01

LOWFER: LOW-RANK BILINEAR POOLING FOR LINK PREDICTION

Grandilevskii Aleksei,
Sorokin Mikhail

ITMO University, AMLT, 2022

LowFER model

Low-rank Bilinear Pooling for Link Prediction

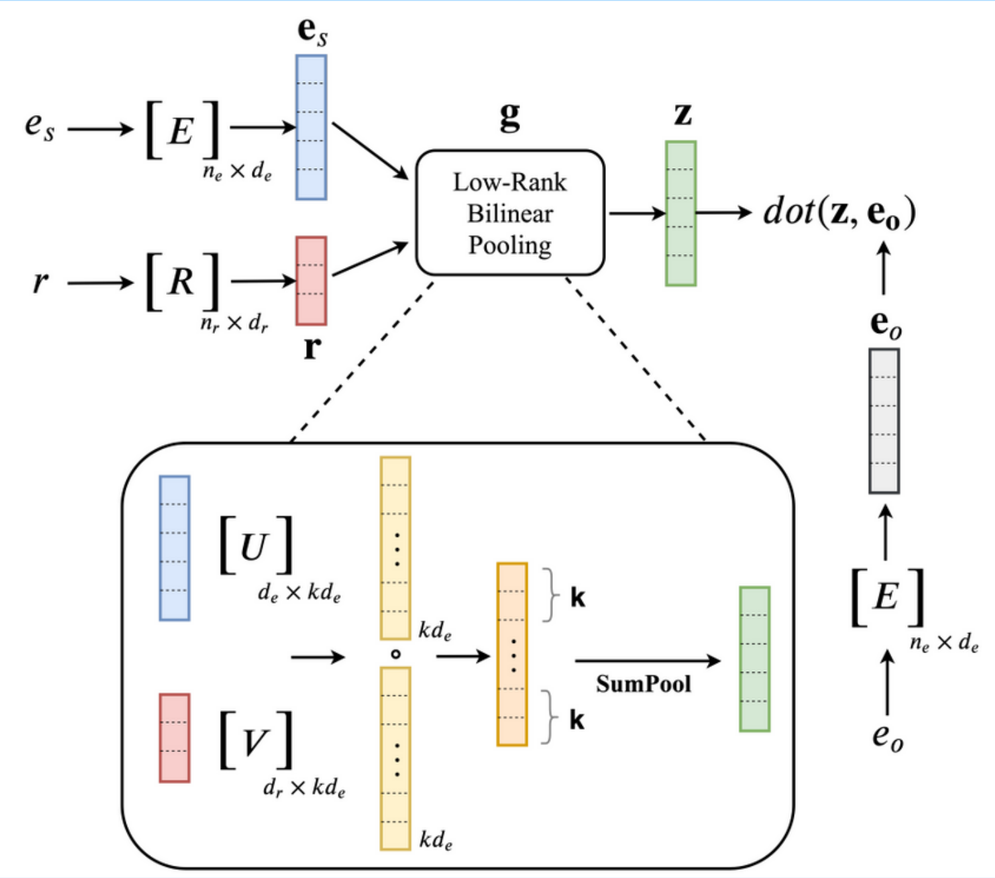
Type: Bilinear model

Commonly used in multi-modal learning, for better fusion of entities and relations, leading to an efficient and constraint-free model.

Origin: TuckER model

LowFER model naturally generalizes Tucker decomposition based TuckER model, which has been shown to generalize other models, as efficient low-rank approximation without substantially compromising the performance.

Model explanation



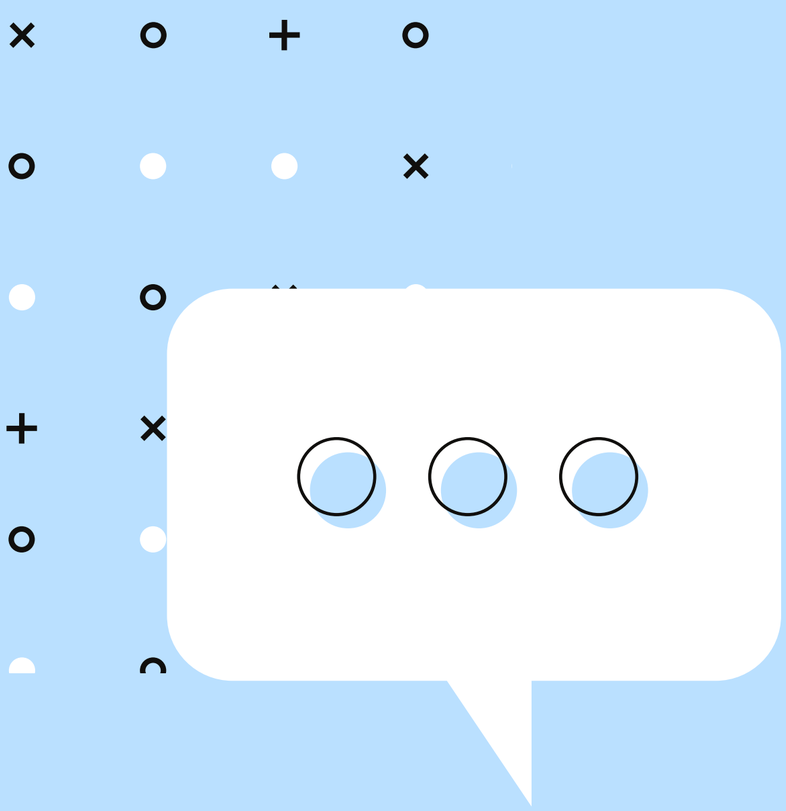
01 Created to complement the knowledge graph.

02 It takes as input Entities and Relations between them.

03 The calculation is made using the LRBP algorithm.

04 Predicts missing links for language models (aka KG thesauri) with high accuracy.

05 Can be used for basically any KG with the corresponding characteristics.



RuWordNet dataset

The RuThes thesaurus is a hierarchy of concepts viewed as units of thought. A concept is associated with the set of language expressions that refer to it in texts. Each concept should have distinctions from related concepts. These distinctions should be expressed in a specific set of relationships or associated language expressions: text entries.

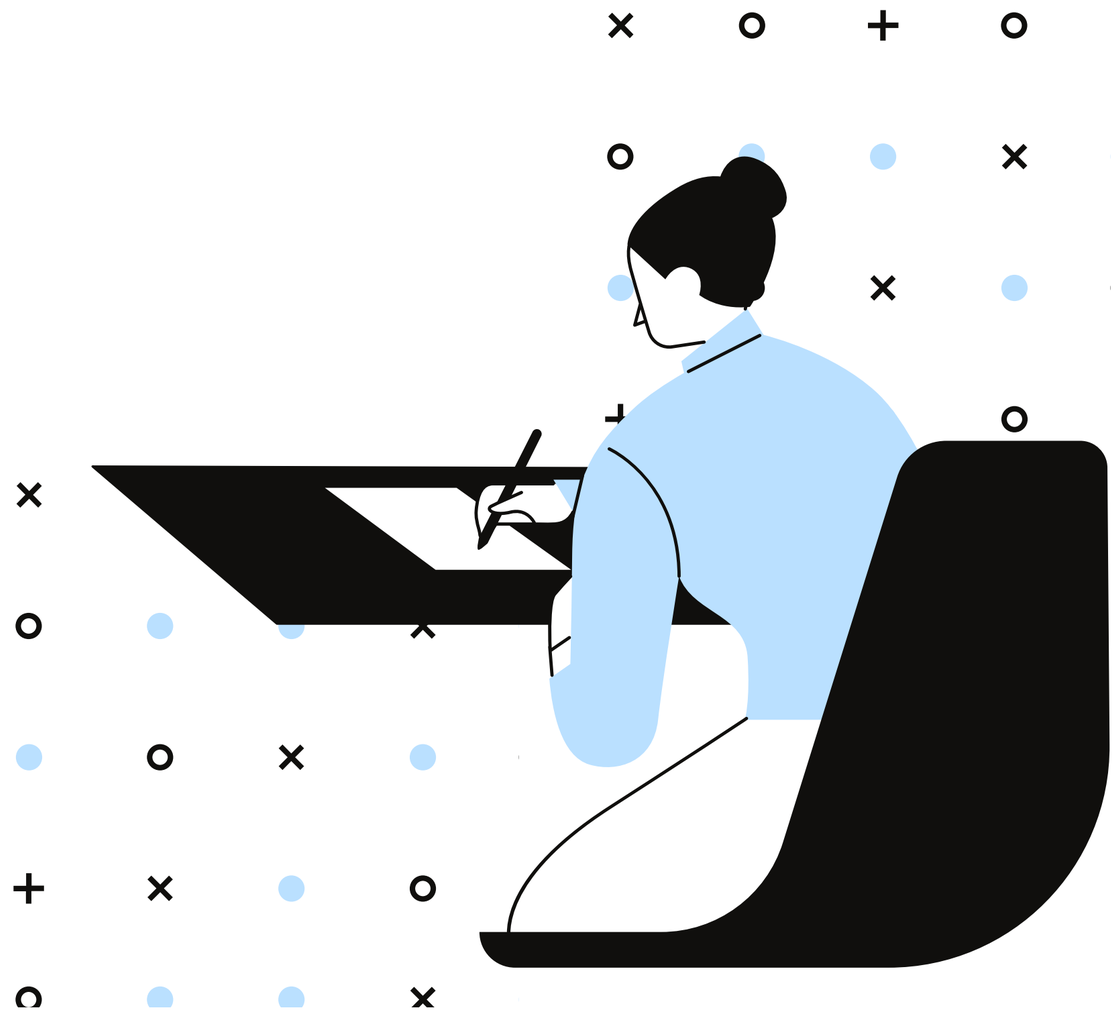
Metrics and results

- **MRR (Mean reciprocal rank)**

  A statistic measure for evaluating any process that produces a list of possible responses to a sample of queries, ordered by probability of correctness.

- **Hits@k**

  is the count of how many positive triples are ranked in the top-k positions against a bunch of synthetic negatives.



*after 30 iterations

06

	FB15k-237	WN18RR	FB15k	WN18
MRR	0.358	0.470	0.795	0.953
HITS 10	0.544	0.526	0.892	0.958
HITS 3	0.394	0.482	0.833	0.955
HITS 1	0.266	0.443	0.741	0.949

	RWN-2021*
MRR	0,91
HITS 10	0,94
HITS 3	0,94
HITS 1	0,92

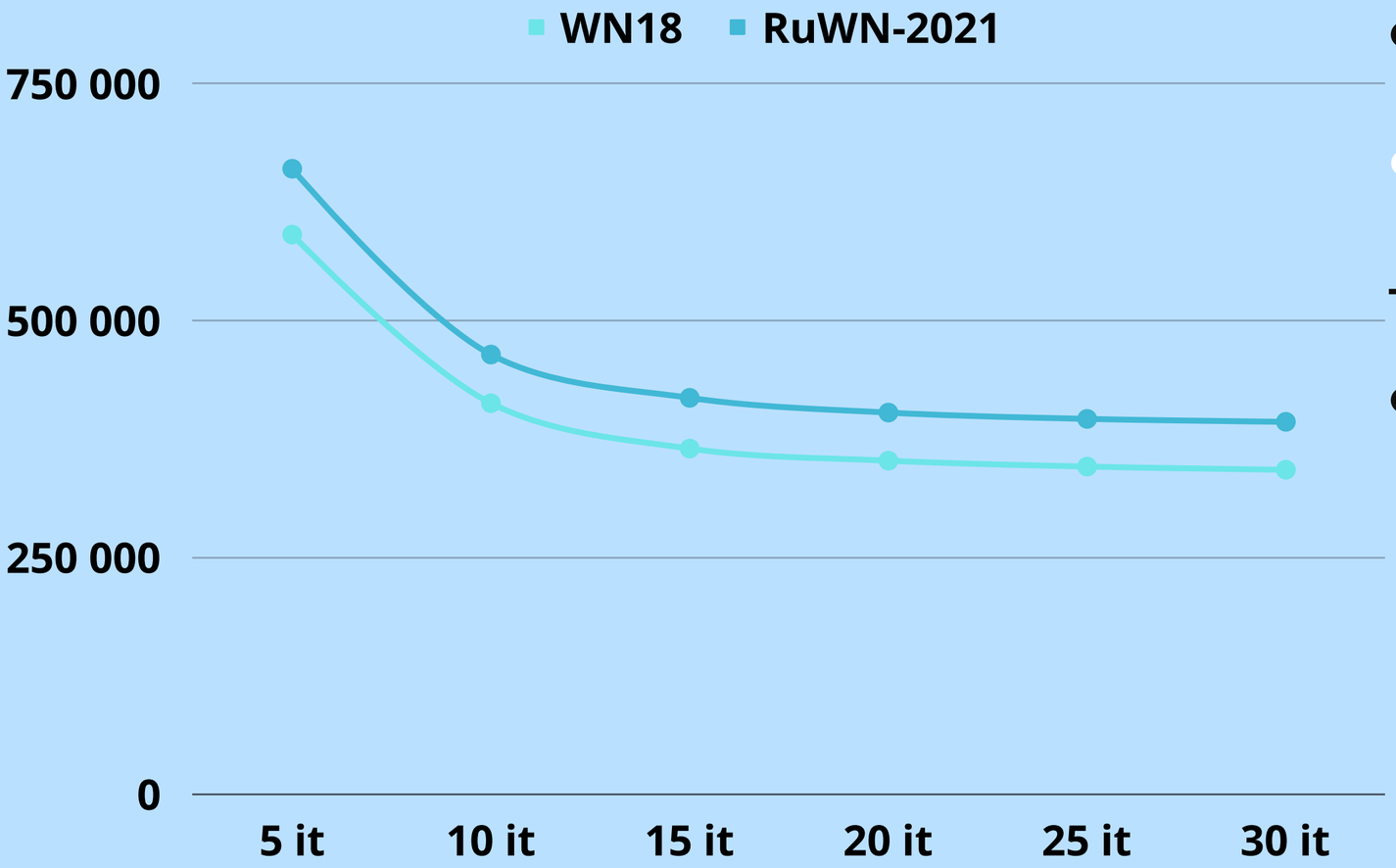
ENG

RU

Original TuckER/LowFER results

Our results for russian language

Conclusion




```
10/11/2022 18:43:57 - INFO - main.py -   Starting training...
10/11/2022 18:43:57 - INFO - main.py -   Params: 8650480
10/11/2022 18:43:57 - INFO - main.py -   Iteration numer 1 is running
10/11/2022 18:45:28 - INFO - main.py -   Epoch 1 / time 90.53296 / loss 0.013521139
10/11/2022 18:45:28 - INFO - main.py -   Iteration numer 2 is running
10/11/2022 18:46:59 - INFO - main.py -   Epoch 2 / time 90.88446 / loss 0.000688367
10/11/2022 18:46:59 - INFO - main.py -   Final Validation:
10/11/2022 18:46:59 - INFO - main.py -   Number of data points: 10000
10/11/2022 18:47:38 - INFO - main.py -   Hits @10: 0.0263
10/11/2022 18:47:38 - INFO - main.py -   Hits @3: 0.013
10/11/2022 18:47:38 - INFO - main.py -   Hits @1: 0.0048
10/11/2022 18:47:38 - INFO - main.py -   Mean rank: 15105.2795
10/11/2022 18:47:38 - INFO - main.py -   Mean reciprocal rank: 0.012298810894385266
10/11/2022 18:47:38 - INFO - main.py -   Final Test:
10/11/2022 18:47:38 - INFO - main.py -   Number of data points: 10000
10/11/2022 18:48:17 - INFO - main.py -   Hits @10: 0.0242
10/11/2022 18:48:17 - INFO - main.py -   Hits @3: 0.014
10/11/2022 18:48:17 - INFO - main.py -   Hits @1: 0.0059
10/11/2022 18:48:17 - INFO - main.py -   Mean rank: 15198.1264
10/11/2022 18:48:17 - INFO - main.py -   Mean reciprocal rank: 0.012848643358805293
```

Effectiveness

The model has shown its effectiveness when working with the Russian-language thesaurus, and therefore can be used for its full analysis and machine learning of Linear models.

Performance growth

The iterative graph (on the top) of the growth of parameters for RuWN-2021 very closely coincides with the growth for WN18, which allows us to make an assumption about similar results with a full cycle of 500 iterations.

Links for our project and data

Dataset link.

Github repo link.

Citing

- **LowFER for link prediction**

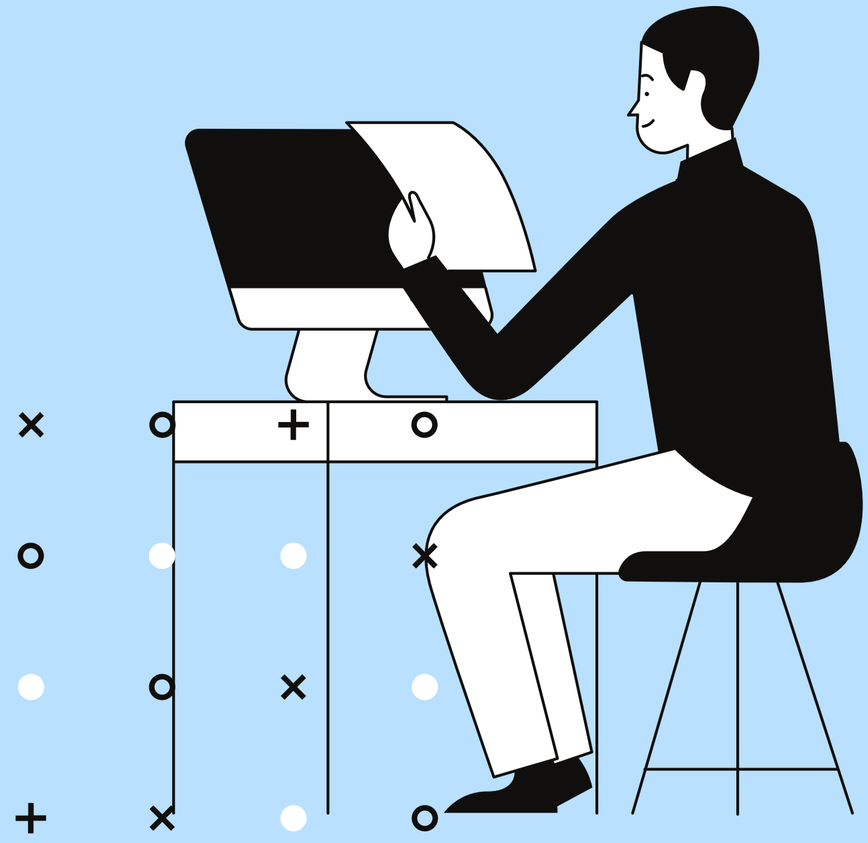
  Amin, S., Varanasi, S., Dunfield, K., & Neumann, G. (2020). LowFER: Low-rank Bilinear Pooling for Link Prediction. In Proceedings of the 37th International Conference on Machine Learning (pp. 257–268). PMLR.

- **Original LowFER model**

  Dikeoulias, I., Amin, S., & Neumann, G. (2022). Temporal Knowledge Graph Reasoning with Low-rank and Model-agnostic Representations. In Proceedings of the 7th Workshop on Representation Learning for NLP (pp. 111–120). Association for Computational Linguistics.

- **TuckER model**

  Balažević, I., Allen, C., & Hospedales, T. (2019). TuckER: Tensor Factorization for Knowledge Graph Completion. In Empirical Methods in Natural Language Processing.



Thank you for your attention

Grandilevskii Aleksei

email

zer0deck.work@icloud.com
337390@niuitmo.ru

site

www.zer0deck.com

git

www.github.com/zer0deck

Sorokin Mikhail

email

338347@niuitmo.ru

git

www.github.com/Mikha1l Sorokin