



Knowledge Graph Embeddings for Recommender Systems

PhD Candidate:

Enrico Palumbo

1. Introduction

Recommender Systems (RS) provide personalized suggestions of items that a user may like. RS leverage different sources of information, such as: 1) the history of the user 2) other users' behavior 3) item content. All of these heterogeneous interactions can be easily modelled in semantic graph structures known as Knowledge Graphs (KG). However, extracting effective feature vectors for recommendation from such complex structures is not a trivial task.

2. Goals

The goal of this thesis is to explore the use of machine learning algorithms that automatically learn feature vectors from a knowledge graph (Knowledge Graph Embeddings) to perform recommendations.

3. Method

In order to preserve the semantics of the KG properties and to learn effective features for recommendations, I have introduced entity2rec [1]. It works as follows (Fig. 1): a) split the KG in a set of property-specific subgraphs b) apply a state-of-the-art graph embedding algorithm (node2vec) on the subgraphs, obtaining property-specific embeddings and user-item relatedness scores c) aggregate property-specific user-item relatedness scores into a global user-item relatedness score for recommendations. In this way, the semantics of properties is preserved in the recommendation model (see 'c' in Fig.1), making it more interpretable.

4. Results

entity2rec achieves better serendipity compared to state-of-the-art collaborative filtering algorithms and existing KG embeddings algorithms on three standard datasets (Fig. 2).

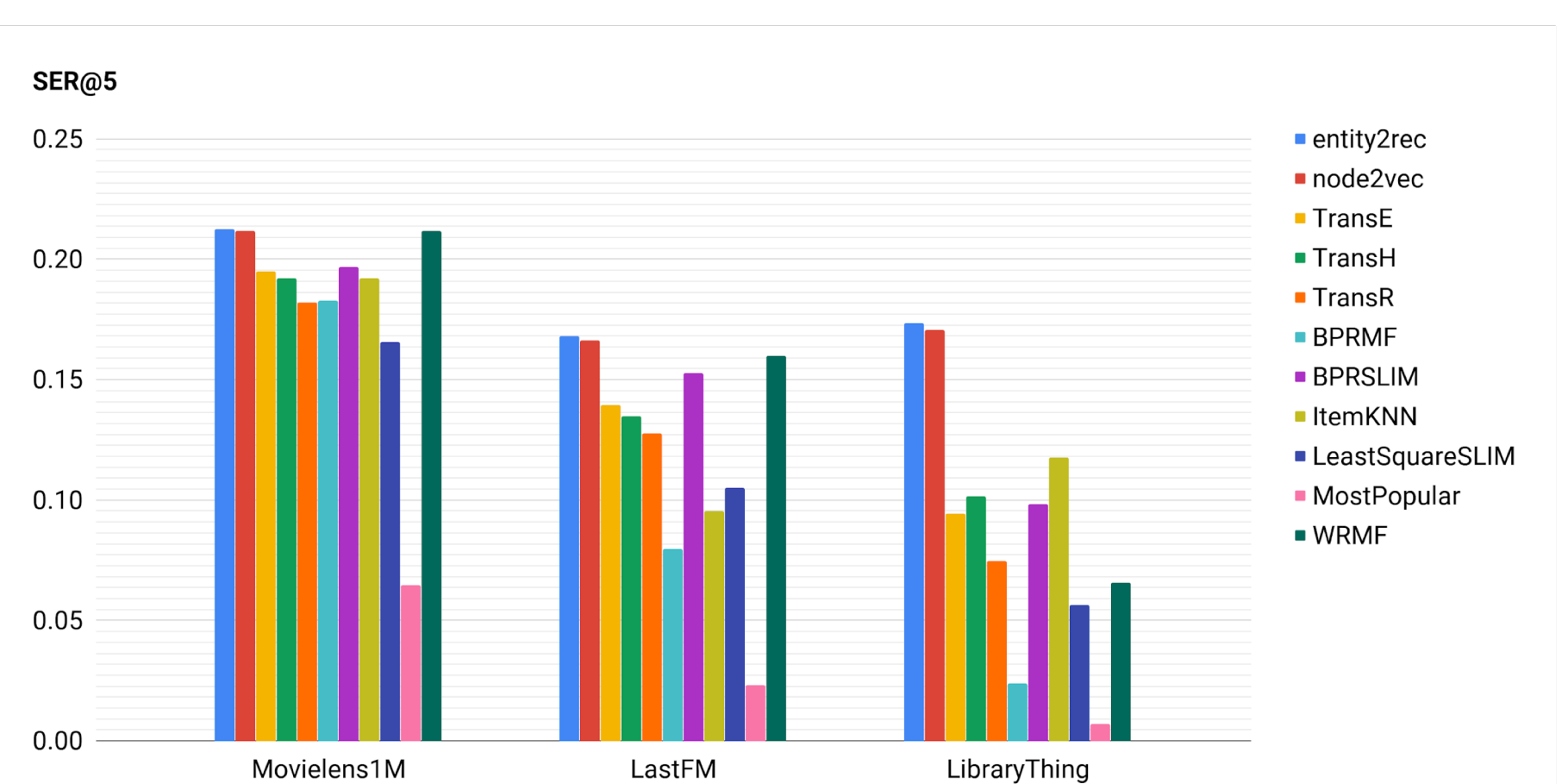


Fig.2

I have also created the book recommendation app Tinderbook (www.tinderbook.it) based on entity2rec. It achieves roughly ~50% of precision, given only one book liked by the user [2].

6. References

- [1]: Palumbo, Enrico, et al.. "Entity2rec: Learning user-item relatedness from knowledge graphs for top-n item recommendation." *Proceedings of the Eleventh ACM Conference on Recommender Systems*. ACM, 2017.
- [2]: Palumbo, Enrico, et al.. "Tinderbook: Fall in Love with Culture." *European Semantic Web Conference*. Springer, Cham, 2019.

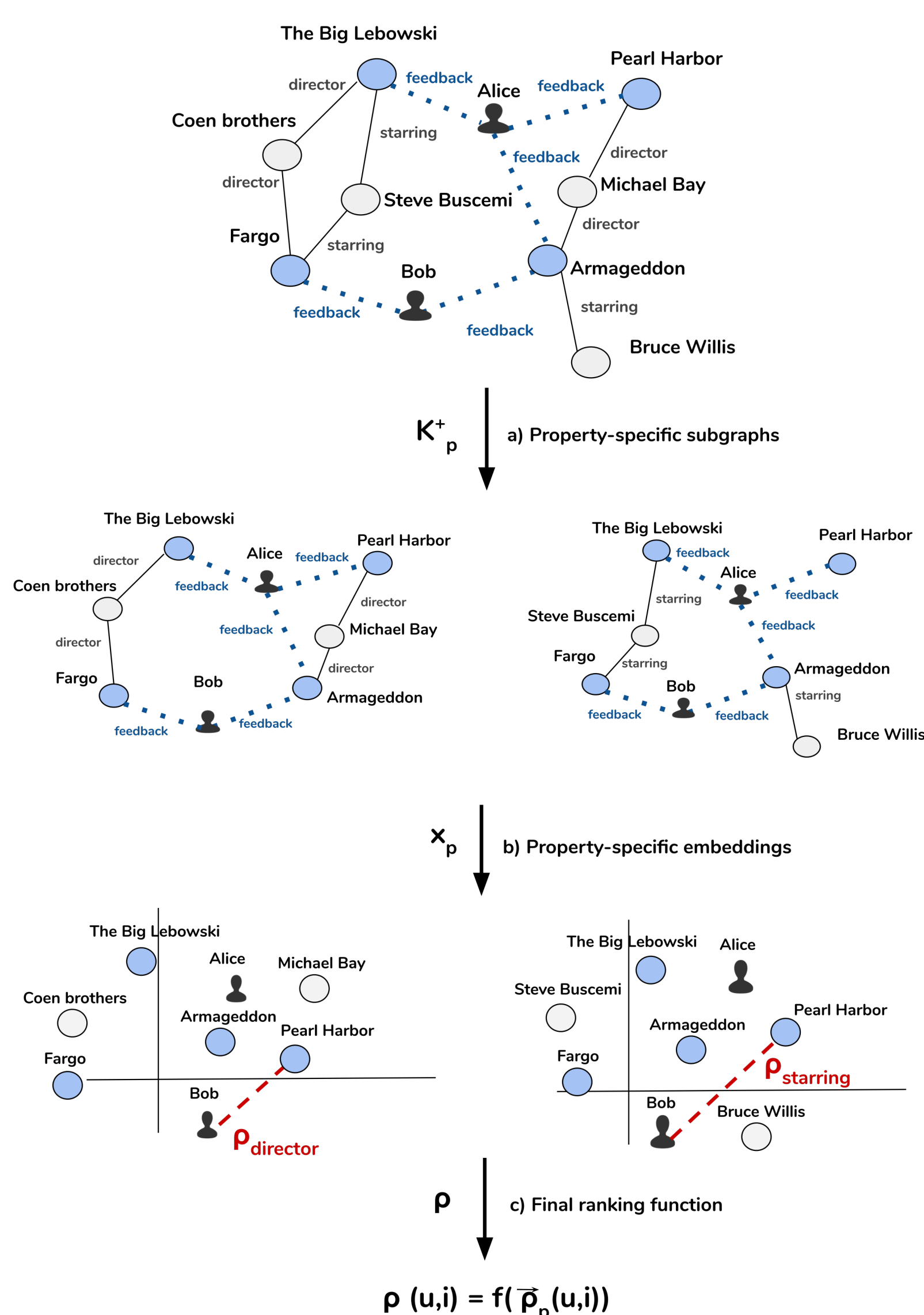


Fig. 1