CONTEXT AWARE REPRESENTATIONS FOR RECOMMENDATIONS USING OPTIMIZATION ALGORITHM OF COT

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ABSTRACT

With the rapid growth of various applications on the Internet, recommender systems become fundamental for helping users alleviate the problem of information overload. Since contextual information is a significant factor in modeling the user behavior, various context-aware recommendation methods have been proposed recently. The state-of-the-art context modeling methods usually treat contexts as certain dimensions similar to those of users and items, and capture relevances between contexts and users/items.

However, such kind of relevance has much difficulty in explanation. Some works on multi-domain relation prediction can also be used for the context-aware recommendation, but they have limitations in generating recommendations under a large amount of contextual information. Motivated by recent works in natural language processing, we represent each context value with a latent vector, and model the contextual information as a semantic operation on the user and item. Besides, we use the contextual operating tensor to capture the common semantic effects of contexts. Experimental results show that the proposed Context Operating Tensor (COT) model yields significant improvements over the competitive compared methods on three typical datasets. From the experimental results of COT, we also obtain some interesting observations which follow our intuition.

I. INTRODUCTION

MATRIX FACTORIZATION

Matrix Factorization (MF) based methods have become a state-of-the-art approach to recommender systems. The basic objective of MF is to factorize a user-item rating matrix into two low rank matrices, each of which represents latent factors of users or items. With the multiplication of two factorized matrices, the original matrix can be reconstructed, and rating predictions are obtained accordingly.

SVD++ combines neighborhood models with latent factor models in one prediction function. There are some MF based methods which are designed for a specific kind of contexts, such as the time factor and entity attributes. Koren proposes a model named time which is one of the most effective models for timeaware recommendation. Xiong et al add the time factor as a new dimension to the rating matrix, and factorize a three-dimensional tensor. Attribute-aware MF is another important direction of MF extensions. The attribute-aware recommender systems extend the conventional MF model to handle user and item attributes..

CONTEXT REPRESENTATION

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There are various types of context values in practical recommender systems, such as categorical value, categorical set value and numerical value. Here, we show how different types of context values can be transformed into corresponding latent representations..

Categorical domain: If a user watches a movie in a theater, theater is the categorical context value.retrieval. CBIR aims at avoiding the use of textual descriptions and instead retrieves images based on similarities in their contents (textures, colors, shapes etc.) to a user-supplied query image or user-specified image features. 2 Content-based image retrieval (CBIR), also known as query by image content (QBIC) and content-based visual information retrieval is the application of computer vision techniques to the image retrieval problem, that is, the problem of searching for digital images in large databases. Content-based image retrieval is opposed to concept-based approaches.

Content-based means that the search analyzes the contents of the image rather than the metadata such as keywords, tags, or descriptions associated with the image. The term content in this context might refer to colors, shapes, textures, or any other information that can be derived from the image itself.

CBIR is desirable because most web-based image search engines rely purely on metadata and this produces a lot of garbage in the results. Also having humans manually enter keywords for images in a large database can be inefficient, expensive and may not capture every keyword that describes the image. Thus a system that can filter images based on their content would provide better indexing and return more accurate results.

Text based information retrieval is the application of computer vision techniques to the image retrieval problem, that is, the problem of searching for digital images in large databases.Text-based means that the search analyzes the text of the image such as keywords, tags, or descriptions associated with the image.

II. RELATED WORKS

Context-Aware Recommender Systems
Contextual information has been proved to be useful for recommender systems and various context-aware recommendation methods have been developed. According to the survey of pre-filtering, post-filtering and context modeling. Employing the pre-filtering or post-filtering strategy, conventional methods

The measurement or counting purposes, all the details of an image is not necessary . Example, a machine inspected items on an assembly line, the only matters of interest may be shape, size or colour is used to simplify the image . Measure the size and shape of the animal without being distracted by unnecessary detail.Searches over all scales and image locations.A difference-of-Gaussian function to identify potential interest points that are invariant to scale and orientation.

Multi-Domain Relation Prediction
A keypoint has been found by comparing a pixel to its neighbors and is to perform a detailed fit to the nearby data for location, scale, and ratio of key curvatures. The low contrast points or poorly localized along an edges are removed by key point localization. Image

similarity assessment is essentially important to various multimedia information processing systems and applications, such as compression, restoration, enhancement, copy detection, retrieval, and recognition/classification. The major goal of image similarity assessment is to design algorithms for automatic and objective evaluation of similarity in a manner that is consistent with subjective human evaluation.

Representation Learning

Based on local image gradient directions,one or more orientations are assigned to each keypoint location. Image data that has been transformed relative to the assigned orientation, scale, andlocation for each feature.

Descriptor Generation Using Vocabulary Tree

The keypoints are transformed into a representation thatallows for significant levels of local shape distortion and change in illumination.The vocabulary tree defines a hierarchical quantizationthat is built by hierarchical k-means clustering. A largeset of representative descriptor vectors are used in theunsupervised training of the tree. The indexing descriptors extracted from local image region and is robust to backroundclutter.The local region descriptors are hierarchically quantized into a vocabulary tree. The vocabulary tree allows a larger and more discriminatory vocabulary to be used efficiently, which leads to a dramatic improvement in retrieval quality. The most significant property of the scheme is that the tree directly defines the quantization.The

quantization and the indexing are fully integrated.

Contextual Operating Tensor

We need two weighting matrices to map the latent matrix of a specific context combination into the operation matrices. For example, we need to estimate two matrices for each Hi and obtain operation matrices MUci and MVci .

III. SYSTEM FRAMEWORK

RELEVANCE FEEDBACK METHOD

A number of powerful image retrieval algorithms have been proposed to retrieve the images from databases. Content-Based Image Retrieval (CBIR) is the mainstay of current image retrieval systems. In general, the purpose of CBIR is to present an image conceptually, with a set of low-level visual features such as color, texture, and shape. These conventional approaches for image retrieval are based on the computation of the similarity between the users query and images via a query by example (QBE) system. Despite the power of the search strategies, it is very difficult to optimize the retrieval quality of CBIR within only one query process. The hidden problem is that the extracted visual features are too diverse to capture the concept of the user's query. To solve such problems, in the QBE system, the users can pick up some preferred images to refine the image explorations iteratively. The feedback procedure, called Relevance Feedback (RF), repeats until the user is satisfied with the retrieval results.

The Relevance Feedback method find an optimal solution to resolve the problems existing in current RF, such as redundant browsing and

exploration convergence. The approximated solution takes advantage of exploited knowledge (relavance feedbacks) to assist the proposed search strategy in efficiently hunting the desired images.

Generally, the task of the proposed approach can be divided into two major operations,

For image retrieval operation, once a query image is submitted to this system, the system first finds the most similar images without considering any search strategy, and then returns a set of the most similar images. The first query process is called initial feedback. Next, the good examples picked up by the user deliver the valuable information to the image search phase, including new feature weights, new query point, and the user's intention. Then by using the relevance feedback, three search strategies are hybridized to find the desired images. Overall, at each feedback, the results are presented to the user and the related browsing information is stored in the log database. After accumulating long-term users browsing behaviors, offline operation for knowledge discovery is triggered to perform relavance feedback mining and pattern indexing.

The Relevance Feedback method used to efficiently optimize the retrieval quality of interactive Content Based Image Retrieval System. The input derived from the users long-term browsing behaviors. This technique used as a good support for minimizing the number of user feedbacks. The algorithm to match the users intention by merging three query refinement strategies.

As a result, traditional problems such as visual diversity and exploration convergence are solved. Search makes use ofthe discovered relavance feedbacks and three kinds of query refinement strategies, Query Point Movement, Query Reweighting, and Query Expansion, to converge the search space toward the user's intention effectively.This method provides accurate results based on ranking system and reduces Memory cost. Most similar images are retrieved from log databases and provide effective image retrieval system.

IV. CONCLUSION AND FUTURE WORK

In this work, a novel context-aware recommendation method, i.e., COT, has been proposed. We provide each context value with a continuous vector, which is a distributed representation. Such representations have a powerful ability in describing the semantic operation of context values. Similar to the semantic composition in NLP where the adjective has an operation on the noun, we provide the contextual information of each rating event with a semantic operation matrix, which can be used to generate new vectors of users and items under this contextual situation. At the same time, the common semantic effects of contexts can be captured by contextual operating tensors. Then the contextual operating matrix can be calculated from the contextual operating tensor and context representations. The experimental results on three real datasets show that COT outperforms state-of the art context-aware models. We also observe that the potential relation among the context values is interesting and follows our intuition. And context weights of COT can be used to explain the importance of context values in changing vectors of users and items.

In the future, we would like to introduce a pairwise ranking constraint on the contextual information. A user-item interaction can be generated under specific contextual information but cannot be yielded under other contextual situations. This kind of pairwise ranking constraint reveals the relative information among different contextual situations and can be used to further enhance context modeling. Moreover, since the top-n recommendation is another significant measurement of recommender systems, analyzing the ranking performance of the COT framework will be a very interesting issue in future.

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