

CROSS SITE COLD START PRODUCT RECOMMENDATION LINKING E-COMMERCE TO SOCIAL NETWORKING SITE

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Abstract: Now-a-days, the boundaries between e-commerce and social networking sites have become increasingly blurred. Most of the e-commerce websites support the mechanism of social login where users can sign on the social network sites using their Facebook or Twitter accounts. Users can also post their newly purchased products on social sites using links to the e-commerce websites. All these things gave an idea of connecting e-commerce to social networking site. In this paper, we designed a new solution for cross-site cold-start product recommendation, where products are recommended to users at social networking sites from e-commerce websites. Here we map the user's social networking features to e-commerce websites. In particular, we gather information from e-commerce websites using recurrent neural networks and apply a modified gradient boosting trees method and feature-based matrix factorization approach

IndexTerms - E-commerce, social networking site, product recommender, recurrent neural networks, cold start product recommendation.

I. INTRODUCTION

In recent times, the boundaries between e-commerce and social networking have become increasingly blurred. E-commerce websites such as eBay features many of the characteristics of social networks, including real-time status updates and interactions between its buyers and sellers.

Most of the e-commerce websites are allowing new users to sign into their sites using users existing login information from social networking services such as Facebook, Twitter or Google+. Both Facebook and Twitter have introduced a new feature last year that allow users to buy products directly from their websites by clicking a "buy" button to purchase items in adverts or other posts. In China, the e-commerce company ALIBABA has made a strategic investment in SINA WEIBO 1 where ALIBABA product adverts can be directly delivered to SINA WEIBO users. It is important to leverage knowledge extracted from social networking sites for the development of product recommender systems for conducting e-commerce activities on social networking sites.

In this paper, we study an interesting issue of recommending products from e-commerce websites to users at social networking sites who do not have historical purchase records, i.e., in "cold-start" situations. We called this problem cross-site cold-start product recommendation. Despite the fact that online product recommendation has been broadly examined previously, most of the studies just spotlight on constructing solutions within certain e-commerce websites and mainly utilize user's historical transaction records. To the best of our insight, cross-site cold-start product recommendation has been rarely studied before.

In our problem setting here, only the user's social networking information is available and it is a challenging task to transform the social networking information into latent user features which can be effectively used for product recommendation. To solve this challenge, we make use of the linked users across social networking sites and e-commerce websites (users who have social networking accounts and have made purchases on e-commerce websites) as a base to map user's social networking features to latent features for product recommendation. In particular, we gather information from e-commerce websites using recurrent neural networks to learn user and product feature representations (i.e.) user and product embeddings and then apply a modified gradient boosting trees method to transform users social networking features into user embeddings. We then use the learnt user embeddings for cold-start product recommendation using feature-based matrix factorization approach.

Our significant commitments are discussed below: We have developed anew solution of recommending products from an e-commerce website to social networking users in "cold-start" situations. To the best of our insight, it has been rarely studied before. For learning correlated feature representations for both users and products from data collected from an e-commerce website we propose to apply the recurrent neural networks.

To convert users microblogging feature attributes to latent feature representation which can be easily incorporated for product recommendation we propose a modified gradient boosting trees method. We use user and product features for cold-start product recommendation by proposing a feature-based matrix factorization approach.

Cold Start Product Recommendation:

Cold Start product recommendation means recommending product to users by overcoming cold start situations.

In general “cold start” situations can be defined in many ways. In our paper we considered two types of cold start situations for solving.

Situation 1: When user does not have any historical purchase records.

Situation 2: When user is in confusion state whether to trust the reviews that are provided for the products in e-commerce websites.

II. LITERATURE SURVEY:**A. E-commerce recommendation of Right product at right time:**

Many e-commerce recommender frameworks that are existing today expect to recommend the right product to a user, in view of whether the client is probably going to buy or like a product. On the other hand, the effectiveness of recommendations also depends on the time of the recommendation. For instance let us consider a user who just purchased a laptop as an example. She may purchase a substitution battery in 2 years (assuming that the PC's unique battery regularly neglects to work around that time) and buy another laptop in an additional 2 years. For this situation, it isn't a smart thought to prescribe another PC or a substitution battery directly after the user bought the new laptop. It could hurt the client's fulfillment of the recommender framework in the event that she gets a possibly right item proposal at the wrong time. We contend that a framework ought suggest the most pertinent thing, as well as prescribe at the perfect time.

B. Product recommendations and Retail sales prediction and using customer statistical information at store level:

This paper plots a retail deals expectation and item suggestion framework that was actualized for a chain of retail locations. The relative significance of buyer statistic attributes for precisely displaying the offers of every client type are determined and actualized in the model. Information comprised of day by day deals data for 600 items at the store level, broken out over an arrangement of non-covering client types. A recommender framework was fabricated in view of a quick online thin Singular Value Decomposition. It is demonstrated that displaying information at a better level of detail by bunching crosswise over client composes and demographic yields enhanced execution contrasted with a solitary total model worked for the whole dataset. Subtle elements of the framework usage are depicted and practical issues that emerge in such real-world are talked about. Preparatory outcomes from test stores over a one year time span demonstrate that the framework brought about altogether expanded deals and enhanced efficiencies. A short outline of how the essential strategies talked about here were stretched out to a considerably bigger informational collection is given to affirm and represent the versatility of this approach.

C. Amazon.com recommendations Item-to-item collaborative filtering:

Online e-commerce Web sites makes use of recommendation algorithms, where they utilize contribution about a customer's importance to create a rundown of prescribed products. Numerous applications utilize just the things that customers buy and easily rate to speak to their interests, yet they can likewise utilize different properties, including things saw, statistic information, subject interests, and most loved artists. The store profoundly changes in view of client interests, demonstrating programming titles to a software engineer and infant toys to a new mother. There are three basic ways to deal with tackling the proposal issue: customary collaboration filtering, cluster models, and inquiry based techniques. Here, we contrast these techniques and our algorithm, which we call thing-to-thing collaborative filtering. Dissimilar to conventional collaborative filtering, our algorithm online calculation scales autonomously of the quantity of customers and number of things in the item list. Our calculation produces proposals progressively, scales to huge informational indexes, and produces high quality recommendations.

III. PROPOSED SYSTEM

We have developed an application which is combination of both social networking site and e-commerce website. We have connected e-commerce to social networking site where user can purchase the product of his choice directly from social networking site without logging into e-commerce website. We developed the following components:

- 1.Admin
- 2.User
- 3.E-commerce

Admin:

In this module Admin has rights to see all the operations done by users. Admin first add Categories later add Products and make them visible to users. Based on user activities Admin maintains different products and admin also monitors all registered users and their actions like friend requests, searches and recommendations.

User:

In this module we develop the Online Social Networking (OSN) system module. We build up the system with the feature of Online Social Networking. Where, this module is used for new user registrations and after registrations the users can login with their authentication.

E-commerce:

In this module E-commerce will login to the social media site and checks for all purchased products and users, total bill on purchased products from that site.

ARCHITECTURE:

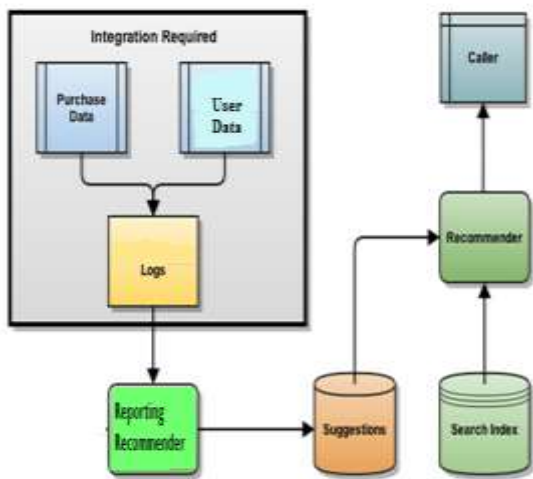


Figure 1 : Architecture

MODULES:

1. OSN System Construction Module
2. Micro blogging Feature Selection
3. Learning Product Embeddings
4. Cold-Start Product Recommendation

MODULES DESCRIPTION:**1. OSN System Construction Module:**

In the first module, we develop the Online Social Networking (OSN) system module. We build up the system with the feature of Online Social Networking. Where, this module is used for new user registrations and after registrations the users can login with their authentication.

Where after the existing users can send messages to privately and publicly, options are built. Users can also share post with others. The user can able to search the other user profiles and public posts. In this module users can also accept and send friend requests.

With all the basic feature of Online Social Networking System modules is build up in the initial module, to prove and evaluate our system features.

Given an e-commerce website, with a set of its users, a set of products and purchase record matrix, each entry of which is a binary value indicating whether has purchased product. Each user is associated with a set of purchased products with the purchase timestamps. Furthermore, a small subset of users can be linked to their microblogging accounts (or other social network accounts).

2. Microblogging Feature Selection:

In this module, we develop the Microblogging Feature Selection. Prepare a list of potentially useful microblogging attributes and construct the microblogging feature vector for each linked user. Generate distributed feature representations using the information from all the users on the ecommerce website through deep learning. Study the mapping function, which changes the microblogging attribute data au to the distributed component representations in the second step. It uses the feature representation pairs of all the connected users as training data.

A demographic profile (often shortened as “a demographic”) of a user such as sex, age and education can be used by ecommerce companies to provide better personalized services. We extract users’ demographic attributes from their public profiles. Demographic attributes have been shown to be very important in marketing, especially in product adoption for consumers.

3. Learning Product Embeddings:

In the previous module, we develop the feature selection, but it is not straightforward to establish connections between users and products. Intuitively, users and products should be represented in the same feature space so that a user is closer to the products that he/she has purchased compared to those he/she has not. Inspired by the recently proposed methods in studying word embeddings, we propose to learn user embeddings or distributed representation of user in a same way.

Given a set of symbol sequences, a fixed-length vector representation for each symbol can be learned in a latent space by exploiting the context information among symbols, in which “similar” symbols will be mapped to nearby positions. If we represent each product ID

as a word token and transform the historical purchase records of a user into a timestamped sequence, we can then use the same methods to learn product embeddings. Not like matrix factorization, the order of historical purchases from a user can be naturally captured.

4. Cold-Start Product Recommendation

We used a local host based e-commerce dataset, which contains some user transaction records. Each transaction record consists of a user ID, a product ID and the purchase timestamp. We first group transaction records by user IDs and then obtain a list of purchased products for each user.

For our methods, an found important component is the embedding models, which can be set to two simple architectures, namely CBOW and Skip-gram. By comparing the results of our method using these two architectures, it is found that that the performance of using Skip-gram is slightly worse than that of using CBOW.

IV. METHODOLOGY

Matrix factorization algorithm

There is most likely no compelling reason to state that there is excessively data on the Web these days. Web search tools help us a little bit. Recommending something interesting to a user automatically without asking is the best thing that can ever happen. Certainly, if we consider the list of the most popular bookmarks on Delicious, to some more personalized recommendations we get on Amazon, we are usually offered recommendations on the Web.

By using a wide range of algorithms recommendations can be generated. Product-based or user-based collaborative filtering matrix factorization techniques are usually more effective when compared to product based and user based filtering methods which are even more simple and instinctive, the reason is matrix factorization techniques help in discovering the latent features underlying the interactions between users and items. Matrix factorization is applicable in various situations where one would like to discover something new hidden under the data and it is just a mathematical tool which is used for matrices.

Matrix factorization is a method to factorize a matrix as the name suggests which means finding out two (or more) matrices such that when we multiply them we will get back the original matrix.

To discover latent features underlying the interactions between two different kinds of entities matrix factorization can be used as mentioned above. (We can even consider more than two kinds of entities and in such case you will be dealing with tensor factorization, which would be more complicated). To predict ratings in collaborative filtering is another application of matrix factorization.

V. CONCLUSION

In this paper, we studied “cold start” situation, a problem which has been rarely explored before and we developed a new solution for cross-site cold-start product recommendation, where products are recommended to users at social networking sites from e-commerce websites without historical purchase records. Our primary thought is that on the e-commerce websites, users and products can be represented in the same latent feature space through feature learning with the recurrent neural networks. To map user’s social networking features to another feature representation for product recommendation we make use of the users who are linked across social networking sites and e-commerce websites. We then use the learnt user embeddings for cold-start product recommendation using feature-based matrix factorization approach.

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