An optimization-inspired approach to parallel sorting

Team Metropolis:
James Farzi, JJ Lay, Graham West

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Outline

Binning

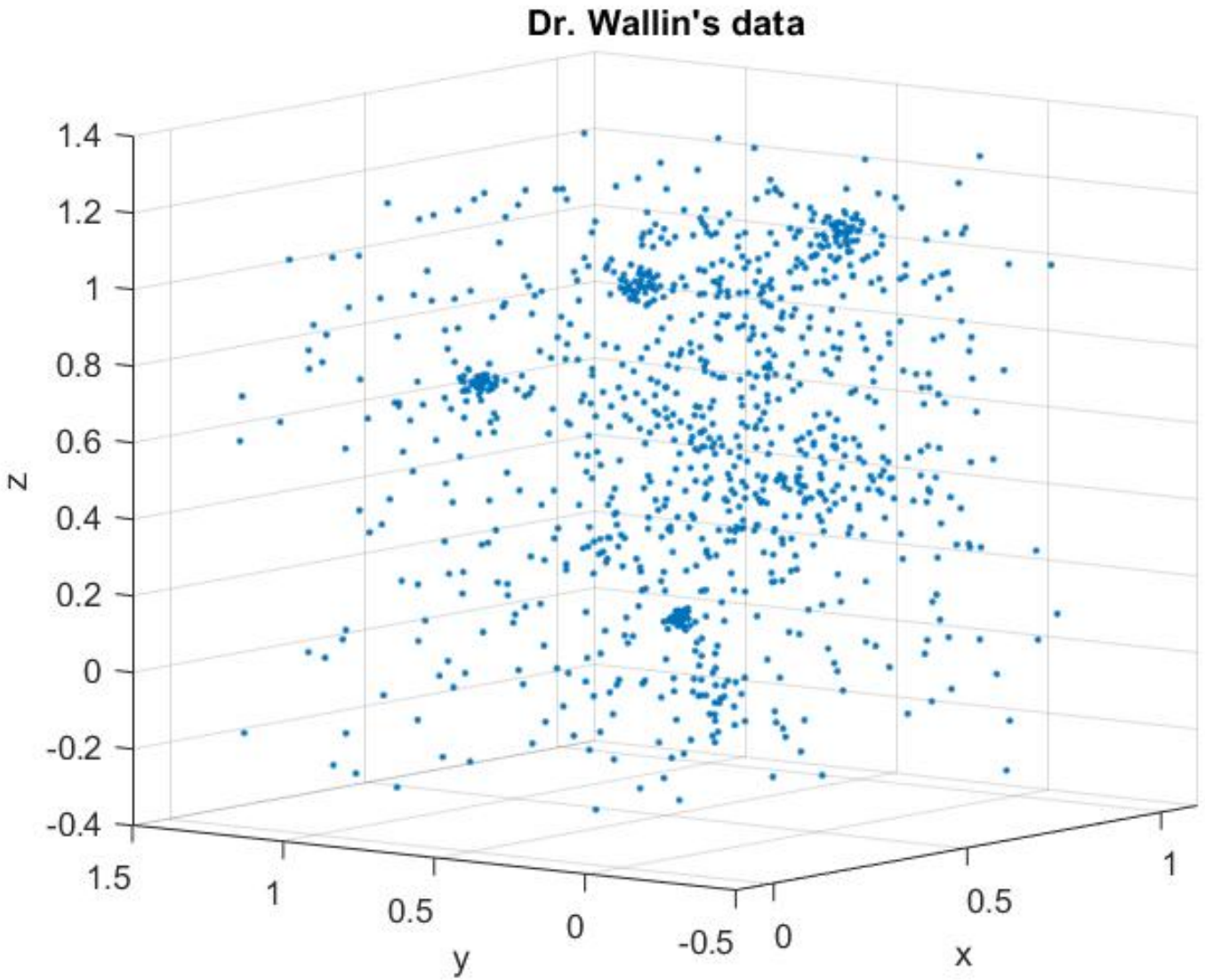

Figure 1: 1000 data points

The Algorithm

The Algorithm

XXX

- XXX
- XXX

XXX

- XXX
- XXX

Distributing/Importing Files

XXX

- XXX
- XXX

XXX

- XXX
- XXX

Sorting

We implemented Merge and Bubble Sort

XXX

- XXX
- XXX

XXX

- XXX
- XXX

Binning

Binary search

- Since the data is sorted, we can use a binary search to find where the bin edges lie in index space
- We can then subtract successive edges' indices to find the number of elements in that bin

xxx

- xxx
- xxx

Binning

Adapting the bins

for interior bin edges (endpoint bins stay constant):

$$\begin{aligned} \Delta C &= 2.0(c_i^n - c_{i-1}^n)/(c_i^n + c_{i-1}^n) \\ \Delta B &= b_{i+1}^n - b_i^n \\ b_i^{n+1} &= b_i^n + \alpha \Delta C \Delta B \end{aligned} \tag{1}$$

where $0 < \alpha < 0.5$ and $b_i^n < b_{i+1}^n$ for all n

Uniformity metric

$$U^n = \max\left(\frac{c_{\max} - c_{\text{avg}}}{c_{\text{avg}}}, \frac{c_{\text{avg}} - c_{\min}}{c_{\text{avg}}}\right) \tag{2}$$

Binning

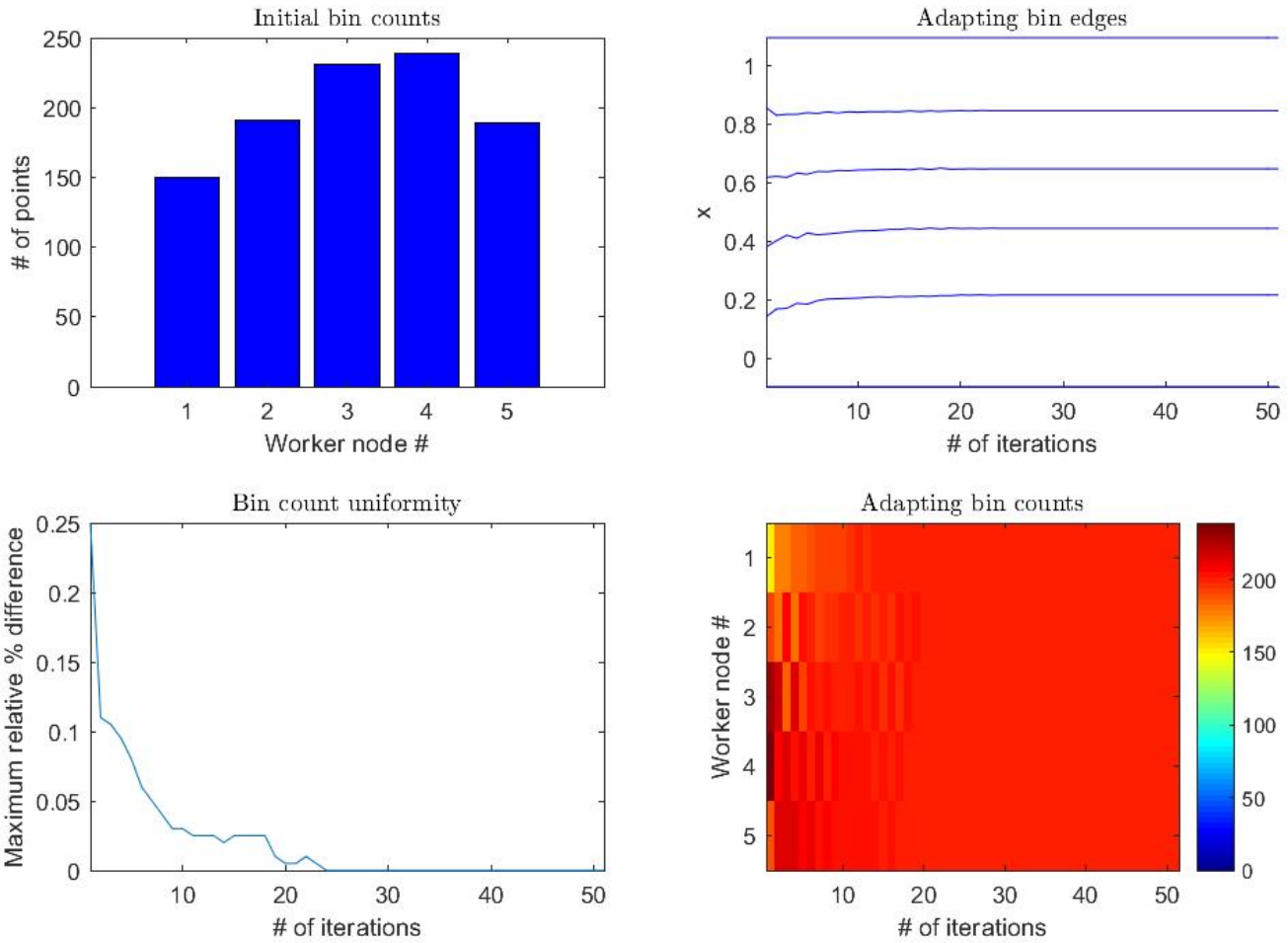

Figure 2: 5 nodes, 1000 data points, $\alpha = 0.475$

Binning

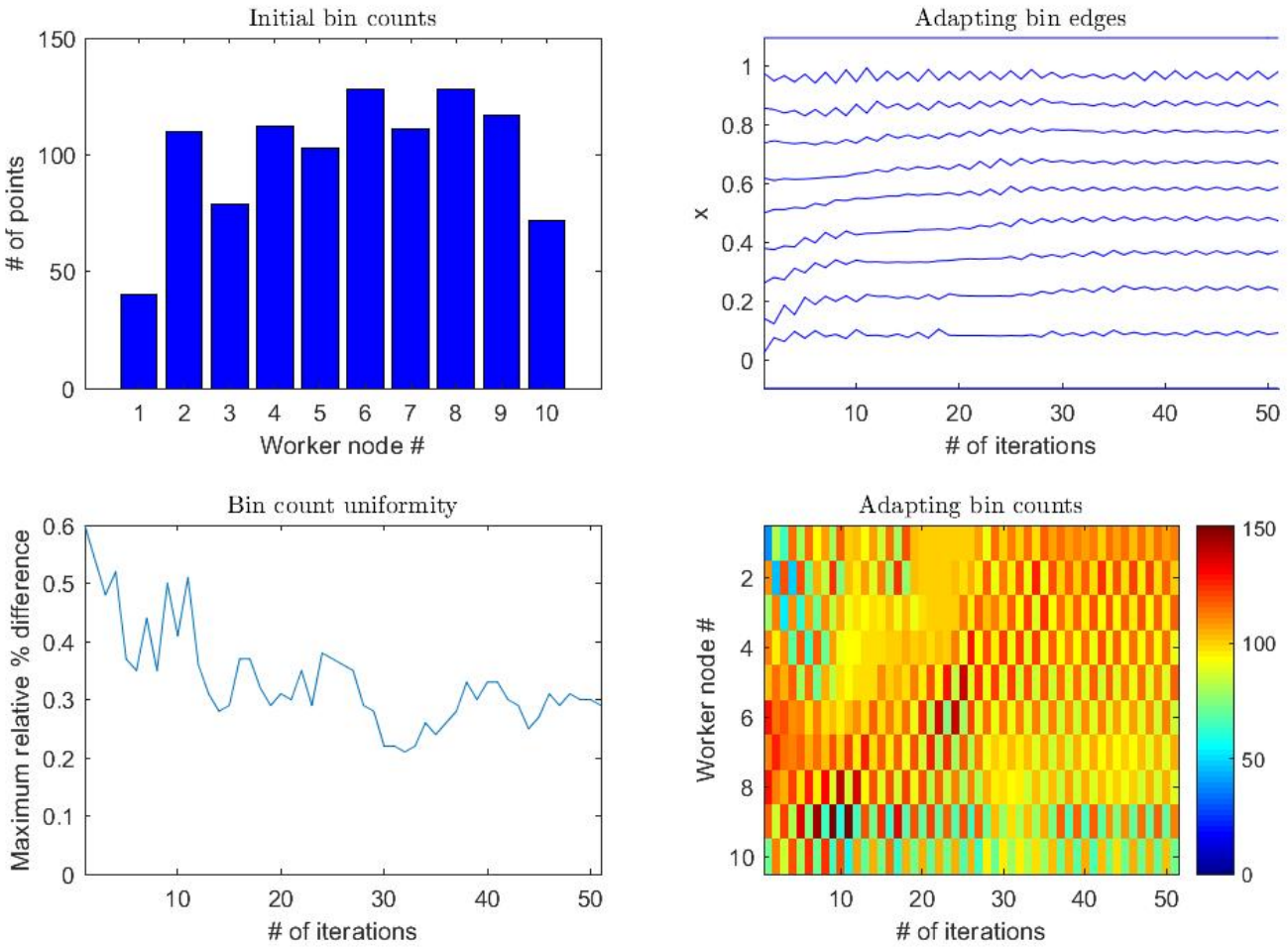

Figure 3: 10 nodes, 1000 data points, $\alpha = 0.475$

Binning

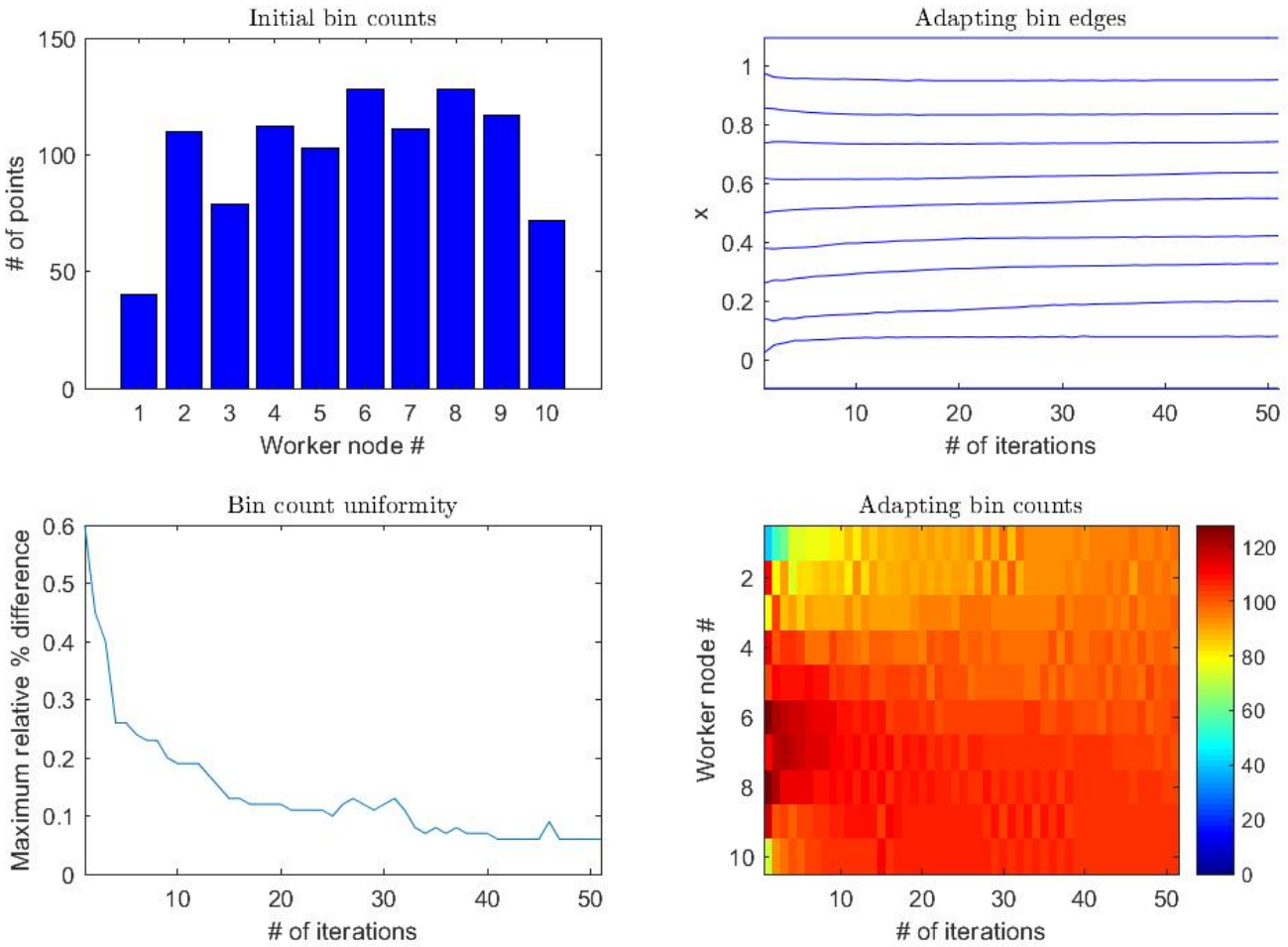

Figure 4: 10 nodes, 1000 data points, $\alpha = 0.25$

Exchanging data

XXX

- XXX
- XXX

XXX

- XXX
- XXX

Testing

Conclusions