Beyond Non-Overlap: Preserving Identifiability in Overlap-Tolerant Label Placement

– Supplementary Material –

This material provides the supporting information for the overlap threshold table and more label placement results generated by the five algorithms: bitmap-based labeling (BBL), PIOT, minimum overlapping area (Jaccard), particle-based labeling (PBL), simulated annealing (SA).

1 Overlap Threshold Table

The threshold table plays a critical role in determining whether a label remains valid under overlapping conditions. It is constructed based on the works of Fan et al. [1] and others [2][3], as shown in Table 1. Specifically, Fan et al. [1] summarized the maximum occlusion ratios under which 26 lower-case letters in serif fonts can still be accurately identified in extreme occlusion scenarios. Additionally, Bowles et al. [2] and Fiset et al. [3] demonstrated that upper-case letters are generally easier to identify than lower-case ones, owing to their clearer visual features.

Table 1. The overlap threshold table for 26 lower-case and upper-case English letters in serif font.

Letter	Threshold	Letter	Threshold
a	15%	o	5%
b	20%	p	20%
c	5%	q	20%
d	20%	r	5%
e	20%	s	20%
f	20%	t	10%
g	30%	u	10%
h	15%	v	5%
i	5%	w	40%
j	15%	x	30%
k	30%	y	20%
l	5%	z	30%
m	30%	A-Z	5%
n	5%		

2 Label Placement Results

In this section, we present additional label placement results generated by the five algorithms: BBL, PIOT, Jaccard, PBL, SA. The corresponding results are shown in Figures (a), (b), (c), (d), and (e), respectively. Due to space constraints, some figures display only partial label placement results for selected regions.

Fig. 1. The real-world dataset : German railway stations (366 point-features).
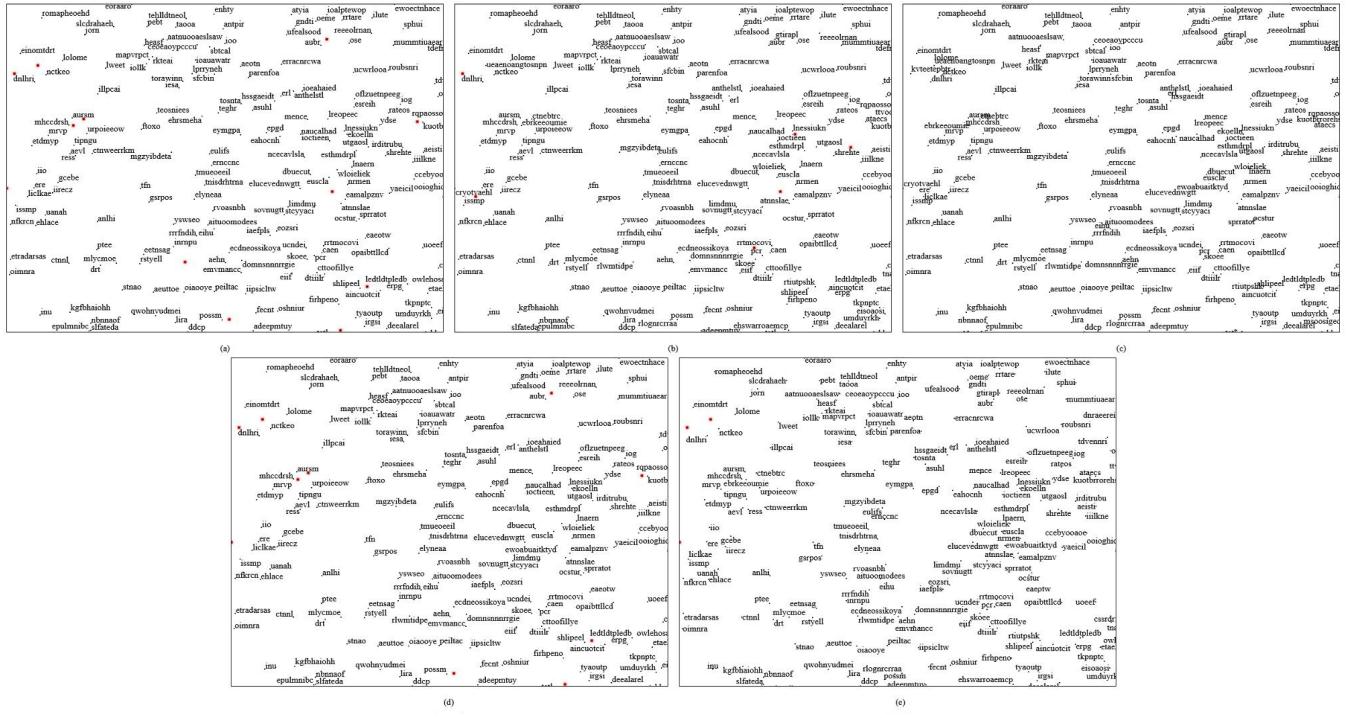
Fig. 2. The generated dataset: partial label placement results for 1500 point−features.
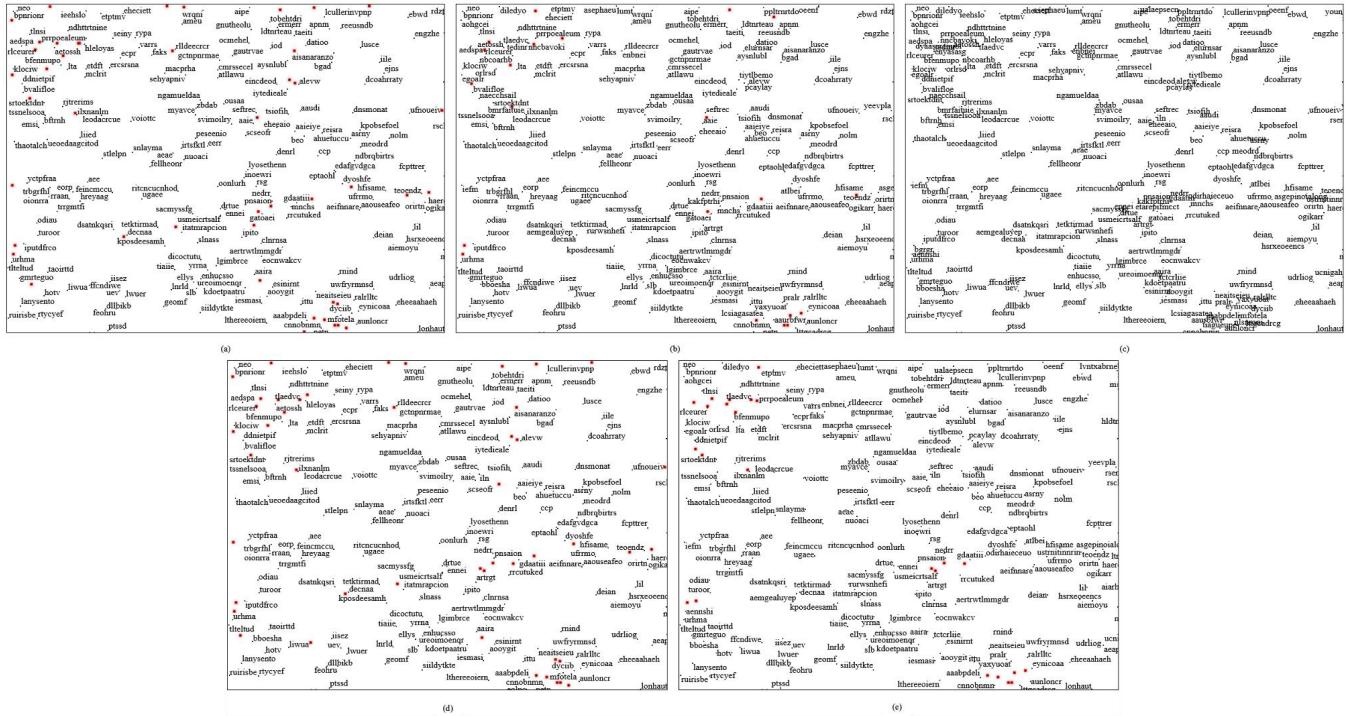
Fig. 3. The generated dataset: partial label placement results for 2000 point−features.

References

[1] Fan Y, Lyu X, Lyu S, et al. Evaluating Effects of Continuous Occlusion on Visual Letter Identification[J]. International Journal of Human—Computer Interaction, 2024: 1–15.

[2] Bowles R P, Pentimonti J M, Gerde H K, et al. Item response analysis of uppercase and lowercase letter name knowledge[J]. Journal of Psychoeducational Assessment, 2014, 32(2): 146–156.

[3] Fiset D, Blais C, Ethier–Majcher C, et al. Features for identification of uppercase and lowercase letters[J]. Psychological science, 2008, 19(11): 1161–1168.