Research Statement

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I have broad research interests. I am currently interested in NLP and knowledge graphs, especially knowledge-enhanced pretrained language models (PLMs) and knowledge graph reasoning. Before that, I worked on data mining, graph representation learning and its applications in recommender systems. My research scope can be roughly divided into the following two aspects: (1) fashion analysis towards clothing matching and (2) recommender system.

Overall, my research goal is to mine knowledge from data and text, as well as incorporating knowledge into deep models.

1 Fashion Analysis towards Clothing Matching

Nowadays, as beauty-enhancing product, fashion items play an important role in human's social life. In fact, the key to a proper outfit usually lies in the harmonious clothing matching. Nevertheless, not everyone is good at clothing matching. It thus deserves our attention to develop an effective clothing matching scheme to help people figure out the suitable match for a given item and make a harmonious outfit.

Clothing Matching Based on Multi-modal Data Recently, with the proliferation of fashion-oriented online communities, fashion experts can publicly share their fashion tips by showcasing their outfit compositions. We thus crawled outfits from Polyvore, a fashion-oriented online community, to construct the FashionVC dataset [5], where each fashion item (e.g., a top or bottom) has an image and context metadata (e.g., title and category). We also proposed an autoencoder-based neural scheme to model the compatibility between fashion items based on the multi-model data. The work has received nearly 100 citations and inspired many follow-up studies.

Graph-based Outfit Recommendation As each outfit usually involves multiple complementary items (e.g., tops, bottoms, and shoes), it is important to model the complex relationships among multiple items when measuring their compatibility (how well these clothes match with each other). The existing work usually measure the pairwise compatibility between each two items at each time, or model an outfit as a sequence and utilize recurrent neural network to model the compatibility. By contrast, we came up with the idea to model an outfit as a graph and leverage Graph Neural Networks (GNNs) to better model the high-order item relationships in an outfit [1].

Semi-supervised Clothing Matching To learn the clothing matching model, previous works require massive supervision data. However, these annotated data are expensive to obtain and hard to cover the numerous and increasing clothing items in real applications, and so these supervised methods often fail to achieve satisfactory performance. To lower the demand for expensive supervision data., we proposed a semi-supervised clothing matching model [3]. Inspired by some related works on NLP, I found that the

distributions of different fashion categories possessed intrinsic similar structures according to styles, which was also verified through my experiments. Our proposed method based on WGAN is able to align the distribution of different categories, and achieve satisfactory performance with few supervision data.

2 Recommender Systems

Graph-based Click-through Prediction The key to click-through prediction is to capture the useful cross features, that is to model the feature interactions among different feature fields. The exiting work usually fail to model high-order feature interactions in an explicit and explainable manner. We first propose to model the multi-field features in the graph structure, where each node corresponds to a feature field, and the edges indicate their interactions. To better model the feature interactions on the graph, we proposed a Feature Interaction Graph Neural Network (Fi-GNN) [2]. This is the first graph-based CTR prediction work, and has been selected as baseline by Huawei's FuxiCTR Recommender System [8].

Although GNN has shown great potential in modeling high-order feature interactions for CTR prediction, it lacks of effective operation to detect the beneficial feature interactions and inject them into the feature representation. Factorization machine (FM) is a prevalent approach to modeling pairwise (second-order) feature interactions when dealing with high-dimensional sparse data, but fails to capture the higher-order ones. To leverage their complementary advantages and solve their issues, we propose a novel model Graph Factorization Machine (GraphFM). We devise a novel mechanism to select the beneficial feature interactions and formulate them as edges in a graph. Then our proposed model which integrates the interaction function of FM into the neighborhood aggregation scheme of GNN, can model arbitrary-order feature interactions in the graph by stacking layers.

Graph-based Collaborative Filtering Existing Graph-based collaborative filtering (CF) algorithms usually models the user-item interactions as a bipartite graph, where users and items are two isolated node sets and edges between them indicate their interactions. However, they only consider the interaction signal while ignoring the important user/item similarity signal. To this end, we propose to model user-item interactions as a heterogeneous graph which consists of not only user-item edges indicating their interaction but also user-user edges indicating their similarity [4]. We develop a GCN-based framework which can explicitly capture both the interaction signal and similarity signal through embedding propagation on the heterogeneous graph.

As for session-based recommendation, recent research mainly models the target session as a sequence or a graph to capture item transitions within it, ignoring complex transitions between items in different sessions that have been generated by other users. These item transitions include potential collaborative information and reflect similar behavior patterns. We thus propose a novel method to model item transitions within not only the target session but also the neighbor sessions [7].

Cold-start Sequential Recommendation Sequential recommendation aims to capture user's dynamic preferences based on historical behavior sequences and acts as a key component of most online recommendation scenarios. However, most previous methods have trouble recommending cold-start items, which are prevalent in those scenarios. I collaborated with two undergraduate students to explore meta-learning in sequential recommendation to alleviate the item cold-start problem [6]. The proposed method effectively extracts user preference from limited interactions and learns to match the target cold-start item with the potential user. Besides, it can be painlessly integrated with neural network-based models.

3 Future Direction: Knowledge-enhanced LM

A long-standing goal of artificial intelligence is to build machines like Apple Siri, Amazon Alexa that can ground on world knowledge to interact with a human to accomplish desired tasks. Recently, pre-trained language models such as BERT have achieved groundbreaking results across a wide range of Natural Language Processing tasks. Although they can well capture the semantic and syntactic patterns from plain text, they rarely consider incorporating knowledge graphs (KGs), which can provide rich structured knowledge facts. Therefore, I aim to develop methods that can utilize KGs to enhance the language models, that is to help them "**memorize**" the knowledge. Beyond that, I look forward to advancing these language models to **reason** based on the knowledge.

References

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