# 基于增强模态对齐和实例保持的多模态知识图谱补全

## MAP: Supporting Multimodal Knowledge Graph Completion via Augmented Modality Alignment and Instance Preserving

收录会议：2025 IEEE International Conference on Acoustics, Speech, and Signal Processing，ICASSP

作者：李懿*，朱庆猛*，宋飞，郑昌文，李江梦
联系人：李懿，liyi212@mails.ucas.ac.cn

## 动 机

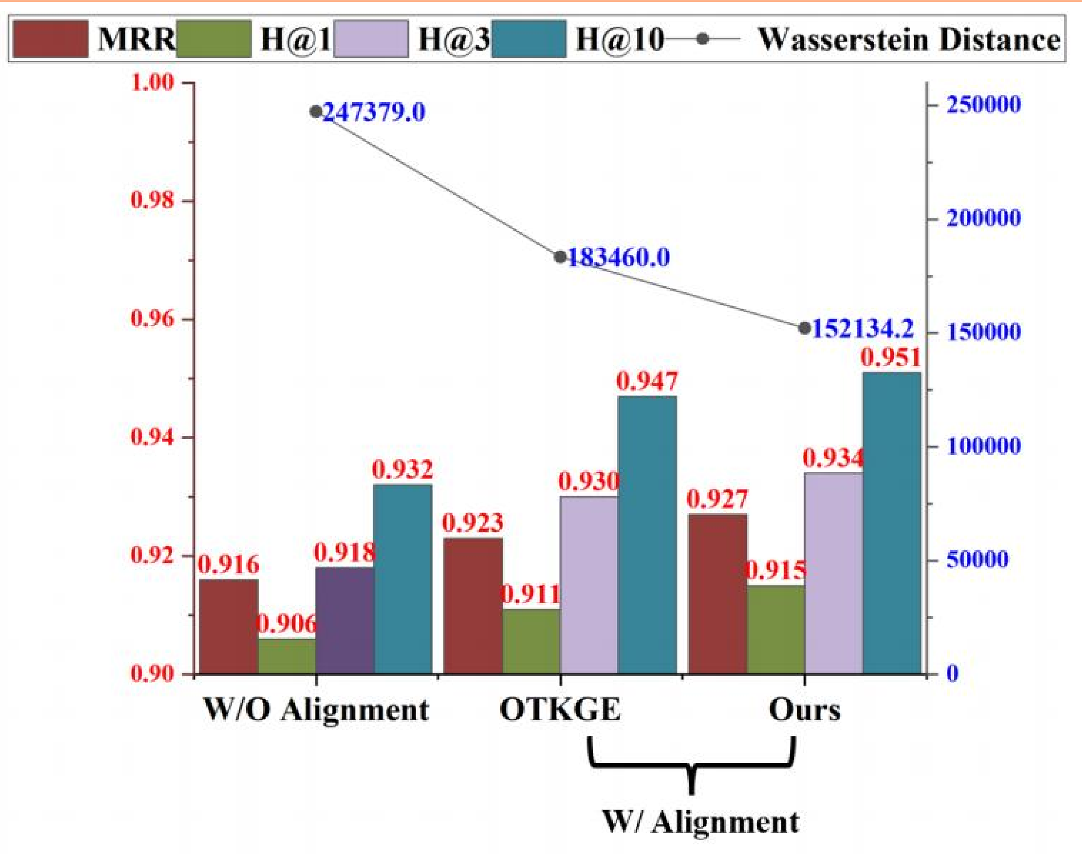



Fig. 1. The effectiveness exploration of the modality distribution alignment procedure. Both OTKGE [24] and our approach (denoted as *Ours*) belong to the approach with the alignment. The demonstrated Wasserstein distance are derived by using arithmetic solutions of the linear programming formulation of the corresponding optimal transport problem.

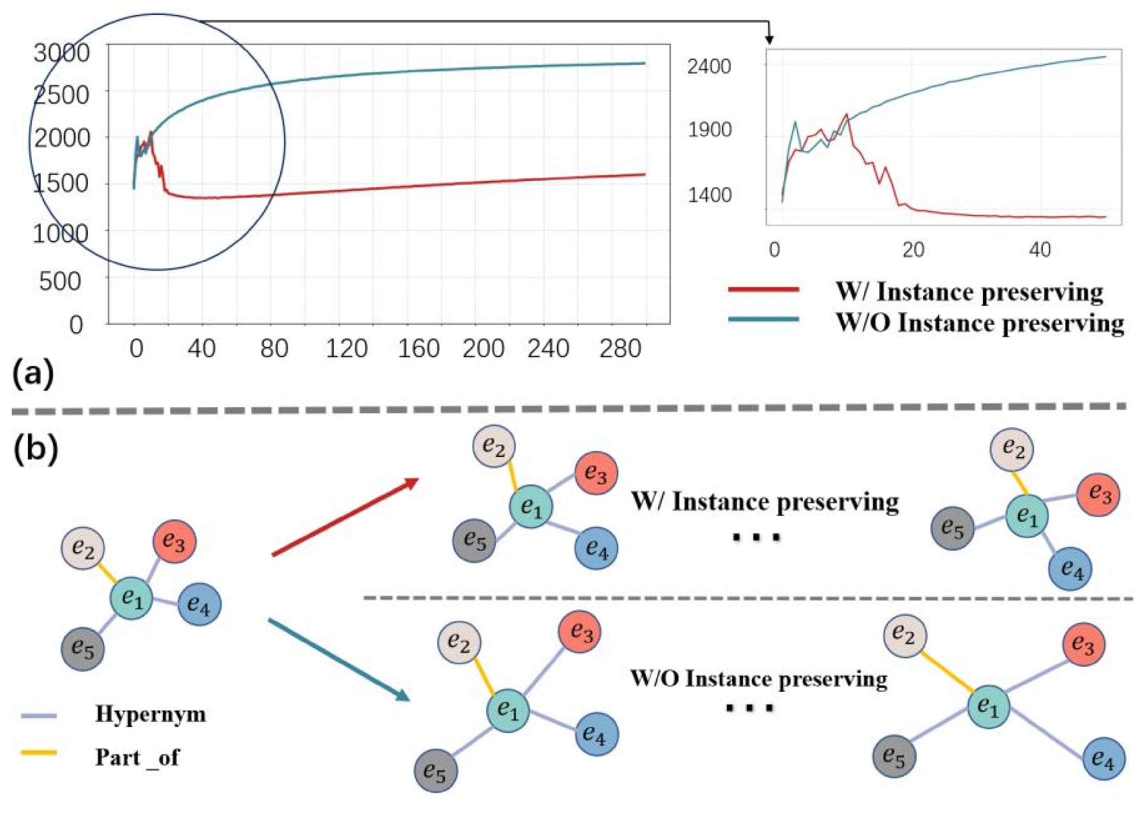
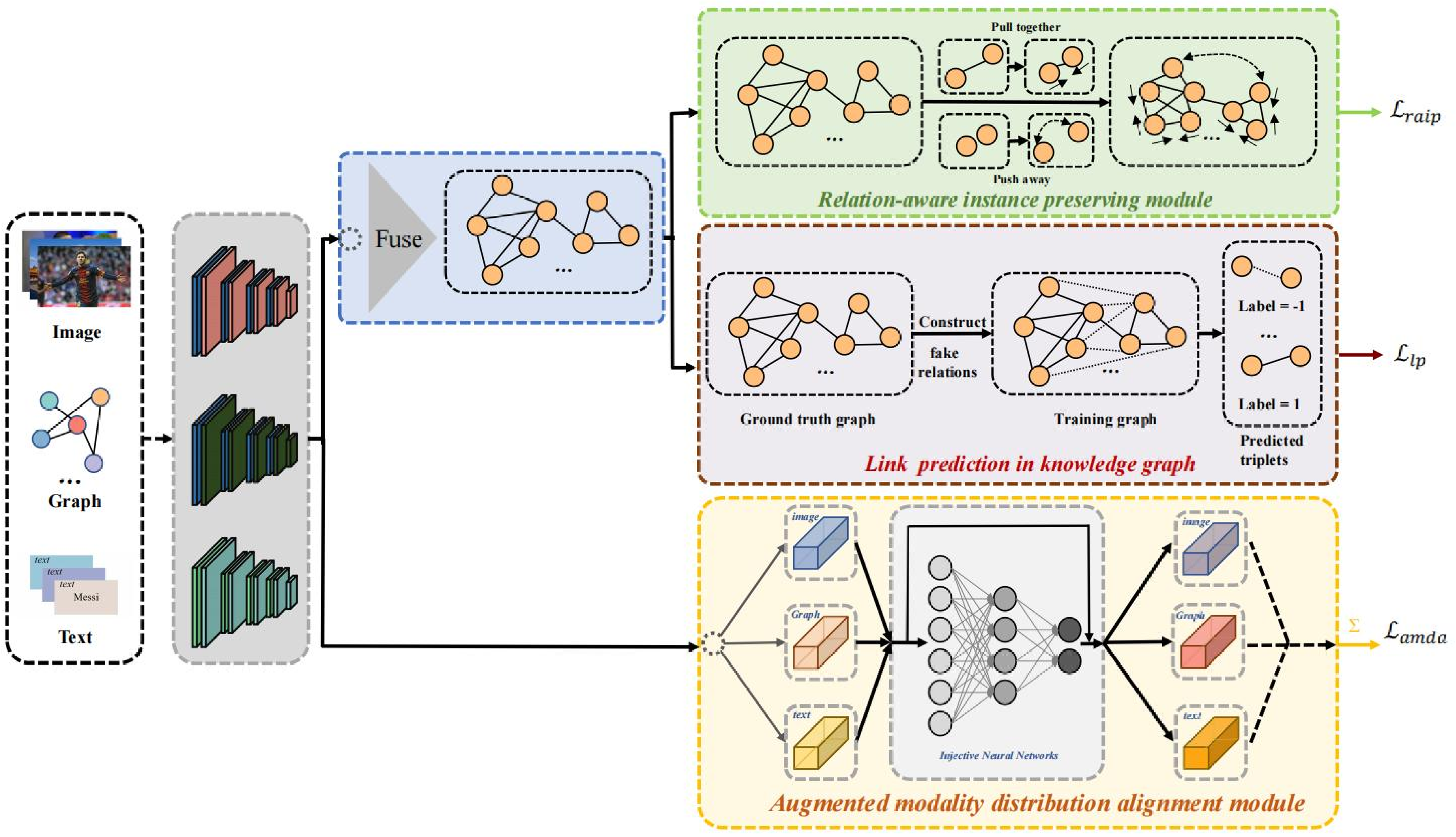



Fig. 2. The empirical proofs demonstrating the existence of the unexpected instance-level feature disorder issue. In subfigure (a), the $x$-axis denotes the training epoch, and the $y$-axis records the Euclidean distance between the selected semantic-relevant entity features, e.g., $\sum_{i=1}^{4}\sum_{j=i+1}^{5}\|e_i - e_j\|_2$. In subfigure (b), we abstractly perform the changing trends of their local structures by using the instance preserving or not, respectively. Concretely, we use the length of the edges to represent the distance between nodes.

- 现有的多模态知识图谱方法使用分布对齐的方法来解决多模态异质性，但是其有着对齐效果差和时间复杂度高的问题
- 在分布对齐的过程中，多模态知识图谱中的节点和边的结构会出现扰动，即本应该互相靠近的向量在对齐过程中被推远

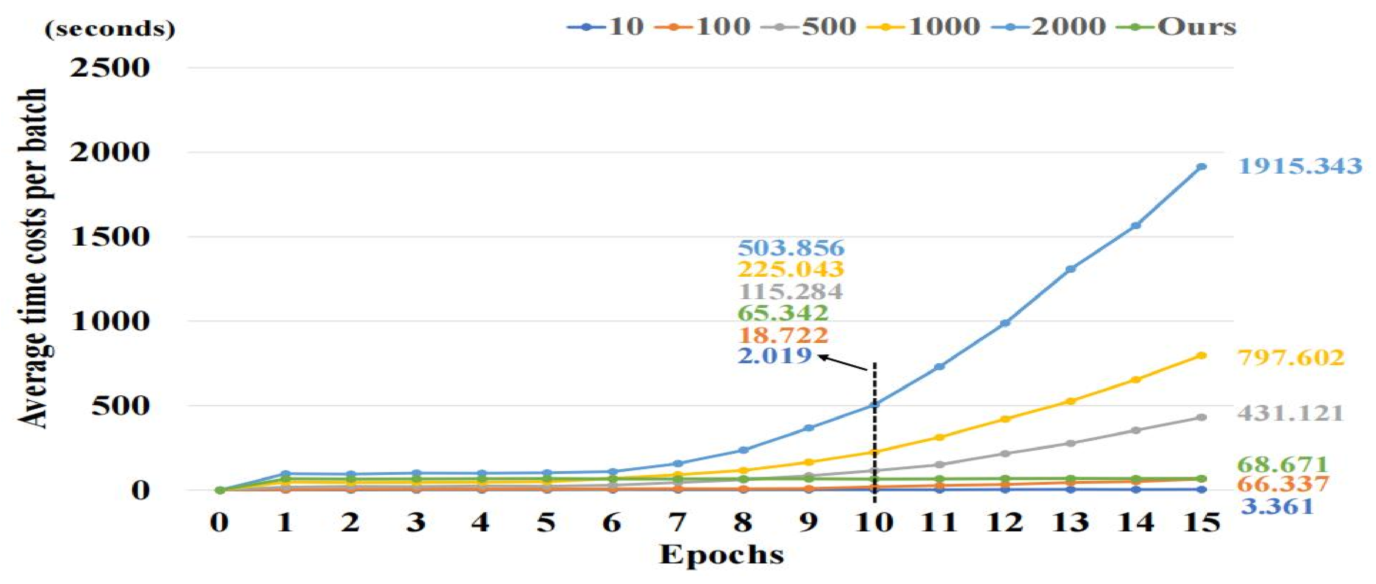
## 方 法




## 实 验

| Model | FB-IMG | | | | WN9-IMG | | | |
|---|---|---|---|---|---|---|---|---|
| | MRR | H@1 | H@3 | H@10 | MRR | H@1 | H@3 | H@10 |
| TransE | 0.712 | 0.618 | 0.781 | 0.859 | 0.865 | 0.765 | 0.816 | 0.871 |
| DistMult | 0.706 | 0.606 | 0.742 | 0.808 | 0.901 | 0.895 | 0.913 | 0.925 |
| ComplEx | 0.808 | 0.757 | 0.845 | 0.892 | 0.908 | 0.903 | 0.907 | 0.928 |
| RotatE | 0.794 | 0.744 | 0.827 | 0.883 | 0.910 | 0.901 | 0.915 | 0.926 |
| TransAE | 0.742 | 0.691 | 0.785 | 0.844 | 0.898 | 0.894 | 0.908 | 0.922 |
| IKLR | 0.755 | 0.698 | 0.794 | 0.857 | 0.901 | 0.900 | 0.912 | 0.928 |
| TBKGE | 0.812 | 0.764 | 0.850 | 0.902 | 0.912 | 0.904 | 0.914 | 0.931 |
| MMKRL | 0.827 | 0.783 | 0.857 | 0.906 | 0.913 | 0.905 | 0.917 | 0.932 |
| OTKGE | 0.843 | 0.799 | 0.876 | 0.916 | 0.923 | 0.911 | 0.930 | 0.947 |
| MAP | **0.854** | **0.815** | **0.884** | **0.921** | **0.930** | **0.918** | **0.936** | **0.955** |

- 在两个多模态知识图谱数据上的实验证明了提出方法的有效性




- 时间复杂度实验证明了提出方法具有较低的时间复杂度

| Model | FB-IMG | | | | WN9-IMG | | | |
|---|---|---|---|---|---|---|---|---|
| | MRR | H@1 | H@3 | H@10 | MRR | H@1 | H@3 | H@10 |
| OTKGE | 0.843 | 0.799 | 0.876 | 0.916 | 0.923 | 0.911 | 0.930 | 0.947 |
| MAP w/o R & A | 0.837 | 0.795 | 0.862 | 0.910 | 0.917 | 0.906 | 0.918 | 0.931 |
| MAP w/o R | 0.850 | 0.809 | 0.881 | 0.919 | 0.927 | 0.915 | 0.934 | 0.951 |
| MAP w/o A | 0.839 | 0.797 | 0.868 | 0.913 | 0.920 | 0.910 | 0.926 | 0.942 |
| MAP | **0.854** | **0.815** | **0.884** | **0.921** | **0.930** | **0.918** | **0.936** | **0.955** |


- 消融实验证明了每一个提出模块的有效性
- 参数实验研究了超参对于模型性能的影响