

According to the experimental results and the chart, the time complexity of bubble sort is $O(n^2)$, that is, when the input size increases, the time consumption will increase quadratically. This can be clearly seen from the fact that the sorting time of 10,000 elements increased sharply to 7137 ms. When the amount of data is small, such as 10 or 1,000 elements, the time consumption is acceptable, but when the scale is expanded to 10,000, it shows great inefficiency.

The time complexity of merge sort is $O(n \log n)$, and its growth rate is relatively slow even if the input size increases. From the data, it can be seen that even when the input size is 10,000, the sorting time is only 19 ms. This shows that merge sort is more efficient when processing large-scale data.

So the following conclusion is drawn: bubble sort is suitable for small-scale data sets, but as the input size increases, the performance drops sharply. Merge sort can maintain high performance and efficiency regardless of small or large-scale data sets. Therefore, for scenarios that need to process large amounts of data, merge sort is significantly better than bubble sort.

