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Personalized fashion recommender system with image based neural networks

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Personalized fashion recommender system with image based neural networks

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Abstract. With an increase in the standard of living, peoples' attention gradually moved towards fashion that is concerned to be a popular aesthetic expression. Humans are inevitably drawn towards something that is visually more attractive. This tendency of humans has led to development of fashion industry over the course of time. However, given too many options of garments on the e-commerce websites, has presented new challenges to the customers in identifying their correct outfit. Thus, in this paper, we proposed a personalized Fashion Recommender system that generates recommendations for the user based on an input given. Unlike the conventional systems that rely on user's previous purchases and history, this project aims at using an image of a product given as input by the user to generate recommendations since many-a-time people see something that they are interested in and tend to look for products that are similar to that. We use neural networks to process the images from DeepFashion dataset and a nearest neighbour backed recommender to generate the final recommendations.

Keywords: personalized, Recommender system, nearest neighbour, fashion, e-commerce, Neural Network

1. Introduction

Humans are inevitably drawn towards something that is visually more attractive. This tendency of humans has led to development of fashion industry over the course of time. With introduction of recommender systems in multiple domains, retail industries are coming forward with investments in latest technology to improve their business. Fashion has been in existence since centuries and will be prevalent in the coming days as well. Women are more correlated with fashion and style, and they have a larger product base to deal with making it difficult to take decisions. It has become an important aspect of life for modern families since a person is more often than not judged based on his attire. Moreover, apparel providers need their customers to explore their entire product line so they can choose what they like the most which is not possible by simply going into a cloth store.

With the rapid growth of Internet technology, intelligent clothing in the fashion retail industry has received more attention. [1] Initially implemented 3D technology to simulate and create virtual store. Based on the customers' preferences, the accessories of the customers' change in [2] that proposed 3D technology an interactive virtual fitting system that guided people to find relevant clothes. Lack of Recommendation techniques in the online store leaves the customers in frustration with exhaustive search. [3] Recognized clothing similar to the frontal view outfit images. Based on customers previous purchasing history, [4] has recommended the clothes to the customers. Thus, the recommendation techniques in virtual stores help the customers to find the suitable and relevant clothes and also the fashion retail industry to gain the profit through the sales .In this paper, we propose a novel personalized Fashion Recommender system on the basis of user preferences. More specifically, we focus on the features of fashion and develop a framework that accepts a single image as an input and returns a top -5 ranked list of similar clothing recommendations.

The rest of the paper is organized as per the following sections. Section 2 discusses the related work of Fashion Recommender system, the proposed framework is discussed in Section 3 and finally Section 4 presents the summary and conclusion of the proposed work.

2. Related work

In the online internet era, the idea of Recommendation technology was initially introduced in the mid-90s[5]. [6] Proposed CRESA that combined visual features, textual attributes and visual attention of the user to build the clothes profile and generate recommendations. [7] Utilized fashion magazines photographs to generate recommendations. Multiples features from the images were extracted to learn the contents like fabric, collar, sleeves, etc., to produce recommendations [8]. In order to meet the diverse needs of different users, an intelligent clothing recommender systems is studied in [9] based on the principles of fashion and aesthetic. To generate garment recommendations, customer ratings and clothing were utilized in [10]. The history of clothes and accessories, weather conditions were considered in [11] to generate recommendations.

Recommender systems can be categorized into two basic approaches for recommending the products i.e., Collaborative filtering and Content-based filtering Recommender system[12][13]. The former approach relies on historical user-item interactions, i.e., user past item rating history and the latter depends on the user profiles and item descriptions to generate recommendations. Recently Deep learning based Neural Collaborative filtering framework[14], that generalizes the matrix factorization approach is extensively used in Collaborative filtering Recommender systems. Modern Recommendation systems consider the dimensions such as purchase histories, user feedbacks, product features, temporal information, etc., However, one significant feature that is ignored by the existing ranking and recommendation approaches is the items' visual appearance to be considered. [15] incorporated visual signals into the users' opinion and proposed a scalable factorization model on large and real world datasets.

An overview of Deep learning based Recommendation systems is detailed in [16][17]. generated product recommendations on the basis of Convolutional Neural Networks based Computer vision tasks for instance object detection, object classification and segmentation. Most of the ecommerce websites depend on the keyword mapping and the knowledge database to generate the recommendations. However, this proved to be inefficient as the product description varies from buyer to seller[18]. General Recommender systems proved to perform poor in recommending the fashion articles due to their high degree of subjectivity[28]. Thus, our approach uses image data of the item, and also prove that it is reasonable to depend on the visual features to generate the item recommendations that are highly appealing and similar to the user tastes and preferences. The approach proposed also mitigates the cold start issue of traditional Collaborative filtering based Recommender systems[18][19].

3. Proposed methodology

In this paper, we propose a model that uses Convolutional Neural Network[20][21]and Nearest neighbour backed recommender. As shown in figure 1 Initially, the neural networks are trained and then an inventory is selected for generating recommendations and a database is created for the items in inventory. The nearest neighbour's algorithm is used to find the most relevant products based on the input image and recommendations are generated.

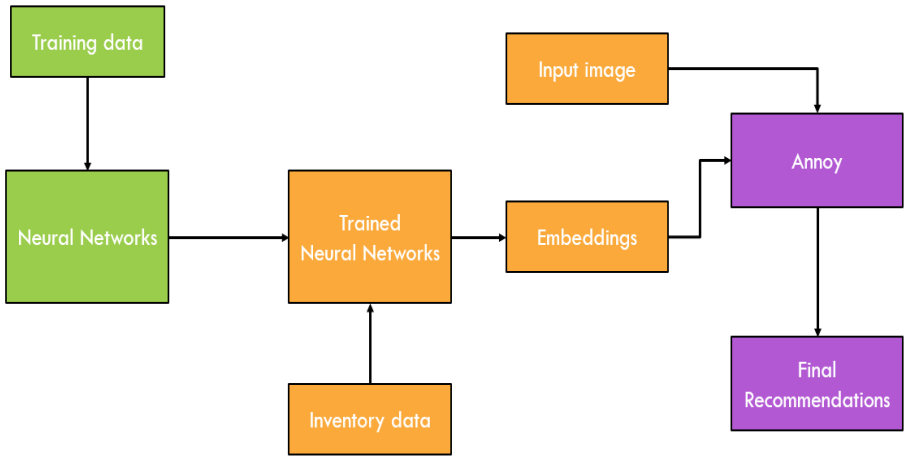

Figure 1. Block diagram of proposed system

3.1. Training the neural networks

Once the data is pre-processed, the neural networks are trained using fastai, utilizing transfer learning from ResNet50. More additional layers are added in the last layers that replaces the architecture and weights from ResNet50 in order to fine tune the network model to serve the current issue. Figure 2 shows the ResNet50 architecture[24].

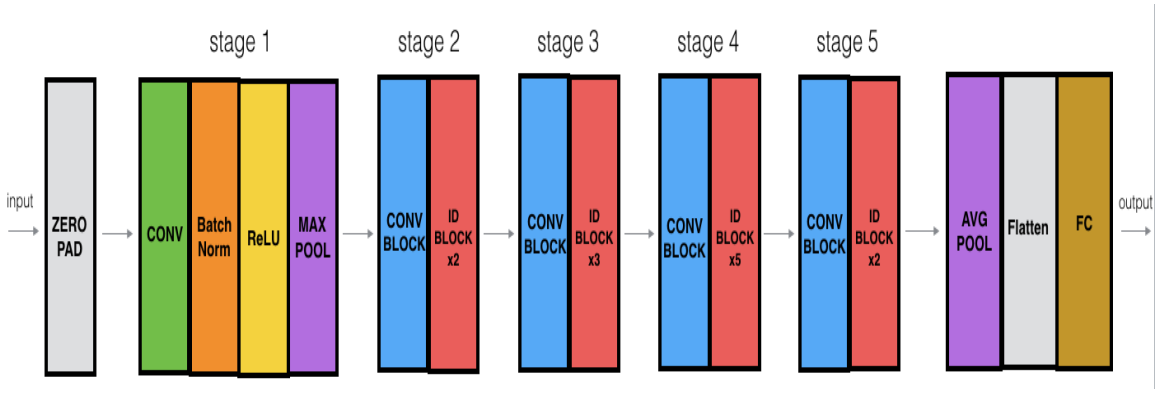

Figure 2. ResNet50 architecture

3.2. Getting the inventory

The images from Rent the Runway's inventory along with some details are added to a database. The inventory is then run through the neural networks to classify and generate embeddings and the output is then used to generate recommendations[22][23]. Figure 3 shows a sample set of inventory data.

Figure 3. Sample inventory data

3.3. Recommendation generation

To generate recommendations, our proposed approach utilizes Spotify's library Annoy i.e. Approximate Nearest neighbours Oh Yeah. This allows us to find the nearest neighbours for the given input image. The similarity measured used in this paper is Cosine Similarity measure. The top 5 recommendations are extracted from the database and their images are displayed[25].

4. Experiment and results

The concept of Transfer learning is used to overcome the issues of the small size Fashion dataset. Therefore we pre-train the classification models on the DeepFashion dataset that consists of 289,222 garment images. The networks are trained and validated on the dataset taken. The training results show a great accuracy of the model with low error, loss and good f-score as shown in Table 1.

Table 1. Performance of the proposed approach for different epochs

Epoch	Train_loss	Validn_losss	Accuracy	Fbeta
0	0.030024	0.029380	0.986307	0.349384
1	0.029840	0.028425	0.985921	0.373826
2	0.027946	0.027426	0.986149	0.400615
3	0.026722	0.027179	0.986413	0.405580

The test set for evaluation are random apparel images from the internet and manually captured images in real world[26][27]. The proposed system is tested using these images which are diverse in nature. From the simulation of the experiment results, we can draw to the conclusion that this method is robust

and effective despite depending only on visual inputs. Figure 4 and figure 5shows the outfits generated by our approach for the given input image.

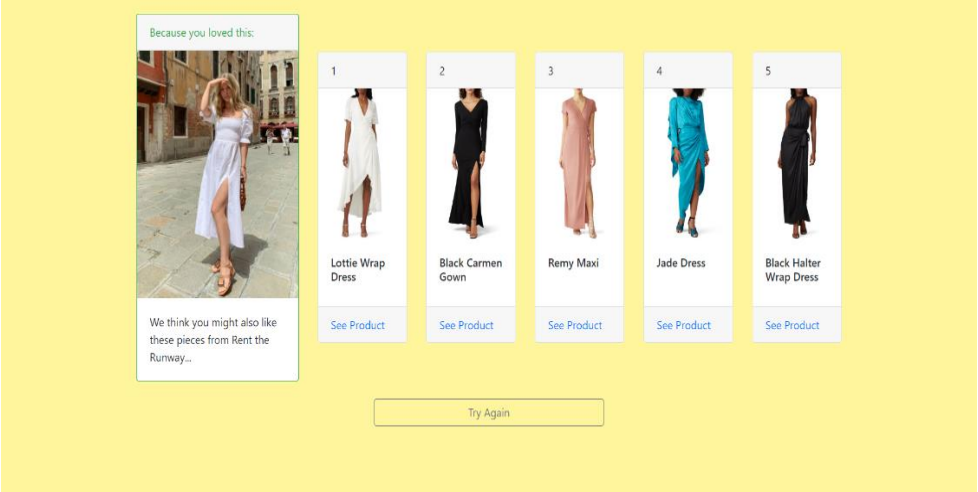

Figure 4. Outfits generated by our proposed approach

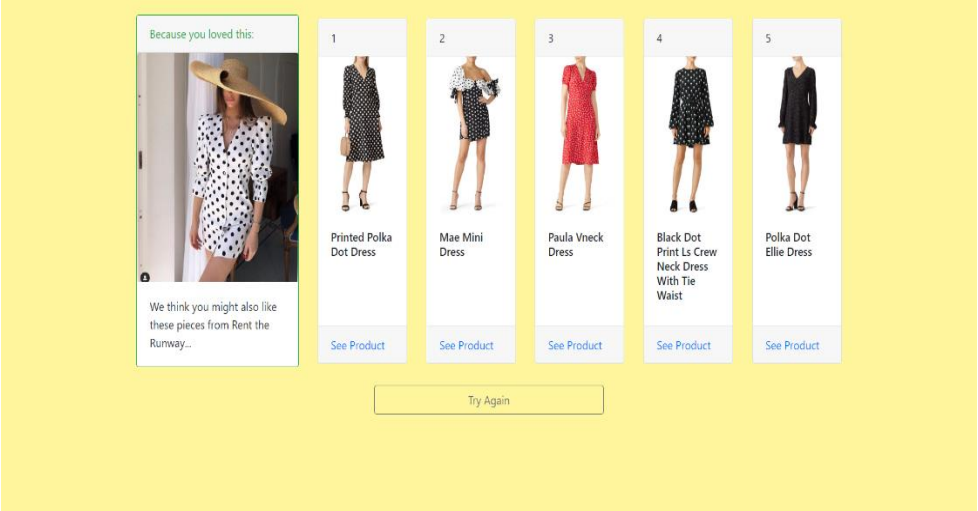

Figure 5. Outfits generated by our proposed approach

5. Conclusion

In this paper, we have presented a novel framework for fashion recommendation that is driven by data, visually related and simple effective recommendation systems for generating fashion product images. The proposed approach uses a two stage phase. Initially, our proposed approach extracts the features of the image using CNN classifier ie., for instance allowing the customers to upload any random fashion image from any Ecommerce website and later generating similar images to the uploaded image based on the features and texture of the input image. It is imperative that such research goes forward to facilitate greater recommendation accuracy and improve the overall experience of fashion exploration for direct and indirect consumers alike.

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