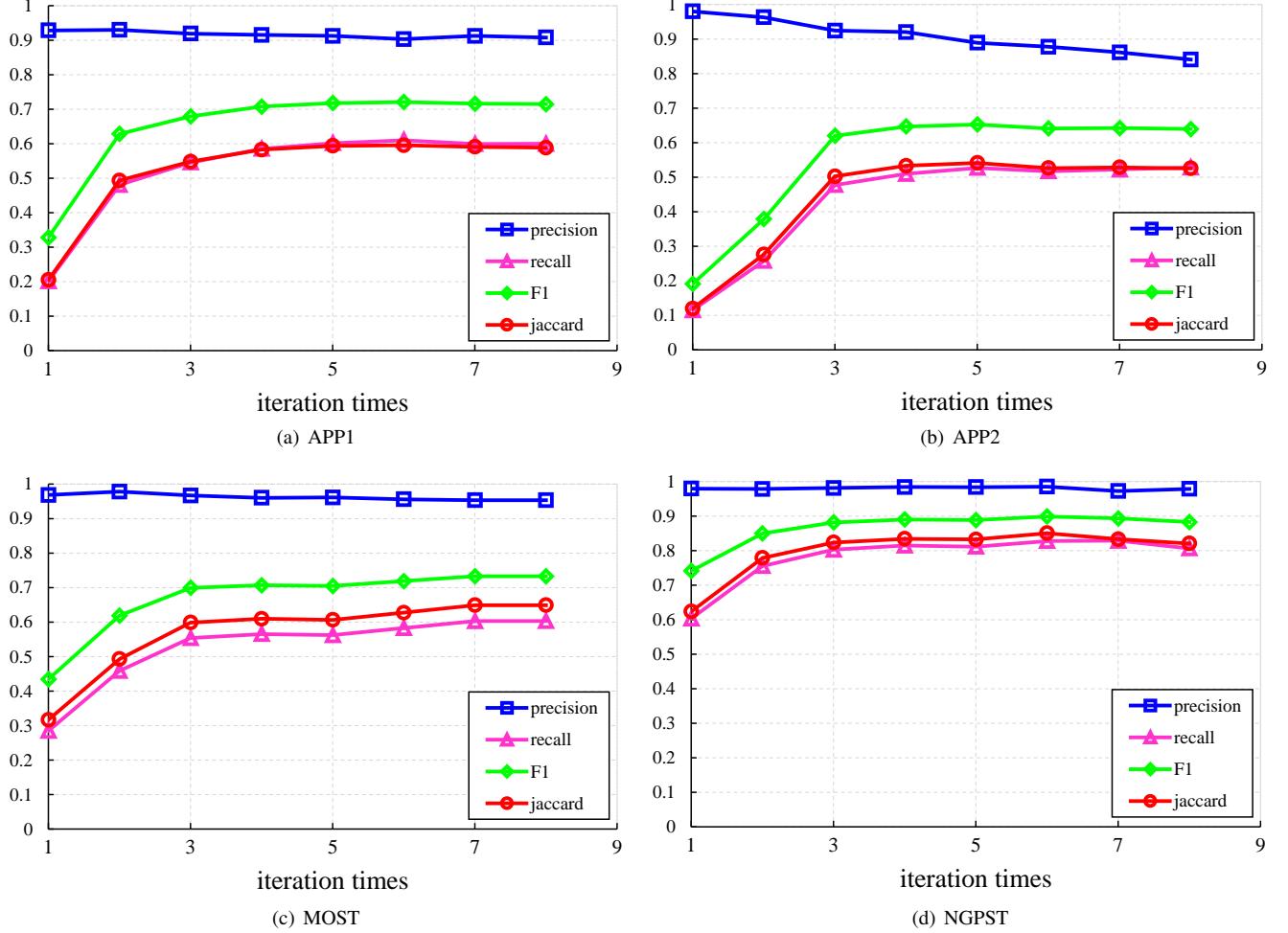
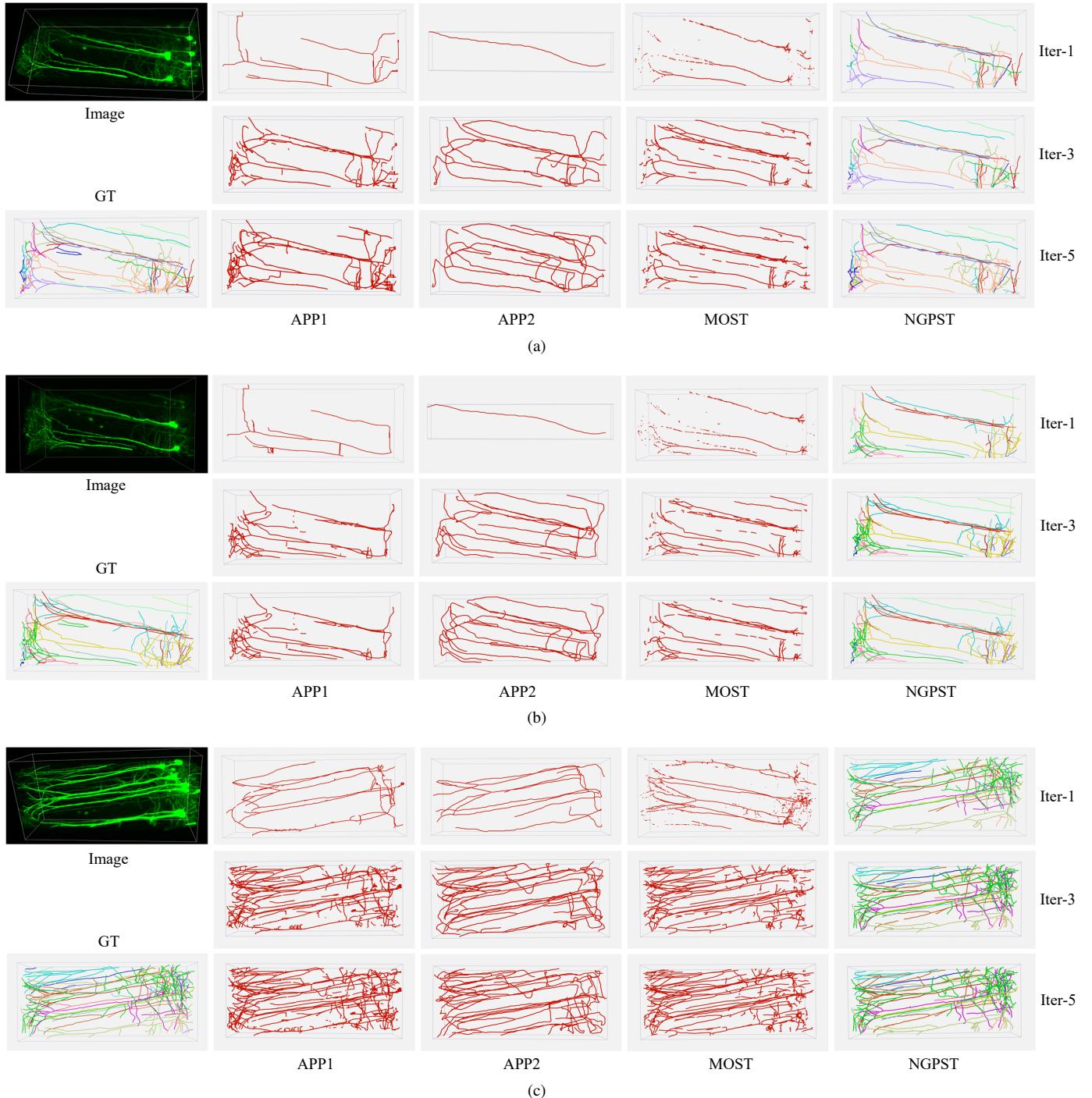
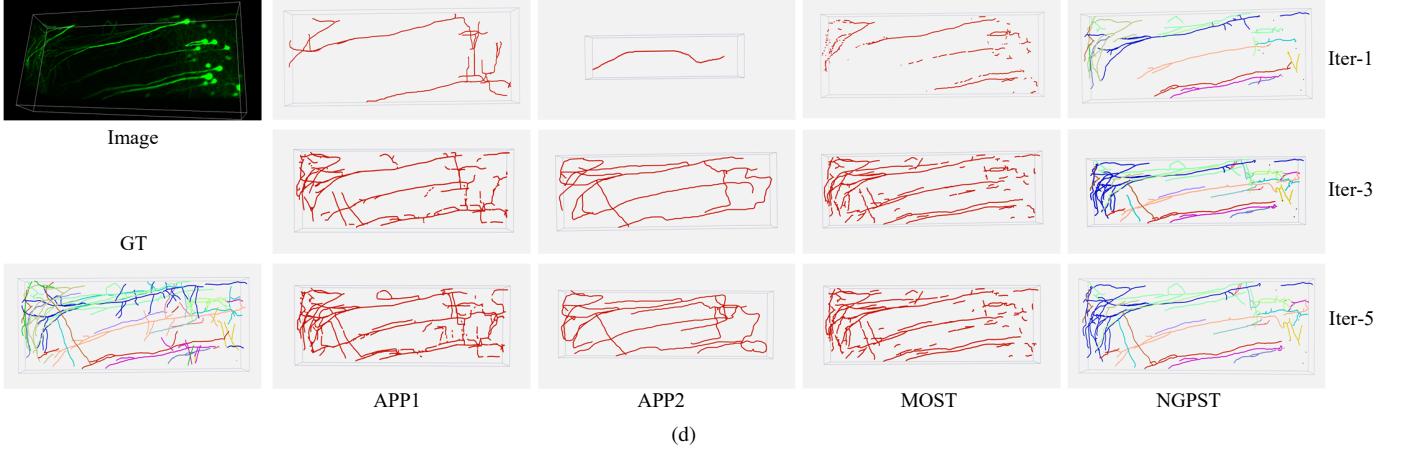


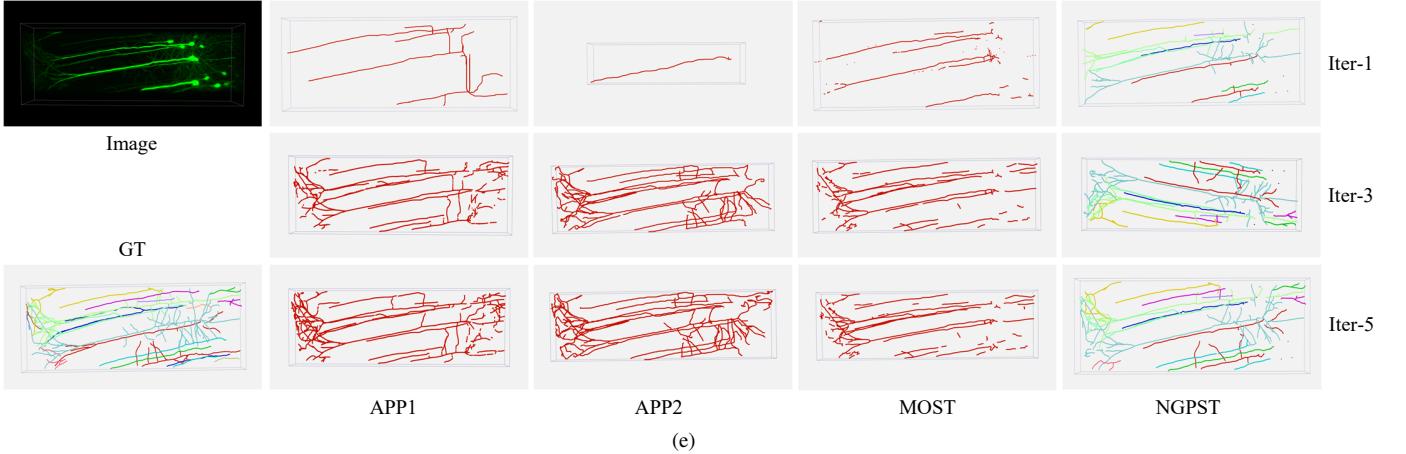
Fig. 2. Comparison of neuron population reconstruction performance of our method on the VISOR-40 test dataset using different traditional neuron tracing methods, including APP1, APP2, MOST and NGPST. Each subgraph shows the quantitative results of our PLNPR at eight iterations using each tracing method. It can be observed that, our progressive learning framework effectively facilitates traditional neuron tracing methods. Each tracing method is promoted to reconstruct more complete neurons. Furthermore, after about five iterations of the progressive learning, our PLNPR converges, and further iteration just improves the performance very slightly.

### III. SUPPLEMENTARY MATERIALS FOR FIGURE 10: VISoR-40 DATASET

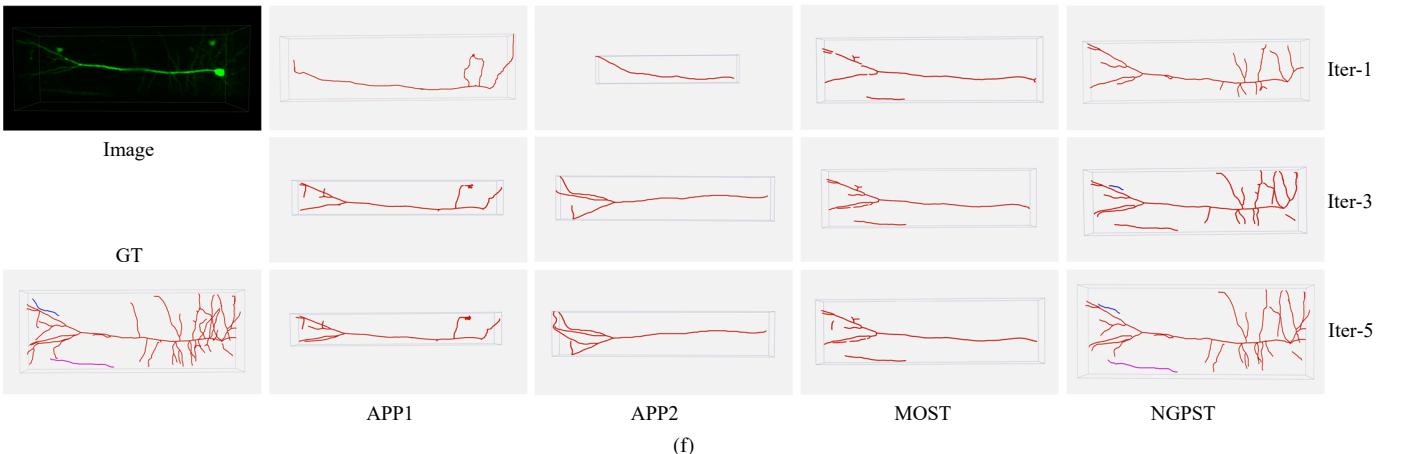




(d)



(e)



(f)

Fig. 3. Comparison of neural population reconstruction results of our method for six test images in the VISoR-40 dataset at different iterations using different traditional neuron tracing methods, including APP1, APP2, MOST and NGPST. For each subgraph, the first column shows the raw image and corresponding ground truth (GT). The remaining columns show reconstruction results generated by our system with the corresponding traditional neuron tracing method at the first, third and fifth iteration, respectively. It can be seen that our progressive learning framework effectively facilitates traditional tracing methods. Each tracing method is promoted to reconstruct more complete and accurate neurons.

#### IV. SUPPLEMENTARY MATERIALS FOR TABLE 1: VISoR-40 DATASET

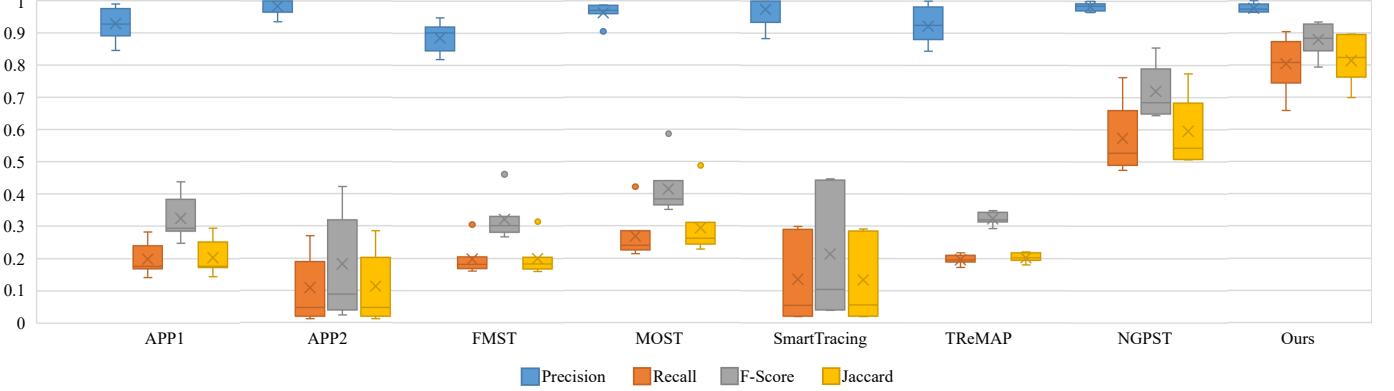


Fig. 4. Performance comparison with eight neuron tracing methods on the VISoR-40 test dataset. For each tracing method, we show the distribution of four metrics (precision, recall, F-Score, Jaccard) on the seven test blocks, including the minimum, the maximum, the median, the average, and the first and third quartiles of each metric. Compared with other methods, our PLNPR approach the highest overall performance and more consistent results over individual blocks.