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Hi, Magic Closet, Tell Me What to Wear!

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"Hi, Magic Closet, Tell Me What to Wear!"

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ABSTRACT

In this demo, we present a practical system, magic closet, for automatic occasion-oriented clothing pairing. Given a user-input occasion, *e.g.*, wedding or shopping, the magic closet intelligently and automatically pairs the user-specified reference clothing (upper-body or lower-body) with the most suitable one from online shops. Two key criteria are explicitly considered for the magic closet system. One criterion is to *wear properly*, *e.g.*, compared to suit pants, it is more decent to wear a cocktail dress for a banquet occasion. The other criterion is to *wear aesthetically*, *e.g.*, a red T-shirt matches better white pants than green pants. To narrow the semantic gap between the low-level visual features and the high-level occasion categories, we propose to adopt middle-level clothing attributes (*e.g.*, clothing category, color, pattern) as a bridge. More specifically, the clothing attributes are treated as latent variables in our proposed latent Support Vector Machine (SVM) based recommendation model. The *wearing properly* criterion is described through a feature-occasion potential and an attribute-occasion potential, while the *wearing aesthetically* criterion is expressed by an attribute-attribute potential.

Categories and Subject Descriptors

H.3.3 [**Information Search and Retrieval**]: Retrieval models; I.2.6 [**Learning**]: Knowledge acquisition

General Terms

Algorithms, Experimentation, Performance

Keywords

Occasion Oriented Clothing pairing, Latent SVM

1. INTRODUCTION

When people select clothing, occasion is the most important factor to consider. Selecting suitable clothing for a certain occasion can reflect a person's courtesy. In this demo, we present a brand-new occasion-oriented clothing recommendation system named magic closet [3]. Magic closet targets at a specific clothing pairing scenario. As shown in Figure 1, a user inputs an occasion and one reference clothing item (such as a T-shirt the user wants to pair), the most matched clothing from the online shopping website is returned (such as a skirt). The returned clothing should aesthetically pair with the reference clothing well and also together be suitable for the specified occasion. The pairing function is very helpful for the customers in big shopping malls. If one customer would like to buy some lower-body clothing to match with her T-shirt and also suitable for wearing when dating, magic closet can intelligently recommend some shops/brand name in the shopping mall where the customer can find the most suitable skirts.

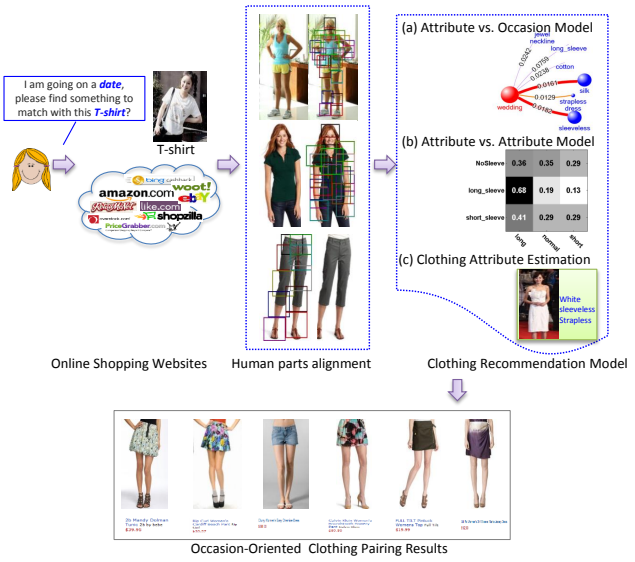

Figure 1: Clothing pairing scenario: given an occasion and a reference clothing, the clothing most suitable for the occasion and most matched with the reference clothing is recommended from online shopping websites.

2. SYSTEM INTERFACE

Magic closet system adopts the client-server mechanism. All the user interaction is in the client-end. As shown in Figure 2, Kinect is chosen due to its nice support for intermediate/ long distance, touchfree control. The heavy computing is implemented in the server-end. The whole user interaction contains the following several steps: (1) User first raises one's left arm to activate an occasion menu. The menu contains 8 options, such as 'dating', 'conference'. Each occasion is represented by both its name and an icon. Once the user moves one's hand upon one occasion icon and pushes one's hand forward, Kinect recognizes the action and considers it as a valid selection. (2) Similarly, user can select 'upper' or 'lower' with one's right hand. Option 'lower' means magic closet should recommend suitable lower-body clothing (such

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Figure 2: The interface of magic closet.

as trousers/skirt) to match with user's upper-body clothing (such as Tees/Coats). (3) Then user holds one's hands together to notify magic closet to capture a photo. After 3 second countdown, magic closet will take a picture of the user. (4) The instantly captured picture is sent to the server-end for further analysis. The recommended clothing will be sent back from the server-end back to the client-end in several seconds. (5) The recommended clothing can even be fitted upon users' body. Therefore, users can try the clothing and check whether it is indeed suitable for the occasion as well as the reference clothing.

3. SYSTEM WORKFLOW

Before parsing the clothing in the provided personal photo album or online websites, to alleviate the large human pose variations in the photos and background noises, we first align human body parts [2]. More specifically, we use the annotated key points on human bodies in human photos provided in [1] and train one human upper-body detector and one human lower-body detector [5, 4]. Figure 1 shows three human detection results from our detectors for whole body, upper body and lower body, respectively. We extract 5 types of features from the 20 upper-body parts and 10 lower-body parts to describe the human body. Features extracted from all the blocks are finally concatenated into a 959 dimensional feature vector to represent a human part.

Several middle-level clothing attributes are manually defined and utilized to narrow down the semantic gap between low-level clothing visual features and high-level occasion concepts. In magic closet, we define 7 multi-value clothing attributes, including the category attribute (with such values as "jeans", "skirts") and detail attributes, describing certain properties of clothing (with such values as "color", "pattern"). Magic closet mines the underlying rules for the clothing (low-level features and attributes) and occasion matching from a set of collected clothing photos with full annotations of occasions and attributes. Meanwhile, magic closet also explores the pairing rules of upper and lower-body clothing. Magic closet recommendation is based on a latent SVM model, which is learned from the collected fully annotated clothing photos. The model describes the matching rules among visual features, clothing attributes (treated as latent variables) and occasions. Specifically, the model integrates four potentials: 1) visual feature vs. attribute, 2) visual feature vs. occasion, 3) attribute vs. occasion, and 4) attribute vs. attribute. Here the first three potentials model the rules of clothing-occasion matching and the last one describes the clothing-clothing pairing. Embedding these matching rules into the latent SVM model ensures that the recommended clothing satisfies the requirement of *wearing properly* and *wearing aesthetically* simultaneously.

During working, magic closet can estimates the occasion-oriented aesthetic score for any clothing pair, which is utilized to rank candidate clothing for clothing pairing.

4. DEMONSTRATION

Figure 3: Some exemplars of the clothing paring results, given an occasion and one reference clothing. The most favored clothing for each occasion are shown in descending order. Their groundtruth scores are shown nearby.

Here, we evaluate the effectiveness of magic closet in occasion-oriented *clothing paring*. From Figure 3, we can see that most of the returned clothing match the query and the specified occasion quite well. For the "dating" occasion, the first query is "short sleeve", and the top 5 returned clothing are either "mini skirt" or "shorts". For the second query in "dating", which is "long sleeve" and thick, therefore, the recommended lower-body clothing are "normal-length skirts" or "pants". These results clearly demonstrate the advantages of the magic closet in the clothing pairing scenario.

5. CONCLUSIONS

We developed a practical occasion oriented clothing pairing system, named magic closet. Given a user specified occasion, the magic closet system automatically recommends the most suitable clothing by considering the *wearing properly* and *wearing aesthetically* principles. Limited by the current performance of human detector, some clothing in the user's clothing photo album may be misdetected. This issue can be further alleviated along with the development of state-of-the-art detection methods.

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