3 Experiment

3.1 Datasets

We use time-characteristic data sets used in HyTE[] papers such as YAGO11k and Wikidata12k. Wikidata and YAGO are the most popular Knowledge Graphs. We extracted the temporally rich subgraph from them for testing our algorithm as well as the baselines.

Q-YAGO11k: Each triplet in YAGO11k[HyTE] corresponds to two time information ts and te in HyTE. But the time information contains a lot of time elements as (<Hugh\_Marlove>, <isMarriedTo>, <K.\_T.\_Stevence>, 1946-##-##, ####-##-##) in the location. We normalize this data as (<Hugh\_Marlove>, <isMarriedTo>, <K.\_T.\_Stevence>, 1946-##-##). And we normalize (<Aimee\_Chan>, <wasBornIn>, <Toronto>, 1981-04-01, 1981-04-01) as (<Aimee\_Chan>, <wasBornIn>, <Toronto>, 1981-04-01). The total Q-YAGO11k contains 10623 entities and 20.5k quadruples.

Q-Wikidata12k: We generate a Q-Wikidata12k using a similar method to generating Q-YAGO11k. Q-Wikidata12k contains 12554 entities and 24 different relations. And it contains almost 40k quadruples. We split almost 32k training sets, 4k test sets and 4k verification sets.

3.2 Evaluation

MeanRank

Hit@10(%)

3.3 Comparison Method

TransE

TransH

t-TransE

Ho1E

HyTE

3.4 Result and Analysis

**Entity Prediction**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Dataset | Q-YAGO11k | | | | | Q-Wikidata12k | | | |
| Metric | Mean Rank | | | Hits@10(%) | | Mean Rank | | Hits@10(%) | |
| tail | | head | tail | head | tail | head | tail | head |
| TransE | 504 | 2020 | | 4.4 | 1.2 | 520 | 740 | 11.0 | 6.0 |
| TransH | 354 | 1808 | | 5.8 | 1.5 | 423 | 648 | 23.7 | 11.8 |
| t-TransE | 292 | 1692 | | 6.2 | 1.3 | 283 | 413 | 24.5 | 14.5 |
| Ho1E | 1828 | 1953 | | 29.4 | 13.7 | 734 | 808 | 25.0 | 12.3 |
| HyTE | 107 | 1069 | | 38.4 | 16.0 | 179 | 237 | 41.6 | 25.0 |
| **T2LP** |  |  | |  |  |  |  |  |  |

**Link Prediction**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Dataset | Q-YAGO11k | | | | Q-Wikidata12k | | | |
| Metric | Mean Rank | | Hits@1(%) | | Mean Rank | | Hits@10(%) | |
| TransE | 1.7 | | 78.4 | | 1.35 | | 88.4 | |
| TransH | 1.53 | | 76.1 | | 1.4 | | 88.1 | |
| t-TransE | 2.57 | | 69.3 | | 2.23 | | 83.96 | |
| Ho1E | 1.66 | | 75.5 | | 1.97 | | 74.2 | |
| HyTE | 1.23 | | 81.2 | | 1.13 | | 92.6 | |
| **T2LP** |  |  |  |  |  |  |  |  |