

# Ranking-based Fusion Algorithms for Extreme Multi-label Text Classification (XMTC)

Celso França  
celsofranca@dcc.ufmg.br  
Federal University of Minas Gerais  
Belo Horizonte, Brazil

Gestefane Rabbi  
gestefane@dcc.ufmg.br  
Federal University of Minas Gerais  
Belo Horizonte, Brazil

Thiago Salles  
tsalles@dcc.ufmg.br  
Federal University of Minas Gerais  
Belo Horizonte, Brazil

Washington Cunha  
washingtoncunha@dcc.ufmg.br  
Federal University of Minas Gerais  
Belo Horizonte, Brazil

Leonardo Rocha  
lrocha@ufs.br  
Federal University of São João del-Rei  
São João del-Rei, Brazil

Marcos André Gonçalves  
mgoncalv@dcc.ufmg.br  
Federal University of Minas Gerais  
Belo Horizonte, Brazil

## Abstract

In the context of Extreme Multi-label Text Classification (XMTC), where labels are assigned to text instances from a large label space, the long-tail distribution of labels presents a significant challenge. Labels can be broadly categorized into frequent, high-coverage **head labels** and infrequent, low-coverage **tail labels**, complicating the task of balancing effectiveness across all labels. To address this, combining predictions from multiple retrieval methods, such as sparse retrievers (e.g., BM25) and dense retrievers (e.g., fine-tuned BERT), offers a promising solution. The fusion of *sparse* and *dense* retrievers is motivated by the complementary ranking characteristics of these methods. Sparse retrievers compute relevance scores based on high-dimensional, bag-of-words representations, while dense retrievers utilize approximate nearest neighbor (ANN) algorithms on dense text and label embeddings within a shared embedding space. Rank-based fusion algorithms leverage these differences by combining the precise matching capabilities of sparse retrievers with the semantic richness of dense retrievers, thereby producing a final ranking that improves the effectiveness across both head and tail labels.

## CCS Concepts

• Information systems → Retrieval models and ranking.

## Keywords

Ranking Fusion Algorithms, Ranking Normalization Strategies

## 1 Introduction

Rank-based fusion algorithms [3] aim to assemble rankings from multiple retrieval systems to produce a unified and optimized final ranking. These algorithms perform under the assumption that aggregating evidence from diverse sources can enhance retrieval

effectiveness, emphasizing consensus and mitigating individual system weaknesses. Rank-based fusion is particularly effective when the strengths of different retrieval methods are complementary.

In the context of Extreme Multi-label Text Classification (XMTC), which involves assigning labels to text instances from an extremely large label space, the long-tail distribution of labels poses a significant challenge. Specifically, labels can be broadly categorized into frequent, high-coverage head labels and infrequent, low-coverage tail labels, making it challenging to balance effectiveness across all labels. Therefore, combining predictions from multiple retrieval methods, such as sparse retrievers (e.g., BM25) and dense retrievers (e.g., fine-tuned BERT), has proven effective. The fusion process enables improved label ranking by leveraging the complementary strengths of sparse and dense methods, ensuring better coverage of both head and tail labels while maintaining overall ranking quality.

## 2 Normalization Strategies

The first step in fusing the results from multiple retrieval systems using score-based fusion methods is score normalization. This step ensures that relevance scores, which can vary significantly across retrieval models, are comparable.

Normalization is crucial because different retrieval models compute relevance scores using diverse scales, intervals, and distributions. For instance, the classical probabilistic retrieval model BM25 [1] generates unbounded positive relevance scores. In contrast, modern deep learning-based retrieval systems, which rely on dot products or cosine similarity to compute relevance, often produce scores that are either unbounded or constrained within a fixed interval, such as  $[-1, 1]$ . To address these discrepancies, we leverage six normalization strategies: Min-Max Norm, Max Norm, Sum Norm, ZMUV Norm, Rank Norm, and Borda Norm [3, 4, 16].

**Min-Max Norm.** Min-Max Norm scales the ranking scores to the interval  $[0, 1]$ , where the minimum score is transformed to 0 and the maximum score is scaled to 1.

**Max Norm.** Max Norm set the maximum score in the ranking to 1 with all other scores scaled proportionally.

**Sum Norm.** Sum Norm adjusts ranking scores to ensure they are proportional and sum to 1. It achieves this by first shifting all scores such that the minimum score becomes 0. Then, the total sum of the adjusted scores is calculated, and each score is divided by this sum.

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than the author(s) must be honored. Abstracting with credit is permitted. To copy otherwise, to republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from [permissions@acm.org](mailto:permissions@acm.org).

Conference acronym 'XX, June 03–05, 2018, Woodstock, NY

© 2018 Copyright held by the owner/author(s). Publication rights licensed to ACM.

ACM ISBN 978-1-4503-XXXX-X/18/06

<https://doi.org/XXXXXXX.XXXXXXX>

**ZMUV Norm.** ZMUV Norm (Zero-Mean, Unit-Variance) normalizes ranking scores by transforming them into a standard normal distribution with a mean of 0 and a variance of 1. This is achieved by first calculating the mean and standard deviation of the scores. Each score is then adjusted by subtracting the mean and dividing by the standard deviation.

**Rank Norm.** Rank Norm normalizes ranking scores by assigning values based on their position in the ranked list. The top-ranked result is assigned a score of 1, while the bottom-ranked result gets a score of  $\frac{1}{N}$ , where  $N$  is the total number of results.

**Borda Norm.** Borda Norm normalizes ranking scores by assigning decreasing points to results based on their position in the ranking. The top position receives  $N - 1$  points, the next  $N - 2$ , and so on, down to 0 points for the last position. The scores are then normalized by dividing by  $N - 1$ .

### 3 Fusion Algorithms

We categorized the fusion algorithms into three categories: score-based methods [9], rank-based methods [14] and voting-based methods [2, 13].

#### 3.1 Score-Based Methods

**CombMIN.** CombMIN selects the minimum ranking score assigned to each document across different ranking sources. The primary rationale behind this method is to reduce the likelihood of non-relevant documents being ranked highly, as it prioritizes caution by relying on the least favorable assessment from the contributing systems.

**CombMAX.** CombMAX identifies the maximum ranking score assigned to each document across all retrieval results. This method ensures that relevant documents, even if highly ranked by only one retrieval system, are not overlooked due to poor performance by other systems.

**CombMED.** CombMED calculates the median ranking score for each document across all retrieval results. By using the median, this method provides a robust central tendency measure, mitigating the impact of extreme scores and ensuring a balanced evaluation of relevance.

**CombSUM.** CombSUM aggregates the ranking scores for each document by summing them across all retrieval systems. This straightforward approach assumes that higher cumulative scores correlate with higher relevance, thereby leveraging the collective contributions of multiple retrieval systems.

**CombANZ.** CombANZ refines CombSUM by normalizing the summed ranking scores with the number of non-zero scores for each document. This normalization ensures fairness by accounting for differences in the number of retrieval systems contributing to the document's score.

**CombMNZ.** CombMNZ builds upon CombSUM by multiplying the summed ranking score of each document by the count of non-zero scores. This method amplifies the influence of documents supported by multiple retrieval systems, highlighting consensus among diverse retrieval strategies.

#### 3.2 Rank-Based Methods

**ISR.** Information Synthesis Ranking (ISR) is a rank-based fusion method designed to aggregate evidence from multiple retrieval systems by assigning weights to documents proportional to their frequency of retrieval. The central assumption of ISR is that a document's relevance is positively correlated with the number of systems that identify it as relevant. By emphasizing consensus among systems, ISR aims to improve retrieval effectiveness by leveraging the collective agreement of diverse retrieval methods.

**Log-ISR.** Log-Information Synthesis Ranking (Log-ISR) extends ISR by incorporating a logarithmic transformation into the weighting process. Instead of assigning weights directly proportional to retrieval frequency, Log-ISR scales these weights logarithmically. This adjustment mitigates the dominance of documents retrieved with exceptionally high frequency while preserving the relative importance of consensus across systems. The logarithmic scaling promotes a more balanced ranking, preventing the overrepresentation of outliers while maintaining the robustness of the fusion process.

#### 3.3 Voting-Based Methods

**BordaFuse.** BordaFuse is a rank-based fusion method derived from the Borda count, a voting system commonly employed in decision-making and preference aggregation. In BordaFuse, each document is assigned a cumulative score based on its rank across multiple retrieval systems. Specifically, a document's position in each ranked list contributes a score inversely proportional to its rank (e.g., higher ranks receive higher scores). The final score is obtained by summing these contributions across all retrieval systems, with higher scores indicating greater consensus. This approach effectively integrates the rankings from diverse retrieval methods to produce a comprehensive and robust final ranking.

**Condorcet.** The Condorcet fusion method draws inspiration from the Condorcet voting principle, a cornerstone of social choice theory. It compares pairs of documents to determine which document is preferred over the other based on their relative rankings across multiple retrieval systems. Each pairwise comparison results in a "win" for the document ranked higher in the majority of systems. The final ranking is derived by aggregating these pairwise preferences, prioritizing documents with the highest overall wins. This method emphasizes relative ranking consensus, ensuring that documents consistently favored across systems are ranked higher in the final list.

### 4 Experimental Setup

To evaluate the effectiveness of the rank-based algorithms under the perspective of the three XMTC's challenges, we conducted extensive experiments leveraging the six normalization strategies outlined in Section 2 and the ten rank-based fusion algorithms detailed in Section 3.

These experiments were performed on four widely adopted and representative XMTC benchmarking datasets [10, 11, 18–20]: **Eurlerx-4K**, **Wiki10-31K**, **Amazon-670K**, and **AmazonCat-13K**. Table 1 summarizes the key statistics of these datasets, emphasizing

their diversity in scale and structure. For example, **AmazonCat-13K** contains millions of documents, while **Amazon-670K** includes hundreds of thousands of labels. This diversity enables a robust and comprehensive evaluation of our approach across various scenarios.

**Table 1: Dataset statistics. # of text instances (N); # of labels ( $\bar{L}$ ); Average # of relevant tail ( $\bar{t}$ ) and head ( $\bar{h}$ ) labels; and Average # of instances per label ( $\bar{n}$ ).**

Dataset	N	$\bar{L}$	$\bar{t}$	$\bar{h}$	$\bar{n}$
<b>Eurlex-4k</b>	19,314	3956	1.07	4.25	20.79
<b>Wiki10-31k</b>	20,762	30,938	3.66	15.1	8.52
<b>Amazon-670k</b>	643,474	670,091	2.56	2.83	3.99
<b>AmazonCat-13k</b>	1,493,021	13,330	0.3	4.75	448.57

A formal definition is adopted to categorize the labels into tail and head. Let  $\mathcal{T} = \{t_i, y_i\}_{i=1}^N$  be an XMTC dataset where the  $N$  labels follow a long-tail distribution. Suppose labels  $\{l_1, \dots, l_L\}$  are organized by frequencies in descending order. By setting a threshold  $h$ , frequently occurring labels  $\{l_1, \dots, l_h\}$  are referred to as head labels, while infrequent ones  $\{l_{h+1}, \dots, l_L\}$  as tail labels. The Pareto principle determines the threshold  $h$ , categorizing the 80% least frequent labels as tail and the remaining 20% as head.

For the sparse retriever, we set the main BM25 parameters at the retrieving stage as  $b=0.75$  and  $k=1.5$  [1]. Regarding the dense retriever, we fine-tune BERT to represent text and labels as embeddings into a shared vector space using the Normalized Temperature-Scaled Cross Entropy Loss [12] as a learning objective. We let the training occur until there is no learning, which often occurs by the third epoch. We set the learning rate between  $5e^{-3}$  and  $5e^{-5}$  through a cyclical learning rate policy [17]. For sparse and dense retrievers, we set the number of candidates to be 64 tail labels and 64 head labels for both retrievers, producing 128 candidates for the fusing stage.

To ensure our results' robustness and reproducibility, we adopt a 5-fold cross-validation approach across all datasets. This rigorous experimental setup guarantees the generality of our observations and serves as a benchmark standard, enabling fair comparisons across different methods [5, 15]. It also mitigates the risk of dataset-specific biases inherent in single train-test splits [6–8].

Effectiveness is evaluated using the *precision@k* and *nDCG@k*, averaged across the five test splits. Since the number of relevant labels (tail + head) per instance varies across datasets—from 6 for Amazon-670K and AmazonCat-13K, to 7 for Eurlex-4k, and up to 19 for Wiki10-31k—the average number of relevant labels is approximately 10. Therefore, evaluating ranking for  $k \in \{1, 5, 10\}$  better represents the evaluation benchmark.

Finally, we assess the statistical significance of our results by employing the two-sided paired Student's *t*-test with 95% confidence to compare the averaged results [5]. In addition, we make our source code, developed models, and data publicly available to ensure the reproducibility of our experiments and results.

## 5 Experimental Results

Tables 2, 3, 4, and 5 present the effectiveness of combining six normalization strategies with ten rank-based fusion algorithm base-lines, evaluated in terms of *nDCG@k* and *Precision@k* across the

four XMTC benchmark datasets. These results provide comprehensive insights into the performance of each combination on the **Eurlex-4K**, **Wiki10-31K**, **Amazon-670K**, and **AmazonCat-13K** datasets.

## 6 Conclusion

Employing the CombMNZ ranking-based fusion algorithm in conjunction with the ZMUV normalization strategy for fusing both dense and sparse rankings yielded the highest effectiveness across all datasets.

## Acknowledgments

This work was partially supported by CNPq, Capes, Fapemig, Fapesp, Google, AWS, and Instituto Nacional de Ciência e Tecnologia em Inteligência Artificial Responsável para Linguística Computacional, Tratamento e Disseminação de Informação (INCT-TILD-IAR).

## References

- [1] Arian Askari et al. 2023. Injecting the BM25 Score as Text Improves BERT-Based Re-rankers. In *ECIR* (Dublin, Ireland). Springer-Verlag, Berlin, Heidelberg, 66–83.
- [2] Javed A. Aslam and Mark H. Montague. 2001. Models for Metasearch. In *SIGIR 2001: Proceedings of the 24th Annual International ACM SIGIR Conference on Research and Development in Information Retrieval, September 9–13, 2001, New Orleans, Louisiana, USA*, W. Bruce Croft, David J. Harper, Donald H. Kraft, and Justin Zobel (Eds.). ACM, 275–284. <https://doi.org/10.1145/383952.384007>
- [3] Elias Bassani. 2023. ranxhub: An Online Repository for Information Retrieval Runs. In *SIGIR* (Taipei, Taiwan). ACM, New York, NY, USA, 3210–3214.
- [4] Elias Bassani and Luca Romelli. 2022. ranx.fuse: A Python Library for Metasearch. In *CIKM*. ACM, 4808–4812. <https://doi.org/10.1145/3511808.3557207>
- [5] Washington Cunha et al. 2023. An Effective, Efficient, and Scalable Confidence-Based Instance Selection Framework for Transformer-Based Text Classification. In *SIGIR* (Taipei, Taiwan). ACM, New York, NY, USA, 665–674.
- [6] Washington Cunha, Vitor Mangaravite, Christian Gomes, Sérgio Canuto, Elaine Resende, Cecilia Nascimento, Felipe Viegas, Celso França, Wellington Santos Martins, Jussara M Almeida, et al. 2021. On the cost-effectiveness of neural and non-neural approaches and representations for text classification: A comprehensive comparative study. *Information Processing & Management* 58, 3 (2021), 102481.
- [7] Washington Cunha, Alejandro Moreo, Andrea Esuli, Fabrizio Sebastiani, Leonardo Rocha, and Marcos André Gonçalves. 2024. A Noise-Oriented and Redundancy-Aware Instance Selection Framework. *ACM Transactions on Information Systems* (Nov. 2024).
- [8] Washington Cunha, Leonardo Rocha, and Marcos André Gonçalves. 2025. A thorough benchmark of automatic text classification: From traditional approaches to large language models. *arXiv preprint arXiv:2504.01930* (2025).
- [9] Edward A. Fox and Joseph A. Shaw. 1993. Combination of Multiple Searches. In *TREC (NIST Special Publication, Vol. 500-215)*. National Institute of Standards and Technology (NIST), 243–252.
- [10] Vedit Jain, Jatin Prakash, Deepak Saini, Jian Jiao, Ramachandran Ramjee, and Manik Varma. 2023. Renee: END-TO-END TRAINING OF EXTREME CLASSIFICATION MODELS. In *Proceedings of Machine Learning and Systems*, D. Song, M. Carbin, and T. Chen (Eds.), Vol. 5. Curran, 646–665.
- [11] Ting Jiang et al. 2021. Lightxml: Transformer with dynamic negative sampling for high-performance extreme multi-label text classification. In *AAAI*, Vol. 35. 7987–7994.
- [12] Jiajing Liu et al. 2023. A contrastive learning framework for safety information extraction in construction. *Advanced Engineering Informatics* 58 (2023), 102194.
- [13] Mark H. Montague and Javed A. Aslam. 2002. Condorcet fusion for improved retrieval. In *Proceedings of the 2002 ACM CIKM International Conference on Information and Knowledge Management*, McLean, VA, USA, November 4–9, 2002. ACM, 538–548. <https://doi.org/10.1145/584792.584881>
- [14] André Mourão, Flávio Martins, and João Magalhães. 2015. Multimodal medical information retrieval with unsupervised rank fusion. *Comput. Medical Imaging Graph.* 39 (2015), 35–45. <https://doi.org/10.1016/j.compmedimag.2014.05.006>
- [15] Andrea Pasin, Washington Cunha, Marcos André Gonçalves, and Nicola Ferro. 2024. A quantum annealing instance selection approach for efficient and effective transformer fine-tuning. In *Proceedings of the 2024 ACM SIGIR International Conference on Theory of Information Retrieval*. 205–214.
- [16] M. Elena Renda and Umberto Straccia. 2003. Web metasearch: rank vs. score based rank aggregation methods. In *Proceedings of the 2003 ACM Symposium on*

Table 2: nDCG@ $k$  and Precision@ $k$  of Normalization Strategies and Fusion Algorithms on Eurlex-4k.

Normalization	Algorithms	nDCG x 100						Precision x 100					
		Tail label			Head label			Tail label			Head label		
		@1	@5	@10	@1	@5	@10	@1	@5	@10	@1	@5	@10
Min-Max Norm	CombMNZ	50.1(1.3)	27.3(0.5)	27.0(0.4)	80.5(1.1)	62.8(0.5)	65.4(0.5)	50.1(1.3)	20.0(0.4)	11.6(0.2)	80.5(1.1)	53.5(0.3)	33.6(0.2)
Min-Max Norm	CombSUM	50.3(1.2)	27.8(0.5)	27.4(0.4)	80.5(1.1)	62.7(0.4)	65.6(0.5)	50.3(1.2)	20.5(0.4)	11.8(0.2)	80.5(1.1)	53.5(0.3)	33.7(0.3)
Min-Max Norm	CombMIN	32.8(1.6)	19.4(0.7)	20.1(0.6)	64.7(1.6)	48.8(1.2)	53.4(1.2)	32.8(1.6)	14.9(0.6)	9.4(0.3)	64.7(1.6)	41.5(1.0)	28.5(0.6)
Min-Max Norm	CombMAX	37.5(0.2)	24.6(0.4)	24.7(0.3)	56.9(1.1)	52.8(0.5)	58.2(0.6)	37.5(0.2)	19.4(0.4)	11.5(0.2)	56.9(1.1)	48.0(0.5)	32.6(0.3)
Min-Max Norm	CombMED	35.2(1.6)	22.6(0.7)	23.1(0.5)	66.3(1.6)	54.6(1.1)	59.2(0.9)	35.2(1.6)	17.9(0.5)	11.0(0.2)	66.3(1.6)	47.8(0.8)	32.0(0.4)
Min-Max Norm	CombANZ	35.2(1.6)	22.6(0.7)	23.1(0.5)	66.3(1.6)	54.6(1.1)	59.2(0.9)	35.2(1.6)	17.9(0.5)	11.0(0.2)	66.3(1.6)	47.8(0.8)	32.0(0.4)
Min-Max Norm	ISR	46.9(0.9)	26.7(0.4)	26.5(0.4)	76.0(1.1)	60.6(0.6)	64.3(0.6)	46.9(0.9)	20.2(0.4)	11.7(0.2)	76.0(1.1)	52.5(0.4)	34.0(0.2)
Min-Max Norm	Log_ISR	47.7(1.1)	26.1(0.4)	25.3(0.3)	76.4(1.1)	60.7(0.5)	63.7(0.6)	47.7(1.1)	19.2(0.4)	10.6(0.2)	76.4(1.1)	52.5(0.2)	33.2(0.2)
Min-Max Norm	BordaFuse	47.2(1.4)	26.1(0.6)	26.1(0.5)	77.3(0.8)	61.9(0.6)	64.6(0.6)	47.2(1.4)	19.2(0.4)	11.4(0.2)	77.3(0.8)	53.2(0.5)	33.4(0.3)
Min-Max Norm	Condorcet	38.3(1.0)	21.4(0.5)	21.5(0.5)	69.7(1.2)	54.4(0.7)	57.3(0.8)	38.3(1.0)	15.9(0.4)	9.5(0.3)	69.7(1.2)	46.3(0.6)	29.7(0.4)
ZMUV Norm	CombMNZ	51.5(1.7)	28.5(0.6)	28.0(0.6)	81.8(1.0)	64.6(0.7)	67.1(0.6)	51.5(1.7)	21.0(0.4)	12.1(0.3)	81.8(1.0)	55.2(0.5)	34.5(0.3)
ZMUV Norm	CombSUM	51.8(1.6)	28.2(0.7)	27.7(0.6)	82.3(0.9)	64.6(0.7)	66.7(0.8)	51.8(1.6)	20.6(0.5)	11.8(0.3)	82.3(0.9)	55.1(0.6)	34.0(0.4)
ZMUV Norm	CombMIN	27.1(2.2)	18.0(0.8)	18.8(0.6)	46.9(1.4)	45.9(1.1)	49.7(1.0)	27.1(2.2)	14.5(0.5)	9.2(0.2)	46.9(1.4)	42.0(0.9)	27.8(0.5)
ZMUV Norm	CombMAX	45.0(2.3)	26.0(0.8)	26.1(0.7)	79.4(1.5)	61.2(1.2)	64.6(1.0)	45.0(2.3)	19.7(0.7)	11.7(0.3)	79.4(1.5)	52.0(1.0)	33.4(0.4)
ZMUV Norm	CombMED	40.3(3.0)	23.7(0.9)	24.1(0.8)	76.4(1.3)	59.4(1.1)	62.4(1.0)	40.3(3.0)	18.1(0.6)	11.0(0.3)	76.4(1.3)	50.6(0.9)	32.2(0.4)
ZMUV Norm	CombANZ	40.3(3.0)	23.7(0.9)	24.1(0.8)	76.4(1.3)	59.4(1.1)	62.4(1.0)	40.3(3.0)	18.1(0.6)	11.0(0.3)	76.4(1.3)	50.6(0.9)	32.2(0.4)
ZMUV Norm	ISR	46.9(0.9)	26.7(0.4)	26.5(0.4)	76.0(1.1)	60.6(0.6)	64.3(0.6)	46.9(0.9)	20.2(0.4)	11.7(0.2)	76.0(1.1)	52.5(0.4)	34.0(0.2)
ZMUV Norm	Log_ISR	47.7(1.1)	26.1(0.4)	25.3(0.3)	76.4(1.1)	60.7(0.5)	63.7(0.6)	47.7(1.1)	19.2(0.4)	10.6(0.2)	76.4(1.1)	52.5(0.2)	33.2(0.2)
ZMUV Norm	BordaFuse	47.2(1.4)	26.1(0.6)	26.1(0.5)	77.3(0.8)	61.9(0.6)	64.6(0.6)	47.2(1.4)	19.2(0.4)	11.4(0.2)	77.3(0.8)	53.2(0.5)	33.4(0.3)
ZMUV Norm	Condorcet	38.3(1.0)	21.4(0.5)	21.5(0.5)	69.7(1.2)	54.4(0.7)	57.3(0.8)	38.3(1.0)	15.9(0.4)	9.5(0.3)	69.7(1.2)	46.3(0.6)	29.7(0.4)
Max Norm	CombMNZ	50.0(1.1)	26.9(0.4)	26.3(0.3)	81.1(1.0)	63.2(0.5)	65.4(0.5)	50.0(1.1)	19.5(0.3)	11.1(0.2)	81.1(1.0)	53.8(0.3)	33.4(0.2)
Max Norm	CombSUM	50.0(1.1)	26.9(0.4)	26.3(0.3)	81.1(1.0)	63.2(0.5)	65.4(0.5)	50.0(1.1)	19.5(0.3)	11.1(0.2)	81.1(1.0)	53.8(0.3)	33.4(0.2)
Max Norm	CombMIN	32.1(1.4)	18.8(0.7)	19.2(0.6)	64.4(1.8)	46.3(1.2)	50.3(1.1)	32.1(1.4)	14.3(0.6)	8.9(0.3)	64.4(1.8)	38.5(0.9)	26.3(0.4)
Max Norm	CombMAX	37.8(0.5)	24.5(0.4)	24.5(0.4)	57.0(0.9)	52.8(0.5)	57.8(0.5)	37.8(0.5)	19.3(0.4)	11.3(0.3)	57.0(0.9)	48.0(0.5)	32.3(0.3)
Max Norm	CombMED	34.8(1.7)	21.9(0.7)	22.2(0.5)	66.1(1.8)	52.8(0.9)	57.1(0.9)	34.8(1.7)	17.2(0.5)	10.4(0.2)	66.1(1.8)	45.7(0.6)	30.5(0.3)
Max Norm	CombANZ	34.8(1.7)	21.9(0.7)	22.2(0.5)	66.1(1.8)	52.8(0.9)	57.1(0.9)	34.8(1.7)	17.2(0.5)	10.4(0.2)	66.1(1.8)	45.7(0.6)	30.5(0.3)
Max Norm	ISR	46.9(0.9)	26.7(0.4)	26.5(0.4)	76.0(1.1)	60.6(0.6)	64.3(0.6)	46.9(0.9)	20.2(0.4)	11.7(0.2)	76.0(1.1)	52.5(0.4)	34.0(0.2)
Max Norm	Log_ISR	47.7(1.1)	26.1(0.4)	25.3(0.3)	76.4(1.1)	60.7(0.5)	63.7(0.6)	47.7(1.1)	19.2(0.4)	10.6(0.2)	76.4(1.1)	52.5(0.2)	33.2(0.2)
Max Norm	BordaFuse	47.2(1.4)	26.1(0.6)	26.1(0.5)	77.3(0.8)	61.9(0.6)	64.6(0.6)	47.2(1.4)	19.2(0.4)	11.4(0.2)	77.3(0.8)	53.2(0.5)	33.4(0.3)
Max Norm	Condorcet	38.3(1.0)	21.4(0.5)	21.5(0.5)	69.7(1.2)	54.4(0.7)	57.3(0.8)	38.3(1.0)	15.9(0.4)	9.5(0.3)	69.7(1.2)	46.3(0.6)	29.7(0.4)
Sum Norm	CombMNZ	48.8(1.0)	26.6(0.4)	26.0(0.3)	80.3(1.2)	62.4(0.6)	65.0(0.5)	48.8(1.0)	19.4(0.3)	11.1(0.2)	80.3(1.2)	53.2(0.3)	33.4(0.2)
Sum Norm	CombSUM	48.4(1.0)	26.2(0.3)	25.9(0.2)	80.4(1.2)	62.3(0.6)	65.1(0.6)	48.4(1.0)	19.1(0.3)	11.1(0.2)	80.4(1.2)	53.0(0.4)	33.4(0.3)
Sum Norm	CombMIN	16.3(1.0)	13.9(0.6)	15.8(0.5)	56.5(2.1)	47.1(1.3)	52.2(1.4)	16.3(1.0)	12.2(0.5)	8.8(0.3)	56.5(2.1)	41.2(1.1)	28.7(0.6)
Sum Norm	CombMAX	39.4(0.5)	23.3(0.1)	23.6(0.1)	67.0(1.6)	55.1(0.8)	59.7(0.8)	39.4(0.5)	17.8(0.2)	10.9(0.1)	67.0(1.6)	48.2(0.6)	32.2(0.3)
Sum Norm	CombMED	32.1(1.0)	21.4(0.3)	22.0(0.4)	65.6(2.1)	55.1(1.1)	59.5(1.0)	32.1(1.0)	17.2(0.2)	10.7(0.2)	65.6(2.1)	48.3(0.8)	32.2(0.4)
Sum Norm	CombANZ	32.1(1.0)	21.4(0.3)	22.0(0.4)	65.6(2.1)	55.1(1.1)	59.5(1.0)	32.1(1.0)	17.2(0.2)	10.7(0.2)	65.6(2.1)	48.3(0.8)	32.2(0.4)
Sum Norm	ISR	46.9(0.9)	26.7(0.4)	26.5(0.4)	76.0(1.1)	60.6(0.6)	64.3(0.6)	46.9(0.9)	20.2(0.4)	11.7(0.2)	76.0(1.1)	52.5(0.4)	34.0(0.2)
Sum Norm	Log_ISR	47.7(1.1)	26.1(0.4)	25.3(0.3)	76.4(1.1)	60.7(0.5)	63.7(0.6)	47.7(1.1)	19.2(0.4)	10.6(0.2)	76.4(1.1)	52.5(0.2)	33.2(0.2)
Sum Norm	BordaFuse	47.2(1.4)	26.1(0.6)	26.1(0.5)	77.3(0.8)	61.9(0.6)	64.6(0.6)	47.2(1.4)	19.2(0.4)	11.4(0.2)	77.3(0.8)	53.2(0.5)	33.4(0.3)
Sum Norm	Condorcet	38.3(1.0)	21.4(0.5)	21.5(0.5)	69.7(1.2)	54.4(0.7)	57.3(0.8)	38.3(1.0)	15.9(0.4)	9.5(0.3)	69.7(1.2)	46.3(0.6)	29.7(0.4)
Rank Norm	CombMNZ	46.2(0.7)	25.7(0.3)	25.6(0.4)	73.1(0.6)	59.6(0.4)	62.7(0.4)	46.2(0.7)	19.1(0.2)	11.2(0.2)	73.1(0.6)	51.7(0.4)	32.9(0.1)
Rank Norm	CombSUM	46.3(0.7)	25.9(0.3)	26.1(0.4)	73.1(0.6)	59.6(0.5)	62.9(0.4)	46.3(0.7)	19.3(0.2)	11.6(0.2)	73.1(0.6)	51.7(0.4)	33.1(0.2)
Rank Norm	CombMIN	29.2(1.4)	17.6(0.6)	18.5(0.6)	59.3(1.5)	43.0(1.0)	47.2(0.9)	29.2(1.4)	13.8(0.5)	9.0(0.2)	59.3(1.5)	35.8(0.9)	24.8(0.3)
Rank Norm	CombMAX	36.7(0.5)	24.5(0.5)	24.8(0.5)	58.6(0.9)	57.2(0.7)	60.7(0.8)	36.7(0.5)	19.2(0.6)	11.6(0.3)	58.6(0.9)	51.2(0.7)	32.9(0.5)
Rank Norm	CombMED	31.4(1.4)	19.8(0.7)	20.6(0.6)	63.3(1.2)	49.8(1.0)	53.7(1.0)	31.4(1.4)	15.6(0.5)	9.9(0.2)	63.3(1.2)	42.6(0.8)	28.5(0.4)
Rank Norm	CombANZ	31.4(1.4)	19.8(0.7)	20.6(0.6)	63.3(1.2)	49.8(1.0)	53.7(1.0)	31.4(1.4)	15.6(0.5)	9.9(0.2)	63.3(1.2)	42.6(0.8)	28.5(0.4)
Rank Norm	ISR	46.9(0.9)	26.7(0.4)	26.5(0.4)	76.0(1.1)	60.6(0.6)	64.3(0.6)	46.9(0.9)	20.2(0.4)	11.7(0.2)	76.0(1.1)	52.5(0.4)	34.0(0.2)
Rank Norm	Log_ISR	47.7(1.1)	26.1(0.4)	25.3(0.3)	76.4(1.1)	60.7(0.5)	63.7(0.6)	47.7(1.1)	19.2(0.4)	10.6(0.2)	76.4(1.1)	52.5(0.2)	33.2(0.2)
Rank Norm	BordaFuse	47.2(1.4)	26.1(0.6)	26.1(0.5)	77.3(0.8)	61.9(0.6)	64.6(0.6)	47.2(1.4)	19.2(0.4)	11.4(0.2)	77.3(0.8)	53.2(0.5)	33.4(0.3)
Rank Norm	Condorcet	38.3(1.0)	21.4(0.5)	21.5(0.5)	69.7(1.2)	54.4(0.7)	57.3(0.8)	38.3(1.0)	15.9(0.4)	9.5(0.3)	69.7(1.2)	46.3(0.6)	29.7(0.4)
Borda Norm	CombMNZ	47.0(1.6)	26.1(0.6)	26.1(0.5)	78.0(1.1)	62.0(0.7)	64.7(0.6)	47.0(1.6)	19.2(0.4)	11.4(0.2)	78.0(1.1)	53.2(0.5)	33.4(0.3)
Borda Norm	CombSUM	47.0(1.6)	26.1(0.6)	26.1(0.5)	78.0(1.1)	62.0(0.7)	64.7(0.6)	47.0(1.6)	19.2(0.4)	11.4(0.2)	78.0(1.1)	53.2(0.5)	33.4(0.3)
Borda Norm	CombMIN	45.9(2.1)	25.1(0.6)	24.6(0.6)	77.0(0.5)	60.6(0.6)	63.3(0.6)	45.9(2.1)	18.4(0.4)	10.4(0.2)	77.0(0.5)	51.7(0.5)	32.7(0.3)
Borda Norm	CombMAX	39.3(0.9)	25.2(0.5)	25.1(0.4)	68.3(0.8)	58.3(0.6)	62.3(0.6)	39.3(0.9)	19.7(0.4)	11.5(0.3)	68.3(0.8)	51.2(0.5)	33.4(0.3)
Borda Norm	CombMED	47.0(1.6)	26.1(0.6)	26.1(0.5)	78.0(1.1)	62.0(0.7)	64.7(0.6)	47.0(1.6)	19.2(0.4)	11.4(0.2)	78.0(1.1)	53.2(0.5)	33.4(0.3)
Borda Norm	CombANZ	47.0(1.6)	26.1(0.6)	26.1(0.5)	78.0(1.1)	62.0(0.7)	64.7(0.6)	47.0(1.6)	19.2(0.4)	11.4(0.2)	78.0(1.1)	53.2(0.5)	33.4(0.3)
Borda Norm	ISR	1.3(0.5)	1.4(0.2)	2.0(0.2)	4.0(0.2)	3.7(0.3)	5.7(0.3)	1.3(0.5)	1.3(0.1)	1.3(0.1)	4.0(0.2)	3.6(0.3)	4.0(0.2)
Borda Norm	Log_ISR	1.3(0.5)	1.4(0.2)	2.0(0.2)	4.0(0.2)	3.7(0.3)	5.7(0.3)	1.3(0.5)	1.3(0.1)	1.3(0.1)	4.0(0.2)	3.6(0.3)	4.0(0.2)
Borda Norm	BordaFuse	1.3(0.5)	1.4(0.2)	2.0(0.2)	4.0(0.2)	3.7(0.3)	5.7(0.3)	1.3(0.5)	1.3(0.1)	1.3(0.1)	4.0(0.2)	3.6(0.3)	4.0(0.2)
Borda Norm	Condorcet	1.3(0.5)	1.4(0.2)	2.0(0.2)	4.0(0.2)	3.7(0.3)	5.7(0.3)	1.3(0.5)	1.3(0.1)	1.3(0.1)	4.0(0.2)	3.6(0.3)	4.0(0.2)

Applied Computing (Melbourne, Florida) (SAC '03). Association for Computing Machinery, New York, NY, USA, 841–846.

- [17] Wei Wei et al. 2022. Contrastive Meta Learning with Behavior Multiplicity for Recommendation. In *WSDM*. ACM, New York, NY, USA, 9 pages.

- [18] Hui Ye, Rajshekhar Sunderraman, and Shihao Ji. 2024. MatchXML: An Efficient Text-Label Matching Framework for Extreme Multi-Label Text Classification. *IEEE Transactions on Knowledge and Data Engineering* 36, 9 (2024), 4781–4793.

- [19] Ronghui You et al. 2019. AttentionXML: Label Tree-based Attention-Aware Deep Model for High-Performance Extreme Multi-Label Text Classification. In *NeurIPS*.

**Table 3: nDCG@k and Precision@k of Normalization Strategies and Fusion Algorithms on Wiki10-31k.**

Normalization	Algorithms	nDCG x 100						Precision x 100					
		Tail label			Head label			Tail label			Head label		
		@1	@5	@10	@1	@5	@10	@1	@5	@10	@1	@5	@10
Min-Max Norm	CombMNZ	48.0(0.9)	26.5(0.4)	26.2(0.5)	80.2(1.4)	62.6(1.2)	65.2(1.0)	48.0(0.9)	19.5(0.3)	11.3(0.3)	80.2(1.4)	53.4(1.1)	33.5(0.5)
Min-Max Norm	CombSUM	48.2(1.1)	26.8(0.7)	26.4(0.7)	80.1(1.4)	62.6(1.1)	65.4(1.1)	48.2(1.1)	19.9(0.5)	11.4(0.3)	80.1(1.4)	53.4(1.1)	33.6(0.6)
Min-Max Norm	CombMIN	33.5(3.0)	19.5(1.6)	20.0(1.6)	65.2(2.9)	49.5(2.5)	53.9(2.5)	33.5(3.0)	14.9(1.2)	9.4(0.6)	65.2(2.9)	42.1(2.3)	28.7(1.2)
Min-Max Norm	CombMAX	37.6(0.7)	24.0(0.8)	24.1(0.7)	57.0(1.2)	52.8(0.8)	58.0(0.9)	37.6(0.7)	18.9(0.7)	11.2(0.4)	57.0(1.2)	48.0(0.8)	32.5(0.5)
Min-Max Norm	CombMED	35.6(3.2)	22.3(1.4)	22.8(1.3)	66.8(2.7)	55.1(1.9)	59.5(1.8)	35.6(3.2)	17.5(0.9)	10.8(0.4)	66.8(2.7)	48.2(1.7)	32.0(0.7)
Min-Max Norm	CombANZ	35.6(3.2)	22.3(1.4)	22.8(1.3)	66.8(2.7)	55.1(1.9)	59.5(1.8)	35.6(3.2)	17.5(0.9)	10.8(0.4)	66.8(2.7)	48.2(1.7)	32.0(0.7)
Min-Max Norm	ISR	45.7(2.2)	25.9(1.0)	25.7(1.0)	75.7(2.1)	60.3(1.7)	64.1(1.5)	45.7(2.2)	19.6(0.7)	11.4(0.4)	75.7(2.1)	52.3(1.6)	33.9(0.7)
Min-Max Norm	Log_ISR	46.0(1.3)	25.5(0.5)	24.8(0.6)	76.1(2.2)	60.5(1.4)	63.5(1.2)	46.0(1.3)	18.8(0.4)	10.5(0.2)	76.1(2.2)	52.2(1.3)	33.2(0.5)
Min-Max Norm	BordaFuse	45.4(1.2)	25.3(0.8)	25.3(0.8)	76.8(1.5)	61.6(1.4)	64.3(1.3)	45.4(1.2)	18.8(0.6)	11.1(0.4)	76.8(1.5)	53.0(1.3)	33.4(0.7)
Min-Max Norm	Condorcet	37.9(2.1)	21.2(1.1)	21.3(1.0)	69.4(2.6)	54.5(1.8)	57.4(1.8)	37.9(2.1)	15.8(0.8)	9.4(0.4)	69.4(2.6)	46.6(1.6)	29.8(0.9)
ZMUV Norm	CombMNZ	49.1(1.6)	27.4(0.9)	27.0(0.9)	81.2(1.5)	64.2(1.6)	66.9(1.4)	49.1(1.6)	20.3(0.8)	11.7(0.4)	81.2(1.5)	54.9(1.5)	34.4(0.6)
ZMUV Norm	CombSUM	49.5(2.9)	27.2(1.4)	26.8(1.3)	81.8(1.7)	64.3(1.9)	66.6(1.7)	49.5(2.9)	20.0(1.1)	11.5(0.5)	81.8(1.7)	54.9(1.8)	34.0(0.8)
ZMUV Norm	CombMIN	27.9(3.9)	18.3(1.8)	18.9(1.7)	49.0(4.8)	47.2(3.4)	50.6(2.9)	27.9(3.9)	14.7(1.2)	9.2(0.6)	49.0(4.8)	42.9(2.8)	28.0(1.1)
ZMUV Norm	CombMAX	43.6(4.2)	25.3(1.8)	25.3(1.7)	79.0(3.0)	61.3(2.9)	64.6(2.3)	43.6(4.2)	19.2(1.1)	11.4(0.5)	79.0(3.0)	52.2(2.7)	33.4(0.9)
ZMUV Norm	CombMED	40.2(4.5)	23.4(1.9)	23.8(1.8)	76.6(3.4)	59.9(3.0)	62.6(2.5)	40.2(4.5)	17.8(1.2)	10.9(0.5)	76.6(3.4)	51.0(2.7)	32.3(1.1)
ZMUV Norm	CombANZ	40.2(4.5)	23.4(1.9)	23.8(1.8)	76.6(3.4)	59.9(3.0)	62.6(2.5)	40.2(4.5)	17.8(1.2)	10.9(0.5)	76.6(3.4)	51.0(2.7)	32.3(1.1)
ZMUV Norm	ISR	45.7(2.2)	25.9(1.0)	25.7(1.0)	75.7(2.1)	60.3(1.7)	64.1(1.5)	45.7(2.2)	19.6(0.7)	11.4(0.4)	75.7(2.1)	52.3(1.6)	33.9(0.7)
ZMUV Norm	Log_ISR	46.0(1.3)	25.5(0.5)	24.8(0.6)	76.1(2.2)	60.5(1.4)	63.5(1.2)	46.0(1.3)	18.8(0.4)	10.5(0.2)	76.1(2.2)	52.2(1.3)	33.2(0.5)
ZMUV Norm	BordaFuse	45.4(1.2)	25.3(0.8)	25.3(0.8)	76.8(1.5)	61.6(1.4)	64.3(1.3)	45.4(1.2)	18.8(0.6)	11.1(0.4)	76.8(1.5)	53.0(1.3)	33.4(0.7)
ZMUV Norm	Condorcet	37.9(2.1)	21.2(1.1)	21.3(1.0)	69.4(2.6)	54.5(1.8)	57.4(1.8)	37.9(2.1)	15.8(0.8)	9.4(0.4)	69.4(2.6)	46.6(1.6)	29.8(0.9)
Max Norm	CombMNZ	48.1(1.5)	26.2(0.4)	25.6(0.5)	80.6(1.2)	63.0(1.1)	65.2(0.9)	48.1(1.5)	19.2(0.3)	10.9(0.2)	80.6(1.2)	53.6(1.0)	33.3(0.4)
Max Norm	CombSUM	48.1(1.5)	26.2(0.4)	25.6(0.5)	80.6(1.2)	63.0(1.1)	65.2(0.9)	48.1(1.5)	19.2(0.3)	10.9(0.2)	80.6(1.2)	53.6(1.0)	33.3(0.4)
Max Norm	CombMIN	32.8(3.2)	18.9(1.6)	19.2(1.5)	64.8(3.2)	46.9(3.0)	50.7(3.0)	32.8(3.2)	14.4(1.2)	8.8(0.6)	64.8(3.2)	39.1(2.8)	26.4(1.6)
Max Norm	CombMAX	37.4(1.0)	24.0(0.9)	24.0(0.9)	56.9(1.2)	52.7(0.9)	57.6(1.0)	37.4(1.0)	18.7(0.7)	11.0(0.4)	56.9(1.2)	47.9(0.8)	32.2(0.6)
Max Norm	CombMED	35.2(3.4)	21.7(1.4)	22.0(1.3)	66.6(2.7)	53.2(2.3)	57.3(2.0)	35.2(3.4)	16.9(0.8)	10.2(0.3)	66.6(2.7)	46.0(2.0)	30.5(0.9)
Max Norm	CombANZ	35.2(3.4)	21.7(1.4)	22.0(1.3)	66.6(2.7)	53.2(2.3)	57.3(2.0)	35.2(3.4)	16.9(0.8)	10.2(0.3)	66.6(2.7)	46.0(2.0)	30.5(0.9)
Max Norm	ISR	45.7(2.2)	25.9(1.0)	25.7(1.0)	75.7(2.1)	60.3(1.7)	64.1(1.5)	45.7(2.2)	19.6(0.7)	11.4(0.4)	75.7(2.1)	52.3(1.6)	33.9(0.7)
Max Norm	Log_ISR	46.0(1.3)	25.5(0.5)	24.8(0.6)	76.1(2.2)	60.5(1.4)	63.5(1.2)	46.0(1.3)	18.8(0.4)	10.5(0.2)	76.1(2.2)	52.2(1.3)	33.2(0.5)
Max Norm	BordaFuse	45.4(1.2)	25.3(0.8)	25.3(0.8)	76.8(1.5)	61.6(1.4)	64.3(1.3)	45.4(1.2)	18.8(0.6)	11.1(0.4)	76.8(1.5)	53.0(1.3)	33.4(0.7)
Max Norm	Condorcet	37.9(2.1)	21.2(1.1)	21.3(1.0)	69.4(2.6)	54.5(1.8)	57.4(1.8)	37.9(2.1)	15.8(0.8)	9.4(0.4)	69.4(2.6)	46.6(1.6)	29.8(0.9)
Sum Norm	CombMNZ	47.5(1.2)	26.0(0.4)	25.5(0.4)	80.1(1.3)	62.3(1.1)	64.9(1.0)	47.5(1.2)	19.1(0.2)	10.9(0.2)	80.1(1.3)	53.0(1.1)	33.3(0.5)
Sum Norm	CombSUM	47.2(1.2)	25.7(0.4)	25.4(0.5)	80.1(1.3)	62.2(1.2)	65.0(1.1)	47.2(1.2)	18.9(0.3)	10.9(0.2)	80.1(1.3)	52.9(1.1)	33.4(0.6)
Sum Norm	CombMIN	18.3(2.4)	14.9(1.3)	16.5(1.3)	58.5(3.5)	48.5(2.8)	53.3(2.8)	18.3(2.4)	13.0(1.0)	8.9(0.6)	58.5(3.5)	42.3(2.4)	29.0(1.4)
Sum Norm	CombMAX	39.0(0.7)	23.0(0.2)	23.3(0.2)	67.3(1.8)	55.3(1.0)	59.8(1.1)	39.0(0.7)	17.6(0.2)	10.7(0.2)	67.3(1.8)	48.3(0.9)	32.3(0.5)
Sum Norm	CombMED	33.0(1.8)	21.5(0.6)	22.0(0.7)	66.5(3.3)	55.7(1.9)	59.9(1.8)	33.0(1.8)	17.1(0.3)	10.5(0.3)	66.5(3.3)	48.7(1.5)	32.2(0.7)
Sum Norm	CombANZ	33.0(1.8)	21.5(0.6)	22.0(0.7)	66.5(3.3)	55.7(1.9)	59.9(1.8)	33.0(1.8)	17.1(0.3)	10.5(0.3)	66.5(3.3)	48.7(1.5)	32.2(0.7)
Sum Norm	ISR	45.7(2.2)	25.9(1.0)	25.7(1.0)	75.7(2.1)	60.3(1.7)	64.1(1.5)	45.7(2.2)	19.6(0.7)	11.4(0.4)	75.7(2.1)	52.3(1.6)	33.9(0.7)
Sum Norm	Log_ISR	46.0(1.3)	25.5(0.5)	24.8(0.6)	76.1(2.2)	60.5(1.4)	63.5(1.2)	46.0(1.3)	18.8(0.4)	10.5(0.2)	76.1(2.2)	52.2(1.3)	33.2(0.5)
Sum Norm	BordaFuse	45.4(1.2)	25.3(0.8)	25.3(0.8)	76.8(1.5)	61.6(1.4)	64.3(1.3)	45.4(1.2)	18.8(0.6)	11.1(0.4)	76.8(1.5)	53.0(1.3)	33.4(0.7)
Sum Norm	Condorcet	37.9(2.1)	21.2(1.1)	21.3(1.0)	69.4(2.6)	54.5(1.8)	57.4(1.8)	37.9(2.1)	15.8(0.8)	9.4(0.4)	69.4(2.6)	46.6(1.6)	29.8(0.9)
Rank Norm	CombMNZ	44.4(0.6)	25.1(0.4)	24.9(0.5)	72.4(1.6)	59.3(0.9)	62.5(0.9)	44.4(0.6)	18.7(0.4)	10.9(0.2)	72.4(1.6)	51.5(0.9)	32.9(0.4)
Rank Norm	CombSUM	44.4(0.6)	25.2(0.5)	25.3(0.6)	72.4(1.6)	59.3(0.9)	62.6(0.9)	44.4(0.6)	18.8(0.5)	11.2(0.3)	72.4(1.6)	51.5(0.9)	33.0(0.5)
Rank Norm	CombMIN	30.0(3.1)	17.7(1.6)	18.5(1.5)	59.7(3.6)	43.6(2.5)	47.6(2.3)	30.0(3.1)	13.8(1.2)	8.9(0.6)	59.7(3.6)	36.2(2.0)	25.0(1.0)
Rank Norm	CombMAX	36.9(0.5)	24.0(1.2)	24.3(1.1)	58.5(1.4)	57.3(2.4)	60.7(2.0)	36.9(0.5)	18.7(1.2)	11.3(0.6)	58.5(1.4)	51.4(2.6)	32.9(1.1)
Rank Norm	CombMED	32.1(3.0)	19.9(1.6)	20.5(1.5)	63.2(3.2)	50.3(2.4)	54.0(2.2)	32.1(3.0)	15.6(1.2)	9.8(0.5)	63.2(3.2)	43.1(2.2)	28.6(1.0)
Rank Norm	CombANZ	32.1(3.0)	19.9(1.6)	20.5(1.5)	63.2(3.2)	50.3(2.4)	54.0(2.2)	32.1(3.0)	15.6(1.2)	9.8(0.5)	63.2(3.2)	43.1(2.2)	28.6(1.0)
Rank Norm	ISR	45.7(2.2)	25.9(1.0)	25.7(1.0)	75.7(2.1)	60.3(1.7)	64.1(1.5)	45.7(2.2)	19.6(0.7)	11.4(0.4)	75.7(2.1)	52.3(1.6)	33.9(0.7)
Rank Norm	Log_ISR	46.0(1.3)	25.5(0.5)	24.8(0.6)	76.1(2.2)	60.5(1.4)	63.5(1.2)	46.0(1.3)	18.8(0.4)	10.5(0.2)	76.1(2.2)	52.2(1.3)	33.2(0.5)
Rank Norm	BordaFuse	45.4(1.2)	25.3(0.8)	25.3(0.8)	76.8(1.5)	61.6(1.4)	64.3(1.3)	45.4(1.2)	18.8(0.6)	11.1(0.4)	76.8(1.5)	53.0(1.3)	33.4(0.7)
Rank Norm	Condorcet	37.9(2.1)	21.2(1.1)	21.3(1.0)	69.4(2.6)	54.5(1.8)	57.4(1.8)	37.9(2.1)	15.8(0.8)	9.4(0.4)	69.4(2.6)	46.6(1.6)	29.8(0.9)
Borda Norm	CombMNZ	45.5(1.3)	25.3(0.7)	25.3(0.9)	77.6(1.6)	61.7(1.4)	64.5(1.4)	45.5(1.3)	18.8(0.6)	11.1(0.4)	77.6(1.6)	52.9(1.4)	33.4(0.7)
Borda Norm	CombSUM	45.5(1.3)	25.3(0.7)	25.3(0.9)	77.6(1.6)	61.7(1.4)	64.5(1.4)	45.5(1.3)	18.8(0.6)	11.1(0.4)	77.6(1.6)	52.9(1.4)	33.4(0.7)
Borda Norm	CombMIN	44.3(1.3)	24.5(0.7)	24.1(0.7)	76.6(1.3)	60.3(1.4)	63.2(1.4)	44.3(1.3)	18.1(0.6)	10.3(0.3)	76.6(1.3)	51.5(1.4)	32.7(0.7)
Borda Norm	CombMAX	39.2(2.3)	24.6(1.1)	24.6(1.1)	67.7(2.0)	58.2(1.8)	62.2(1.6)	39.2(2.3)	19.1(0.8)	11.3(0.4)	67.7(2.0)	51.2(1.7)	33.4(0.7)
Borda Norm	CombMED	45.5(1.3)	25.3(0.7)	25.3(0.9)	77.6(1.6)	61.7(1.4)	64.5(1.4)	45.5(1.3)	18.8(0.6)	11.1(0.4)	77.6(1.6)	52.9(1.4)	33.4(0.7)
Borda Norm	CombANZ	45.5(1.3)	25.3(0.7)	25.3(0.9)	77.6(1.6)	61.7(1.4)	64.5(1.4)	45.5(1.3)	18.8(0.6)	11.1(0.4)	77.6(1.6)	52.9(1.4)	33.4(0.7)
Borda Norm	ISR	1.4(0.4)	1.4(0.2)	2.0(0.2)	4.1(0.3)	3.8(0.2)	5.8(0.3)	1.4(0.4)	1.3(0.1)	1.3(0.1)	4.1(0.3)	3.7(0.2)	4.1(0.2)
Borda Norm	Log_ISR	1.4(0.4)	1.4(0.2)	2.0(0.2)	4.1(0.3)	3.8(0.2)	5.8(0.3)	1.4(0.4)	1.3(0.1)	1.3(0.1)	4.1(0.3)	3.7(0.2)	4.1(0.2)
Borda Norm	BordaFuse	1.4(0.4)	1.4(0.2)	2.0(0.2)	4.1(0.3)	3.8(0.2)	5.8(0.3)	1.4(0.4)	1.3(0.1)	1.3(0.1)	4.1(0.3)	3.7(0.2)	4.1(0.2)
Borda Norm	Condorcet	1.4(0.4)	1.4(0.2)	2.0(0.2)	4.1(0.3)	3.8(0.2)	5.8(0.3)	1.4(0.4)	1.3(0.1)	1.3(0.1)	4.1(0.3)	3.7(0.2)	4.1(0.2)

Table 4: nDCG@k and Precision@k of Normalization Strategies and Fusion Algorithms on Amazon-670k.

Normalization	Algorithms	nDCG x 100						Precision x 100					
		Tail label			Head label			Tail label			Head label		
		@1	@5	@10	@1	@5	@10	@1	@5	@10	@1	@5	@10
Min-Max Norm	CombMNZ	43.5(0.2)	34.2(0.1)	33.7(0.1)	45.4(0.2)	36.6(0.1)	37.0(0.1)	43.5(0.2)	28.5(0.1)	17.3(0.0)	45.4(0.2)	32.4(0.1)	21.1(0.0)
Min-Max Norm	CombSUM	43.4(0.1)	33.7(0.1)	33.2(0.1)	45.3(0.2)	36.5(0.1)	36.8(0.1)	43.4(0.1)	27.8(0.1)	16.9(0.1)	45.3(0.2)	32.2(0.1)	20.9(0.0)
Min-Max Norm	CombMIN	25.5(0.2)	21.4(0.2)	22.8(0.1)	32.0(0.1)	25.2(0.1)	26.4(0.1)	25.5(0.2)	18.4(0.1)	12.8(0.1)	32.0(0.1)	22.2(0.1)	15.4(0.1)
Min-Max Norm	CombMAX	28.4(0.1)	27.2(0.1)	28.2(0.1)	36.3(0.1)	32.8(0.1)	33.8(0.1)	28.4(0.1)	24.2(0.1)	16.0(0.1)	36.3(0.1)	30.1(0.1)	20.0(0.1)
Min-Max Norm	CombMED	26.0(0.2)	23.9(0.1)	25.6(0.1)	33.9(0.2)	29.6(0.1)	31.3(0.1)	26.0(0.2)	21.3(0.1)	14.9(0.1)	33.9(0.2)	27.0(0.1)	18.9(0.1)
Min-Max Norm	CombANZ	26.0(0.2)	23.9(0.1)	25.6(0.1)	33.9(0.2)	29.6(0.1)	31.3(0.1)	26.0(0.2)	21.3(0.1)	14.9(0.1)	33.9(0.2)	27.0(0.1)	18.9(0.1)
Min-Max Norm	ISR	43.7(0.2)	32.7(0.1)	32.9(0.1)	43.4(0.1)	34.2(0.1)	35.5(0.1)	43.7(0.2)	27.2(0.1)	17.2(0.1)	43.4(0.1)	30.4(0.1)	20.7(0.0)
Min-Max Norm	Log_ISR	42.7(0.2)	32.9(0.1)	31.9(0.1)	43.6(0.1)	34.9(0.1)	35.3(0.1)	42.7(0.2)	27.3(0.1)	16.1(0.1)	43.6(0.1)	30.9(0.1)	20.2(0.1)
Min-Max Norm	BordaFuse	42.4(0.1)	33.7(0.1)	33.5(0.1)	44.0(0.1)	35.1(0.1)	35.6(0.1)	42.4(0.1)	28.2(0.1)	17.4(0.1)	44.0(0.1)	31.0(0.1)	20.2(0.1)
Min-Max Norm	Condorcet	36.7(0.2)	27.4(0.1)	26.8(0.1)	38.7(0.2)	29.6(0.2)	29.8(0.1)	36.7(0.2)	22.4(0.1)	13.6(0.1)	38.7(0.2)	25.7(0.1)	16.7(0.1)
ZMUV Norm	CombMNZ	<b>47.3(0.1)</b>	<b>36.0(0.1)</b>	<b>35.1(0.1)</b>	<b>46.4(0.2)</b>	<b>37.0(0.1)</b>	<b>37.4(0.1)</b>	<b>47.3(0.1)</b>	<b>29.6(0.1)</b>	<b>17.7(0.0)</b>	<b>46.4(0.2)</b>	<b>32.7(0.2)</b>	<b>21.2(0.1)</b>
ZMUV Norm	CombSUM	<b>48.0(0.2)</b>	35.5(0.1)	34.6(0.1)	<b>46.1(0.2)</b>	36.5(0.1)	36.8(0.1)	<b>48.0(0.2)</b>	28.9(0.1)	17.3(0.1)	<b>46.1(0.2)</b>	32.1(0.1)	20.8(0.0)
ZMUV Norm	CombMIN	31.7(0.1)	25.3(0.1)	25.9(0.1)	32.7(0.2)	27.1(0.1)	27.9(0.1)	31.7(0.1)	21.3(0.1)	14.0(0.1)	32.7(0.2)	24.1(0.1)	16.3(0.1)
ZMUV Norm	CombMAX	46.4(0.2)	34.1(0.1)	33.7(0.1)	42.6(0.2)	34.4(0.1)	35.4(0.1)	46.4(0.2)	27.8(0.1)	17.1(0.0)	42.6(0.2)	30.6(0.1)	20.4(0.1)
ZMUV Norm	CombMED	43.4(0.3)	31.4(0.1)	31.5(0.1)	41.1(0.2)	32.6(0.1)	33.6(0.1)	43.4(0.3)	25.5(0.1)	16.2(0.1)	41.1(0.2)	28.8(0.1)	19.4(0.1)
ZMUV Norm	CombANZ	43.4(0.3)	31.4(0.1)	31.5(0.1)	41.1(0.2)	32.6(0.1)	33.6(0.1)	43.4(0.3)	25.5(0.1)	16.2(0.1)	41.1(0.2)	28.8(0.1)	19.4(0.1)
ZMUV Norm	ISR	43.7(0.2)	32.7(0.1)	32.9(0.1)	43.4(0.1)	34.2(0.1)	35.5(0.1)	43.7(0.2)	27.2(0.1)	17.2(0.1)	43.4(0.1)	30.4(0.1)	20.7(0.0)
ZMUV Norm	Log_ISR	42.7(0.2)	32.9(0.1)	31.9(0.1)	43.6(0.1)	34.9(0.1)	35.3(0.1)	42.7(0.2)	27.3(0.1)	16.1(0.1)	43.6(0.1)	30.9(0.1)	20.2(0.1)
ZMUV Norm	BordaFuse	42.4(0.1)	33.7(0.1)	33.5(0.1)	44.0(0.1)	35.1(0.1)	35.6(0.1)	42.4(0.1)	28.2(0.1)	17.4(0.1)	44.0(0.1)	31.0(0.1)	20.2(0.1)
ZMUV Norm	Condorcet	36.7(0.2)	27.4(0.1)	26.8(0.1)	38.7(0.2)	29.6(0.2)	29.8(0.1)	36.7(0.2)	22.4(0.1)	13.6(0.1)	38.7(0.2)	25.7(0.1)	16.7(0.1)
Max Norm	CombMNZ	43.4(0.2)	33.9(0.1)	33.3(0.0)	45.3(0.2)	36.4(0.1)	36.6(0.1)	43.4(0.2)	28.2(0.1)	17.0(0.1)	45.3(0.2)	32.1(0.1)	20.8(0.1)
Max Norm	CombSUM	43.4(0.2)	33.9(0.1)	33.3(0.1)	45.3(0.2)	36.4(0.1)	36.7(0.1)	43.4(0.2)	28.2(0.1)	17.1(0.1)	45.3(0.2)	32.2(0.1)	20.8(0.1)
Max Norm	CombMIN	25.0(0.2)	21.2(0.2)	22.2(0.2)	33.0(0.1)	26.1(0.1)	26.9(0.1)	25.0(0.2)	18.3(0.1)	12.4(0.1)	33.0(0.1)	23.0(0.1)	15.5(0.1)
Max Norm	CombMAX	28.3(0.1)	27.1(0.1)	28.1(0.1)	36.3(0.2)	32.8(0.1)	33.7(0.1)	28.3(0.1)	24.1(0.1)	15.9(0.0)	36.3(0.2)	30.1(0.2)	19.9(0.1)
Max Norm	CombMED	25.5(0.2)	23.5(0.1)	24.9(0.1)	34.1(0.2)	29.6(0.1)	30.9(0.1)	25.5(0.2)	21.0(0.1)	14.3(0.1)	34.1(0.2)	27.0(0.1)	18.3(0.1)
Max Norm	CombANZ	25.5(0.2)	23.5(0.1)	24.9(0.1)	34.1(0.2)	29.6(0.1)	30.9(0.1)	25.5(0.2)	21.0(0.1)	14.3(0.1)	34.1(0.2)	27.0(0.1)	18.3(0.1)
Max Norm	ISR	43.7(0.2)	32.7(0.1)	32.9(0.1)	43.4(0.1)	34.2(0.1)	35.5(0.1)	43.7(0.2)	27.2(0.1)	17.2(0.1)	43.4(0.1)	30.4(0.1)	20.7(0.0)
Max Norm	Log_ISR	42.7(0.2)	32.9(0.1)	31.9(0.1)	43.6(0.1)	34.9(0.1)	35.3(0.1)	42.7(0.2)	27.3(0.1)	16.1(0.1)	43.6(0.1)	30.9(0.1)	20.2(0.1)
Max Norm	BordaFuse	42.4(0.1)	33.7(0.1)	33.5(0.1)	44.0(0.1)	35.1(0.1)	35.6(0.1)	42.4(0.1)	28.2(0.1)	17.4(0.1)	44.0(0.1)	31.0(0.1)	20.2(0.1)
Max Norm	Condorcet	36.7(0.2)	27.4(0.1)	26.8(0.1)	38.7(0.2)	29.6(0.2)	29.8(0.1)	36.7(0.2)	22.4(0.1)	13.6(0.1)	38.7(0.2)	25.7(0.1)	16.7(0.1)
Sum Norm	CombMNZ	45.7(0.1)	35.2(0.1)	34.5(0.0)	<b>46.2(0.1)</b>	<b>37.2(0.1)</b>	<b>37.5(0.1)</b>	45.7(0.1)	29.1(0.1)	17.5(0.1)	<b>46.2(0.1)</b>	<b>32.9(0.1)</b>	<b>21.3(0.1)</b>
Sum Norm	CombSUM	46.5(0.1)	34.9(0.1)	34.2(0.1)	<b>46.2(0.1)</b>	36.9(0.1)	37.2(0.1)	46.5(0.1)	28.6(0.1)	17.3(0.1)	<b>46.2(0.1)</b>	32.6(0.1)	21.1(0.0)
Sum Norm	CombMIN	27.2(0.3)	23.2(0.2)	24.3(0.1)	31.2(0.2)	25.8(0.2)	26.9(0.1)	27.2(0.3)	20.0(0.1)	13.7(0.1)	31.2(0.2)	23.0(0.1)	15.8(0.1)
Sum Norm	CombMAX	42.3(0.1)	31.9(0.1)	32.0(0.1)	42.3(0.2)	34.9(0.1)	35.5(0.1)	42.3(0.1)	26.4(0.1)	16.7(0.1)	42.3(0.2)	31.3(0.1)	20.4(0.1)
Sum Norm	CombMED	36.5(0.3)	28.7(0.2)	29.4(0.2)	38.5(0.2)	32.3(0.1)	33.4(0.1)	36.5(0.3)	24.2(0.1)	15.9(0.1)	38.5(0.2)	29.1(0.1)	19.5(0.1)
Sum Norm	CombANZ	36.5(0.3)	28.7(0.2)	29.4(0.2)	38.5(0.2)	32.3(0.1)	33.4(0.1)	36.5(0.3)	24.2(0.1)	15.9(0.1)	38.5(0.2)	29.1(0.1)	19.5(0.1)
Sum Norm	ISR	43.7(0.2)	32.7(0.1)	32.9(0.1)	43.4(0.1)	34.2(0.1)	35.5(0.1)	43.7(0.2)	27.2(0.1)	17.2(0.1)	43.4(0.1)	30.4(0.1)	20.7(0.0)
Sum Norm	Log_ISR	42.7(0.2)	32.9(0.1)	31.9(0.1)	43.6(0.1)	34.9(0.1)	35.3(0.1)	42.7(0.2)	27.3(0.1)	16.1(0.1)	43.6(0.1)	30.9(0.1)	20.2(0.1)
Sum Norm	BordaFuse	42.4(0.1)	33.7(0.1)	33.5(0.1)	44.0(0.1)	35.1(0.1)	35.6(0.1)	42.4(0.1)	28.2(0.1)	17.4(0.1)	44.0(0.1)	31.0(0.1)	20.2(0.1)
Sum Norm	Condorcet	36.7(0.2)	27.4(0.1)	26.8(0.1)	38.7(0.2)	29.6(0.2)	29.8(0.1)	36.7(0.2)	22.4(0.1)	13.6(0.1)	38.7(0.2)	25.7(0.1)	16.7(0.1)
Rank Norm	CombMNZ	42.0(0.1)	33.4(0.1)	33.2(0.0)	43.8(0.1)	35.3(0.1)	35.9(0.1)	42.0(0.1)	27.9(0.1)	17.3(0.0)	43.8(0.1)	31.3(0.1)	20.5(0.1)
Rank Norm	CombSUM	42.1(0.2)	33.6(0.1)	33.5(0.1)	43.9(0.1)	35.4(0.1)	36.1(0.1)	42.1(0.2)	28.1(0.1)	17.5(0.1)	43.9(0.1)	31.4(0.1)	20.7(0.1)
Rank Norm	CombMIN	30.9(0.2)	23.9(0.1)	24.8(0.1)	33.0(0.1)	25.9(0.1)	26.9(0.1)	30.9(0.2)	20.1(0.1)	13.5(0.1)	33.0(0.1)	22.7(0.1)	15.6(0.1)
Rank Norm	CombMAX	31.5(0.1)	30.5(0.1)	31.0(0.1)	36.3(0.1)	32.0(0.1)	33.6(0.1)	31.5(0.1)	26.7(0.1)	17.0(0.1)	36.3(0.1)	28.8(0.1)	20.0(0.1)
Rank Norm	CombMED	32.2(0.2)	26.0(0.1)	26.7(0.1)	34.7(0.1)	28.1(0.1)	29.2(0.1)	32.2(0.2)	22.2(0.1)	14.6(0.1)	34.7(0.1)	25.0(0.1)	17.1(0.1)
Rank Norm	CombANZ	32.2(0.2)	26.0(0.1)	26.7(0.1)	34.7(0.1)	28.1(0.1)	29.2(0.1)	32.2(0.2)	22.2(0.1)	14.6(0.1)	34.7(0.1)	25.0(0.1)	17.1(0.1)
Rank Norm	ISR	43.7(0.2)	32.7(0.1)	32.9(0.1)	43.4(0.1)	34.2(0.1)	35.5(0.1)	43.7(0.2)	27.2(0.1)	17.2(0.1)	43.4(0.1)	30.4(0.1)	20.7(0.0)
Rank Norm	Log_ISR	42.7(0.2)	32.9(0.1)	31.9(0.1)	43.6(0.1)	34.9(0.1)	35.3(0.1)	42.7(0.2)	27.3(0.1)	16.1(0.1)	43.6(0.1)	30.9(0.1)	20.2(0.1)
Rank Norm	BordaFuse	42.4(0.1)	33.7(0.1)	33.5(0.1)	44.0(0.1)	35.1(0.1)	35.6(0.1)	42.4(0.1)	28.2(0.1)	17.4(0.1)	44.0(0.1)	31.0(0.1)	20.2(0.1)
Rank Norm	Condorcet	36.7(0.2)	27.4(0.1)	26.8(0.1)	38.7(0.2)	29.6(0.2)	29.8(0.1)	36.7(0.2)	22.4(0.1)	13.6(0.1)	38.7(0.2)	25.7(0.1)	16.7(0.1)
Borda Norm	CombMNZ	42.5(0.2)	33.8(0.1)	33.5(0.1)	44.0(0.1)	35.1(0.1)	35.6(0.2)	42.5(0.2)	28.2(0.1)	17.4(0.1)	44.0(0.1)	30.9(0.2)	20.2(0.1)
Borda Norm	CombSUM	42.5(0.2)	33.8(0.1)	33.5(0.1)	44.0(0.1)	35.1(0.1)	35.6(0.2)	42.5(0.2)	28.2(0.1)	17.4(0.1)	44.0(0.1)	30.9(0.2)	20.2(0.1)
Borda Norm	CombMIN	40.9(0.1)	31.9(0.1)	31.1(0.1)	43.0(0.1)	33.9(0.1)	34.0(0.2)	40.9(0.1)	26.5(0.1)	15.8(0.1)	43.0(0.1)	29.7(0.1)	19.2(0.1)
Borda Norm	CombMAX	36.9(0.1)	30.8(0.1)	31.3(0.1)	38.4(0.2)	32.9(0.1)	34.3(0.1)	36.9(0.1)	26.1(0.1)	16.8(0.1)	38.4(0.2)	29.6(0.1)	20.3(0.1)
Borda Norm	CombMED	42.5(0.2)	33.8(0.1)	33.5(0.1)	44.0(0.1)	35.1(0.1)	35.6(0.2)	42.5(0.2)	28.2(0.1)	17.4(0.1)	44.0(0.1)	30.9(0.2)	20.2(0.1)
Borda Norm	CombANZ	42.5(0.2)	33.8(0.1)	33.5(0.1)	44.0(0.1)	35.1(0.1)	35.6(0.2)	42.5(0.2)	28.2(0.1)	17.4(0.1)	44.0(0.1)	30.9(0.2)	20.2(0.1)
Borda Norm	ISR	1.7(0.0)	1.7(0.0)	2.3(0.0)	2.4(0.1)	2.2(0.1)	3.0(0.1)	1.7(0.0)	1.6(0.0)	1.5(0.1)	2.4(0.1)	2.2(0.1)	2.1(0.0)
Borda Norm	Log_ISR	1.7(0.0)	1.7(0.0)	2.3(0.0)	2.4(0.1)	2.2(0.1)	3.0(0.1)	1.7(0.0)	1.6(0.0)	1.5(0.1)	2.4(0.1)	2.2(0.1)	2.1(0.0)
Borda Norm	BordaFuse	1.7(0.0)	1.7(0.0)	2.3(0.0)	2.4(0.1)	2.2(0.1)	3.0(0.1)	1.7(0.0)	1.6(0.0)	1.5(0.1)	2.4(0.1)	2.2(0.1)	2.1(0.0)
Borda Norm	Condorcet	1.7(0.0)	1.7(0.0)	2.3(0.0)	2.4(0.1)	2.2(0.1)	3.0(0.1)	1.7(0.0)	1.6(0.0)	1.5(0.1)	2.4(0.1)	2.2(0.1)	2.1(0.0)

Table 5: nDCG@k and Precision@k of Normalization Strategies and Fusion Algorithms on Amazon-13k.

Normalization	Algorithms	nDCG x 100						Precision x 100					
		Tail label			Head label			Tail label			Head label		
		@1	@5	@10	@1	@5	@10	@1	@5	@10	@1	@5	@10
Min-Max Norm	CombMNZ	70.5(0.2)	<b>34.0(0.1)</b>	<b>31.2(0.1)</b>	<b>95.6(0.1)</b>	86.5(0.1)	86.5(0.1)	70.5(0.2)	<b>22.7(0.1)</b>	<b>12.0(0.1)</b>	<b>95.6(0.1)</b>	63.7(0.1)	38.5(0.0)
Min-Max Norm	CombSUM	69.9(0.2)	33.8(0.1)	<b>31.0(0.1)</b>	<b>95.6(0.1)</b>	86.0(0.1)	85.9(0.1)	69.9(0.2)	<b>22.7(0.1)</b>	<b>12.0(0.1)</b>	<b>95.6(0.1)</b>	63.2(0.1)	38.0(0.1)
Min-Max Norm	CombMIN	49.2(0.6)	25.2(0.1)	23.9(0.1)	82.8(0.1)	69.4(0.2)	71.2(0.1)	49.2(0.6)	17.6(0.1)	9.9(0.0)	82.8(0.1)	49.2(0.2)	30.7(0.1)
Min-Max Norm	CombMAX	61.4(0.1)	31.8(0.1)	29.4(0.1)	74.3(0.0)	74.3(0.1)	76.9(0.0)	61.4(0.1)	22.0(0.1)	11.8(0.0)	74.3(0.0)	56.5(0.0)	35.9(0.1)
Min-Max Norm	CombMED	52.3(0.7)	28.5(0.1)	26.8(0.1)	85.0(0.1)	76.1(0.1)	78.2(0.1)	52.3(0.7)	20.3(0.1)	11.3(0.0)	85.0(0.1)	55.6(0.1)	35.0(0.1)
Min-Max Norm	CombANZ	52.3(0.7)	28.5(0.1)	26.8(0.1)	85.0(0.1)	76.1(0.1)	78.2(0.1)	52.3(0.7)	20.3(0.1)	11.3(0.0)	85.0(0.1)	55.6(0.1)	35.0(0.1)
Min-Max Norm	ISR	67.6(0.1)	33.0(0.1)	30.4(0.1)	92.8(0.1)	83.4(0.1)	84.6(0.1)	67.6(0.1)	22.4(0.1)	<b>12.0(0.1)</b>	92.8(0.1)	61.8(0.0)	38.3(0.1)
Min-Max Norm	Log_ISR	68.2(0.1)	33.1(0.1)	30.3(0.1)	92.8(0.1)	84.4(0.1)	85.2(0.1)	68.2(0.1)	22.2(0.1)	11.7(0.1)	92.8(0.1)	62.6(0.1)	38.6(0.1)
Min-Max Norm	BordaFuse	67.9(0.2)	33.1(0.1)	30.4(0.0)	91.9(0.1)	85.3(0.1)	85.7(0.0)	67.9(0.2)	22.3(0.1)	<b>11.9(0.1)</b>	91.9(0.1)	63.6(0.1)	<b>38.8(0.0)</b>
Min-Max Norm	Condorcet	57.6(0.4)	29.1(0.1)	27.2(0.1)	86.0(1.7)	78.5(0.6)	79.2(0.5)	57.6(0.4)	20.0(0.1)	11.0(0.1)	86.0(1.7)	57.9(0.3)	35.3(0.1)
ZMUV Norm	CombMNZ	<b>71.2(0.2)</b>	<b>34.1(0.1)</b>	<b>31.2(0.1)</b>	<b>95.7(0.1)</b>	<b>87.4(0.1)</b>	<b>87.2(0.1)</b>	<b>71.2(0.2)</b>	<b>22.8(0.1)</b>	<b>12.0(0.1)</b>	<b>95.7(0.1)</b>	<b>64.5(0.1)</b>	<b>38.9(0.1)</b>
ZMUV Norm	CombSUM	<b>69.0(0.4)</b>	33.1(0.1)	30.4(0.1)	<b>95.6(0.1)</b>	87.0(0.1)	86.7(0.1)	<b>69.0(0.4)</b>	22.1(0.1)	<b>11.8(0.1)</b>	<b>95.6(0.1)</b>	64.1(0.1)	38.5(0.1)
ZMUV Norm	CombMIN	22.2(0.6)	16.5(0.1)	17.0(0.1)	63.4(0.2)	63.8(0.2)	66.9(0.1)	22.2(0.6)	13.6(0.0)	8.9(0.0)	63.4(0.2)	48.4(0.1)	32.0(0.1)
ZMUV Norm	CombMAX	56.2(0.7)	29.8(0.1)	27.9(0.1)	94.2(0.2)	84.7(0.2)	85.1(0.1)	56.2(0.7)	21.1(0.1)	11.7(0.0)	94.2(0.2)	62.0(0.1)	37.9(0.1)
ZMUV Norm	CombMED	44.4(0.7)	25.9(0.1)	24.8(0.1)	92.7(0.2)	82.6(0.1)	83.3(0.1)	44.4(0.7)	19.2(0.1)	11.1(0.0)	92.7(0.2)	60.2(0.1)	37.0(0.1)
ZMUV Norm	CombANZ	44.4(0.7)	25.9(0.1)	24.8(0.1)	92.7(0.2)	82.6(0.1)	83.3(0.1)	44.4(0.7)	19.2(0.1)	11.1(0.0)	92.7(0.2)	60.2(0.1)	37.0(0.1)
ZMUV Norm	ISR	67.6(0.1)	33.0(0.1)	30.4(0.1)	92.8(0.1)	83.4(0.1)	84.6(0.1)	67.6(0.1)	22.4(0.1)	<b>12.0(0.1)</b>	92.8(0.1)	61.8(0.0)	38.3(0.1)
ZMUV Norm	Log_ISR	68.2(0.1)	33.1(0.1)	30.3(0.1)	92.8(0.1)	84.4(0.1)	85.2(0.1)	68.2(0.1)	22.2(0.1)	11.7(0.1)	92.8(0.1)	62.6(0.1)	38.6(0.1)
ZMUV Norm	BordaFuse	67.9(0.2)	33.1(0.1)	30.4(0.0)	91.9(0.1)	85.3(0.1)	85.7(0.0)	67.9(0.2)	22.3(0.1)	<b>11.9(0.1)</b>	91.9(0.1)	63.6(0.1)	<b>38.8(0.0)</b>
ZMUV Norm	Condorcet	57.6(0.4)	29.1(0.1)	27.2(0.1)	86.0(1.7)	78.5(0.6)	79.2(0.5)	57.6(0.4)	20.0(0.1)	11.0(0.1)	86.0(1.7)	57.9(0.3)	35.3(0.1)
Max Norm	CombMNZ	69.4(0.1)	33.5(0.1)	30.8(0.1)	95.5(0.1)	86.9(0.1)	86.8(0.1)	69.4(0.1)	22.4(0.1)	<b>11.9(0.1)</b>	95.5(0.1)	64.0(0.0)	38.6(0.1)
Max Norm	CombSUM	69.5(0.2)	33.5(0.1)	30.8(0.1)	95.5(0.1)	86.9(0.1)	86.8(0.1)	69.5(0.2)	22.4(0.1)	<b>11.9(0.1)</b>	95.5(0.1)	64.0(0.0)	38.6(0.1)
Max Norm	CombMIN	50.2(0.6)	25.3(0.1)	23.7(0.1)	85.7(0.1)	70.8(0.2)	71.8(0.2)	50.2(0.6)	17.3(0.1)	9.6(0.0)	85.7(0.1)	50.1(0.3)	30.5(0.2)
Max Norm	CombMAX	61.9(0.1)	31.8(0.1)	29.4(0.1)	74.3(0.1)	74.4(0.1)	76.8(0.1)	61.9(0.1)	21.9(0.1)	<b>11.8(0.1)</b>	74.3(0.1)	56.5(0.1)	35.8(0.1)
Max Norm	CombMED	52.9(0.6)	27.9(0.1)	26.0(0.1)	86.1(0.1)	75.6(0.2)	76.7(0.2)	52.9(0.6)	19.5(0.1)	10.5(0.1)	86.1(0.1)	54.8(0.2)	33.6(0.1)
Max Norm	CombANZ	52.9(0.6)	27.9(0.1)	26.0(0.1)	86.1(0.1)	75.6(0.2)	76.7(0.2)	52.9(0.6)	19.5(0.1)	10.5(0.1)	86.1(0.1)	54.8(0.2)	33.6(0.1)
Max Norm	ISR	67.6(0.1)	33.0(0.1)	30.4(0.1)	92.8(0.1)	83.4(0.1)	84.6(0.1)	67.6(0.1)	22.4(0.1)	<b>12.0(0.1)</b>	92.8(0.1)	61.8(0.0)	38.3(0.1)
Max Norm	Log_ISR	68.2(0.1)	33.1(0.1)	30.3(0.1)	92.8(0.1)	84.4(0.1)	85.2(0.1)	68.2(0.1)	22.2(0.1)	11.7(0.1)	92.8(0.1)	62.6(0.1)	38.6(0.1)
Max Norm	BordaFuse	67.9(0.2)	33.1(0.1)	30.4(0.0)	91.9(0.1)	85.3(0.1)	85.7(0.0)	67.9(0.2)	22.3(0.1)	<b>11.9(0.1)</b>	91.9(0.1)	63.6(0.1)	<b>38.8(0.0)</b>
Max Norm	Condorcet	57.6(0.4)	29.1(0.1)	27.2(0.1)	86.0(1.7)	78.5(0.6)	79.2(0.5)	57.6(0.4)	20.0(0.1)	11.0(0.1)	86.0(1.7)	57.9(0.3)	35.3(0.1)
Sum Norm	CombMNZ	68.0(0.1)	33.1(0.1)	30.5(0.1)	<b>95.7(0.1)</b>	<b>87.2(0.1)</b>	<b>87.2(0.1)</b>	68.0(0.1)	22.2(0.1)	<b>11.9(0.1)</b>	<b>95.7(0.1)</b>	<b>64.2(0.1)</b>	<b>38.9(0.1)</b>
Sum Norm	CombSUM	66.7(0.2)	32.6(0.1)	30.2(0.1)	<b>95.6(0.1)</b>	87.0(0.1)	87.0(0.1)	66.7(0.2)	22.0(0.1)	<b>11.8(0.1)</b>	<b>95.6(0.1)</b>	64.1(0.0)	<b>38.8(0.1)</b>
Sum Norm	CombMIN	31.2(0.5)	21.3(0.1)	21.0(0.1)	80.1(0.2)	73.0(0.1)	74.6(0.1)	31.2(0.5)	17.0(0.1)	10.2(0.0)	80.1(0.2)	53.7(0.1)	33.7(0.1)
Sum Norm	CombMAX	62.6(0.1)	31.4(0.1)	29.3(0.1)	90.4(0.2)	82.2(0.1)	83.2(0.1)	62.6(0.1)	21.4(0.1)	11.7(0.1)	90.4(0.2)	60.6(0.1)	37.4(0.0)
Sum Norm	CombMED	58.9(0.2)	30.3(0.1)	28.4(0.1)	92.3(0.1)	82.5(0.1)	83.3(0.1)	58.9(0.2)	21.0(0.1)	11.6(0.1)	92.3(0.1)	60.1(0.1)	37.0(0.0)
Sum Norm	CombANZ	58.9(0.2)	30.3(0.1)	28.4(0.1)	92.3(0.1)	82.5(0.1)	83.3(0.1)	58.9(0.2)	21.0(0.1)	11.6(0.1)	92.3(0.1)	60.1(0.1)	37.0(0.0)
Sum Norm	ISR	67.6(0.1)	33.0(0.1)	30.4(0.1)	92.8(0.1)	83.4(0.1)	84.6(0.1)	67.6(0.1)	22.4(0.1)	<b>12.0(0.1)</b>	92.8(0.1)	61.8(0.0)	38.3(0.1)
Sum Norm	Log_ISR	68.2(0.1)	33.1(0.1)	30.3(0.1)	92.8(0.1)	84.4(0.1)	85.2(0.1)	68.2(0.1)	22.2(0.1)	11.7(0.1)	92.8(0.1)	62.6(0.1)	38.6(0.1)
Sum Norm	BordaFuse	67.9(0.2)	33.1(0.1)	30.4(0.0)	91.9(0.1)	85.3(0.1)	85.7(0.0)	67.9(0.2)	22.3(0.1)	<b>11.9(0.1)</b>	91.9(0.1)	63.6(0.1)	<b>38.8(0.0)</b>
Sum Norm	Condorcet	57.6(0.4)	29.1(0.1)	27.2(0.1)	86.0(1.7)	78.5(0.6)	79.2(0.5)	57.6(0.4)	20.0(0.1)	11.0(0.1)	86.0(1.7)	57.9(0.3)	35.3(0.1)
Rank Norm	CombMNZ	67.6(0.1)	33.1(0.1)	30.5(0.1)	88.8(0.1)	83.6(0.1)	84.3(0.1)	67.6(0.1)	22.4(0.1)	<b>12.0(0.1)</b>	88.8(0.1)	62.7(0.1)	38.6(0.0)
Rank Norm	CombSUM	67.6(0.1)	33.2(0.1)	30.6(0.1)	88.8(0.1)	83.6(0.1)	84.4(0.1)	67.6(0.1)	22.4(0.1)	<b>12.0(0.1)</b>	88.8(0.1)	62.7(0.1)	38.6(0.0)
Rank Norm	CombMIN	45.8(0.6)	21.9(0.1)	21.5(0.1)	78.9(0.1)	61.6(0.1)	64.5(0.1)	45.8(0.6)	14.9(0.1)	9.1(0.1)	78.9(0.1)	43.1(0.1)	28.8(0.1)
Rank Norm	CombMAX	61.5(0.1)	31.1(0.1)	29.0(0.1)	75.3(0.0)	80.1(0.1)	81.3(0.1)	61.5(0.1)	21.3(0.1)	11.7(0.0)	75.3(0.0)	61.3(0.1)	37.9(0.0)
Rank Norm	CombMED	48.3(0.7)	24.4(0.1)	23.7(0.1)	81.1(0.1)	68.6(0.1)	71.6(0.1)	48.3(0.7)	17.0(0.0)	10.1(0.0)	81.1(0.1)	49.5(0.1)	32.8(0.1)
Rank Norm	CombANZ	48.3(0.7)	24.4(0.1)	23.7(0.1)	81.1(0.1)	68.6(0.1)	71.6(0.1)	48.3(0.7)	17.0(0.0)	10.1(0.0)	81.1(0.1)	49.5(0.1)	32.8(0.1)
Rank Norm	ISR	67.6(0.1)	33.0(0.1)	30.4(0.1)	92.8(0.1)	83.4(0.1)	84.6(0.1)	67.6(0.1)	22.4(0.1)	<b>12.0(0.1)</b>	92.8(0.1)	61.8(0.0)	38.3(0.1)
Rank Norm	Log_ISR	68.2(0.1)	33.1(0.1)	30.3(0.1)	92.8(0.1)	84.4(0.1)	85.2(0.1)	68.2(0.1)	22.2(0.1)	11.7(0.1)	92.8(0.1)	62.6(0.1)	38.6(0.1)
Rank Norm	BordaFuse	67.9(0.2)	33.1(0.1)	30.4(0.0)	91.9(0.1)	85.3(0.1)	85.7(0.0)	67.9(0.2)	22.3(0.1)	<b>11.9(0.1)</b>	91.9(0.1)	63.6(0.1)	<b>38.8(0.0)</b>
Rank Norm	Condorcet	57.6(0.4)	29.1(0.1)	27.2(0.1)	86.0(1.7)	78.5(0.6)	79.2(0.5)	57.6(0.4)	20.0(0.1)	11.0(0.1)	86.0(1.7)	57.9(0.3)	35.3(0.1)
Borda Norm	CombMNZ	67.2(0.2)	33.0(0.1)	30.3(0.1)	92.6(0.0)	85.5(0.1)	85.9(0.0)	67.2(0.2)	22.3(0.1)	<b>11.9(0.1)</b>	92.6(0.0)	63.6(0.0)	<b>38.8(0.0)</b>
Borda Norm	CombSUM	67.2(0.2)	33.0(0.1)	30.3(0.1)	92.6(0.0)	85.5(0.1)	85.9(0.0)	67.2(0.2)	22.3(0.1)	<b>11.9(0.1)</b>	92.6(0.0)	63.6(0.0)	<b>38.8(0.0)</b>
Borda Norm	CombMIN	65.8(0.2)	32.1(0.1)	29.4(0.1)	91.7(0.1)	84.4(0.1)	84.9(0.1)	65.8(0.2)	21.6(0.1)	11.4(0.1)	91.7(0.1)	62.7(0.1)	38.3(0.1)
Borda Norm	CombMAX	57.9(0.4)	31.3(0.1)	28.9(0.1)	84.7(1.4)	81.1(0.2)	82.5(0.2)	57.9(0.4)	22.1(0.1)	<b>11.9(0.0)</b>	84.7(1.4)	60.7(0.1)	37.9(0.1)
Borda Norm	CombMED	67.2(0.2)	33.0(0.1)	30.3(0.1)	92.6(0.0)	85.5(0.1)	85.9(0.0)	67.2(0.2)	22.3(0.1)	<b>11.9(0.1)</b>	92.6(0.0)	63.6(0.0)	<b>38.8(0.0)</b>
Borda Norm	CombANZ	67.2(0.2)	33.0(0.1)	30.3(0.1)	92.6(0.0)	85.5(0.1)	85.9(0.0)	67.2(0.2)	22.3(0.1)	<b>11.9(0.1)</b>	92.6(0.0)	63.6(0.0)	<b>38.8(0.0)</b>
Borda Norm	ISR	1.3(0.1)	1.3(0.1)	1.8(0.1)	2.9(0.9)	4.3(1.5)	6.0(1.8)	1.3(0.1)	1.3(0.1)	1.3(0.1)	2.9(0.9)	4.0(1.1)	4.1(0.8)
Borda Norm	Log_ISR	1.3(0.1)	1.3(0.1)	1.8(0.1)	2.9(0.9)	4.3(1.5)	6.0(1.8)	1.3(0.1)	1.3(0.1)	1.3(0.1)	2.9(0.9)	4.0(1.1)	4.1(0.8)
Borda Norm	BordaFuse	1.3(0.1)	1.3(0.1)	1.8(0.1)	2.9(0.9)	4.3(1.5)	6.0(1.8)	1.3(0.1)	1.3(0.1)	1.3(0.1)	2.9(0.9)	4.0(1.1)	4.1(0.8)
Borda Norm	Condorcet	1.3(0.1)	1.3(0.1)	1.8(0.1)	2.9(0.9)	4.3(1.5)	6.0(1.8)	1.3(0.1)	1.3(0.1)	1.3(0.1)	2.9(0.9)	4.0(1.1)	4.1(0.8)