

# Merge-Tie-Judge: Low-Cost Preference Judgments with Ties

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## Background

Two rankings from system  $S_1$  and  $S_2$ :

$$S_1: d_3, d_1, d_2$$
$$S_2: d_5, d_4, d_2, d_1$$

Graded judgments on five documents:

$$d_1: 0, d_2: 1, d_3: 1, d_4: 1, d_5: 2$$

Preference judgments:

$$d_1 < d_2, d_1 < d_3, \dots, d_3 \sim d_4, d_3 < d_5, d_4 < d_5$$

A ground-truth document ranking:

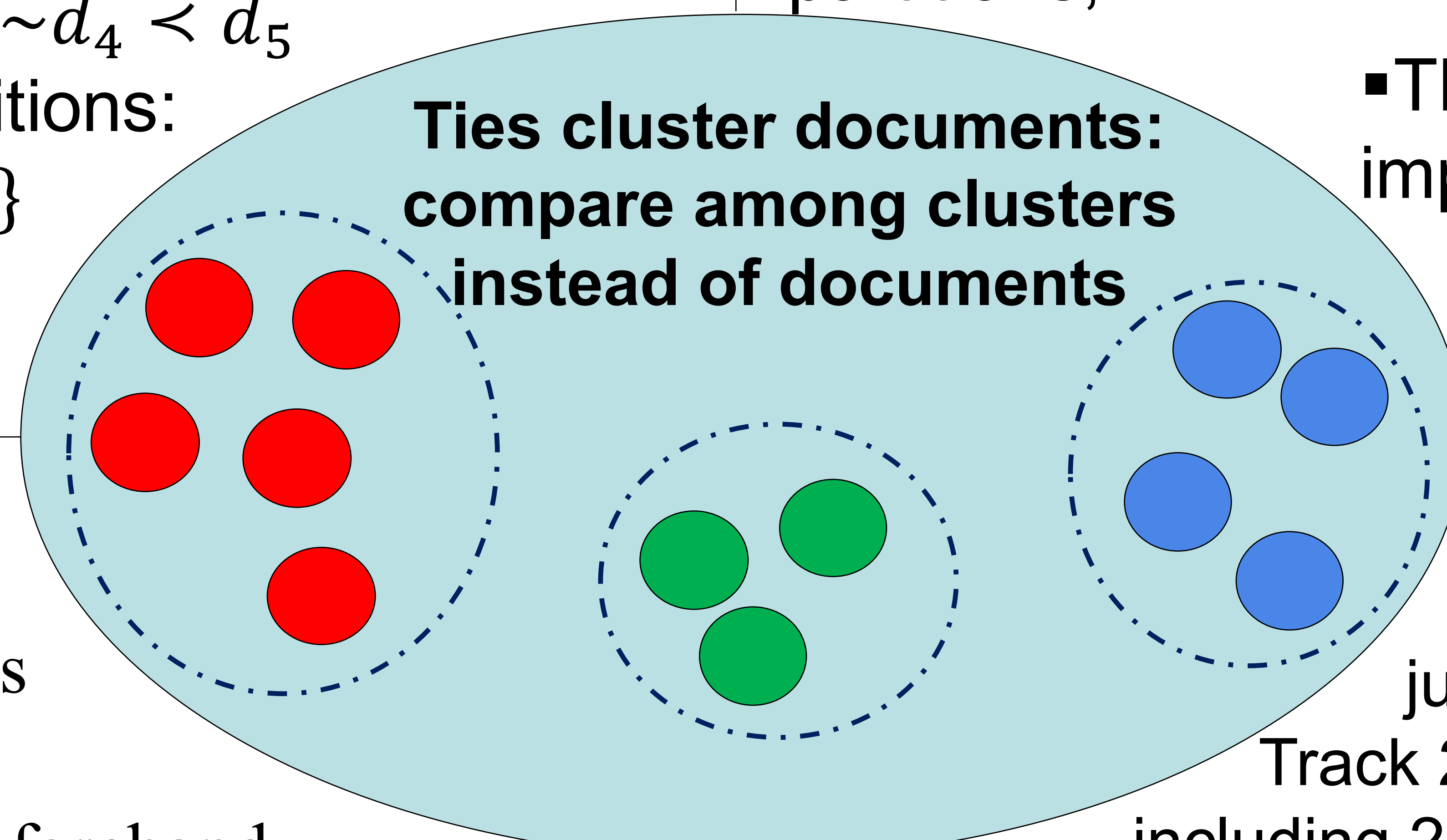
$$d_1 < d_2 \sim d_3 \sim d_4 < d_5$$

Represented as tie partitions:

$$\{d_1\} < \{d_2, d_3, d_4\} < \{d_5\}$$

## Motivation

- Preference judgments achieve better quality;
- Require  $O(N_d \log N_d)$  judgments, which are too expensive for practical usage;
- Theoretically, employing ties could reduce the number of judgments to  $O(2N_t \log N_t + N_d)$  [1] over  $N_d$  documents and  $N_t$  tie partitions;
- This work attempts to implement the finding.



## Results

### Merge-Tie-Judge

- $O(2N_t \log N_t + N_d)$  is achievable only when tie partitions are recognized beforehand
- Henceforth, prioritize the pairs that are more likely to be tied during judgments**

### Algorithm

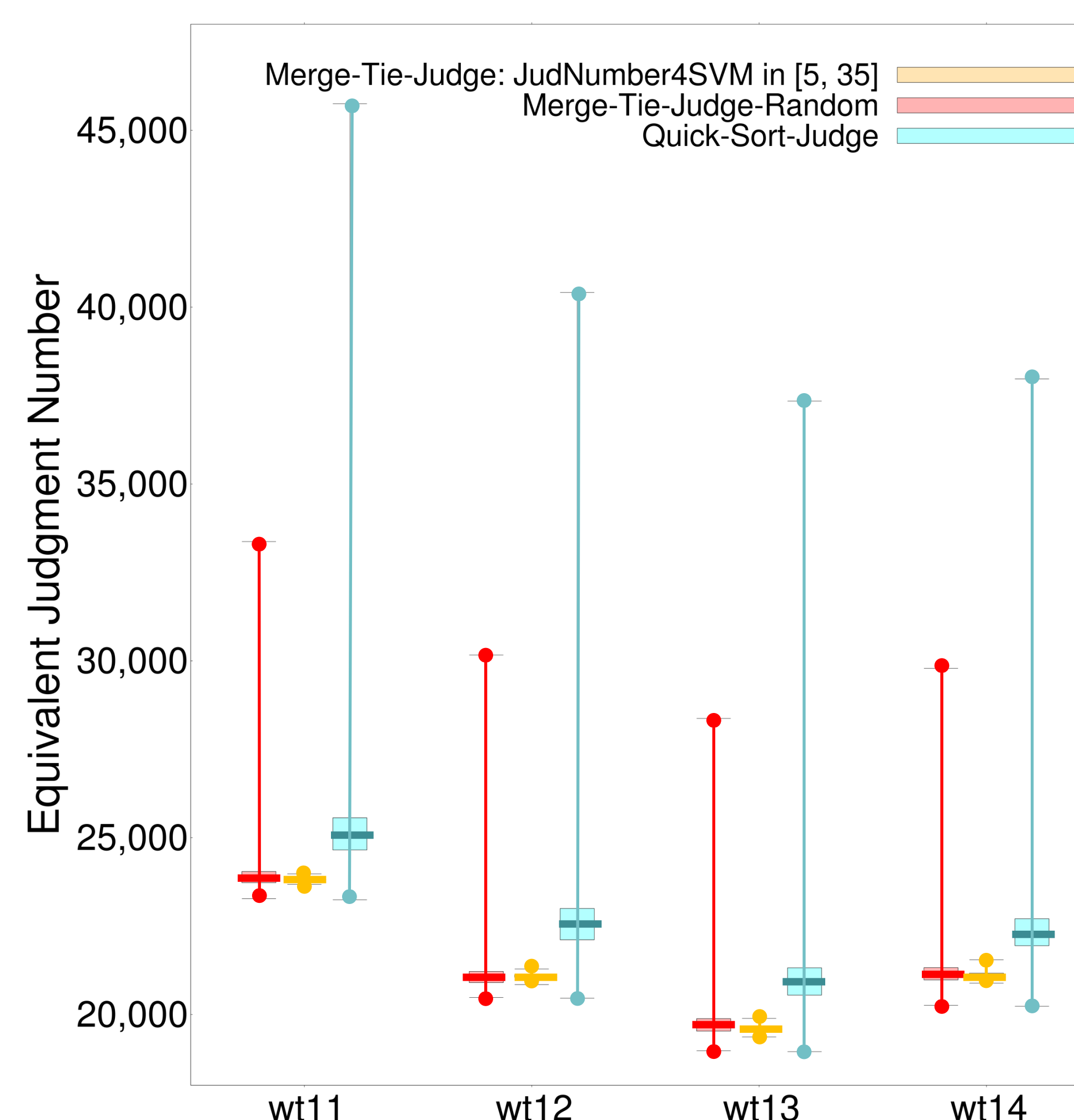
0.1) regard individual documents as tie partitions  $c_1, c_2, \dots, c_{N_d}$ ;  
0.2) initialization of the probability for two partitions being tied, denoted as  $\Pr_{tie}(c_i, c_j)$ , randomly or with ActiveSVM using document content;

While there exist unjudged pairs of partitions:

- pick up  $c_i$  and  $c_j$  that are most likely to be tied based on  $\Pr_{tie}(c_i, c_j)$ ;
  - manually judge the selected pairs;
- If the judged pair is tied:
- merge them to generate new partition;
  - update  $\Pr_{tie}(c_i, c_j)$  based on the manual judgments;

**Dataset:** graded judgments from TREC Web Track 2011–2014 for ad-hoc task including 200 queries.

### Number of judgments required to obtain the same ground truth.



- Merge-Tie-Judge significantly reduces the number of judgments (—&—);
- The usage of ActiveSVM further improve the robustness (—).

[1] Kai Hui and Klaus Berberich. Low-cost preference judgment via ties. In Proceedings of the 39th European Conference on IR Research on Advances in Information Retrieval, ECIR2017, 626-632.

