ABSTRACT

Recommendation systems are the techniques that are used to predict the rating one individual will give to an item or social entity. The items can include books, movies, restaurants and things on which individuals have different preferences. These preferences are being predicted using two approaches first content-based approach which involves characteristics of an item and second collaborative filtering approaches which considers user's past behaviour to evaluate its choices. This thesis proposes a fashion recommendation system which will recommend clothing images supported the style sort of the provided clothing images. In this work, we focus on the images of upper body as well as the lower body clothing and with human model in the images. We have created our own datasets through web scrapping of different e-commerce websites. In this paper we have come up with an idea to build a content-based recommendation system using ResNet-50 convolutional neural network.

INTRODUCTION

Recommender systems help users navigate large collections of products to find items relevant to their interests leveraging large amounts of product information and user signals like product views, followed or ignored items, purchases or web-page visits to determine how, when and what to recommend to their customers. Recommender systems have grown to be an essential part of all large Internet retailers, driving up to 35% of Amazon sales [103] or over 80% of the content watched on Netflix [31]. In this work we are interested in recommender systems that operate in one particular vertical market: garments and fashion products. This setting introduces a particular set of challenges and sub-problems, that are relevant for developing effective recommender systems. Due to market dynamics and customer preferences, there is a large vocabulary of distinct fashion products, as well as high turnover.

This leads to sparse purchase data, which challenges the usage of traditional recommender systems [83]. Furthermore, precise and detailed product information is often not available, making it difficult to establish similarity between products. To deal with the aforementioned problems, and given the visual and aesthetic nature of fashion products, there is a growing body of computer vision research addressing tasks like localizing fashion items [50, 151], determining their category and attributes [24, 43, 145], or establishing the degree of similarity to other products [7, 46, 97, 99], to name only a few. In addition to allowing recommendations tailored to match the existing shopping basket or wardrobe of customers, these datasets help uncover other insights useful for recommender systems, such as the structure of fashion styles [61], social group preferences [81], or the evolution of trends across time and location [104, 106]. In addition to product-to-product relationships, fashion recommender systems also face particular product-to-user uncertainties, like fit, that can hurt the quality of recommendations if not taken into account. Fit prediction is a pain point for online fashion shopping according to customers, and the primary reason for product returns faced by online retailers [33]. The many sizing systems in use throughout the world, as well as their interpretation by different clothing manufacturers, make it very difficult to predict whether a particular product will properly fit a customer. Therefore, research on how to estimate a personalized garment fit has leveraged sources of information like co□purchase data [124], customer-reported measurements [112], or advanced imaging devices such as 3D scanners [11, 12, 35]. Needless to say, this information can be very valuable for recommendation.

Major Challenges

In this section we will describe the major challenges faced by recommender systems in the fashion domain.

Fashion item representation:

Traditional recommender systems such as Collaborative Filtering or Content-Based Filtering have difficulties in the fashion domain due to the sparsity of purchase data. However, learning product representations from such input data requires large datasets to generalize well across different

image (or text) styles, attribute variations, etc. Furthermore, constructing a representation that learns which product features customers take most into account when evaluating fashion products is still an open research problem.

Fashion item compatibility:

Training a model that is able to predict if two fashion items 'go together,' or directly combine several products into an outfit, is a challenging task. An additional under explored difficulty for compatibility prediction is the dependency on trends, seasonality, location or social group. Current approaches usually leverage image and text information.

Personalization and fit:

The best fashion product to recommend depends on factors such as the location where the outfit will be used [8, 23, 80, 143], the season or occasion [98, 105, 162], or the cultural and social background of the customer [81, 131, 165]. A challenging task in fashion recommendation systems is how to discover and integrate these disparate factors [127, 147]. Current research often tackles these tasks by utilizing large-scale social media data. As discussed earlier, a personalization dimension very particular to the fashion domain is that of fit. In addition to predicting what size of a product will be more comfortable to wear, body shape can influence stylistic choices [58, 60, 122].

Interpretability and Explanation:

Most of the existing fashion recommender systems in the literature focus on improving predictive performance, treating the model as a black box. However, deploying accountable and interpretable systems able to explain their recommendations can foster user loyalty in the long term and improve the shopping experience. Current models generally offer explanations through highlighted image regions and attributes or keywords [47, 59, 89, 110, 149, 155].

Discovering Trends:

Being able to forecast consumer preferences is valuable for fashion designers and retailers in order to optimize product-to-market fit, logistics and advertising. Many factors are confounded in what features are considered 'fashionable' or 'trendy', like seasonality [105], geographical

influence [8], historical events [63]. Again, social media is a useful resource leveraged by researchers [41, 67].

Publication date:

The challenges above, as well as many other issues have been discussed in the studied research works, and they are reviewed in the following sections. For instance, visual modelling of fashion items.

Literature survey

Myntra-Matching Clothes Recommendation:

On selecting a particular item to buy, Myntra automatically suggests a full set of clothes that are matching to the selected item. For example, on selecting a particular t-shirt, the system automatically generates a combination of watches, shoes, pants, etc. that are matching to the selected t-shirt. This system does not take into consideration private qualities of customers like skin color and existing clothes. It will only suggest clothes that already exist in its database.

Your Closet:

This is a mobile application that organizes the closet. The user interface is shown in Fig. 1. The application asks customer to input their clothes. It then matches each cloth with other clothes. For example, if there are 4 shirts and 4 pants, the application matches each shirt with each pant and thus provides 16 possibilities. The application does not make matches of clothes depending upon patterns, color and texture of clothes. It also does not have a recommendation system.Fig. 1. Your Closet App

Magic Closet:

This system aims to retrieve clothes from online stores that are matching to the input clothes. These clothes must be fit to a particular occasion. In this system, the user takes a photo of them specifying if they

want to use the top or bottom clothes along with the occasion they want to use it for. The system will search for clothing that matches the user query and satisfies the criterion of wearing aesthetically and wearing properly [1].

Which Clothes to wear confidently?

The basic problem the system addresses is: From the two given images corresponding to a pair of clothes, we have to determine if the pair of clothes matches or not. While there may be several aesthetics espoused by dierent individuals, it takes a simplistic approach in this problem. An example of shirts and ties is used. Various machine learning methods are used to classify if the clothes are matching or not such as Ridge Regression, Standard Neural Network and Siamese Neural Network [2].

Personalized Clothing Recommendation Based on Knowledge Graph:

This system attempts to exploit the knowledge graph for providing clothing recommendations to the user keeping the user context in mind. The recommendation is done by calculating the similarity in the clothing ontology similar to users collection [8].

Skin and Clothes matching seeded by Color System Selection:

The main aim of the system is to suggest clothes to user based on skin color. The paper first finds out which color scheme is best suited to represent skin colors and then tries to find a way to recommend if clothes and skin color match. An automated system to determine the highest levels of color suitability between skin and clothing was made [3].

Discerning Advisor:

The system tries to recommend clothes based on skin olor of the customer. Using a neural network, first the skin color is detected. Fuzzy logic is used to map a skin color to the skin color of a fashion model, and clothes suited to that model are recommended [4].

Garment Detectives:

The garment detection is to detect the presence of clothes in images and somewhat locate their extents, where the localization can be defined from coarse (image) level to fine (pixel) level [5]. A unified system is proposed for detecting and recognizing clothes in customer photos.

Identifying Corners of Clothes by Image Processing:

This system aims to find the edges of the clothes for clothes manipulation. This system achieves this by finding pixels that represent the clothes. This system first accepts user image and then performs several image processing operations to improve the efficiency of edge detection. It then uses certain criterion to decide whether a pixel represents an image or not [6].

Real-time Clothing Recognition from Surveillance Videos [7]:

It is an analysis system of contents of video which is capable of tagging various clothes of different persons is created. First, face detection and tracking is performed and each frame is aligned. The system then proceeds to clothing segmentation using a variant of region growing method. Through this, clothes are detected. The system then proceeds to clothing recognition and indicates the type of clothing – skirt, t-shirt, etc. [7].

CONCLUSION AND FUTURE OUTLOOK

In this survey, we have analyzed and classified the RS that function in a specific vertical market: clothes and fashion goods. In particular, we have introduced a taxonomy of fashion recommender systems, which categorizes them according to the task (e.g., item, outfit, size recommendation, explainability among others), and type of side information (users, items, context). We have also identified the most important evaluation goals (outfit generation, outfit recommendation, pair recommendation, fill in the blank, and outfit compatibility prediction) and perspectives (evaluate the recommendation, the explanation, the generated images, or the social perspectives) exploited by the community, together

with the most common datasets and evaluation metrics. This domain presents a unique collection of challenges and sub-problems pertinent to the development of successful recommender systems. Datasets. We may recall how data collections began with simple “harvested” datasets and progressed to more “curated” datasets in subsequent years (e.g., images from fashion models rather than e.g., co-purchase data). It is interesting to consider which of these methods is preferable and where the field is headed in terms of datasets. Even though harvested datasets are easy to collect and correspond well to real prediction tasks (e.g., purchase estimate), collected datasets are noisy; they may also not reflect the real semantics of visual preferences, compatibility, or other aspects of a user’s experience. In contrast, curated datasets may not match the distribution of real data; or “models” may not represent the preference dimensions of regular users, or the datasets may actually be contrary to one’s goals. While traditional task in fashion RS research involved purchase or co-purchase prediction tasks, recent systems focus on combinatorial outputs (e.g. outfits).