Friend Recommendation According to Appearances on Photos

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ABSTRACT
Unlike the questionnaire based friend recommendation scheme used in Social Network Service (SNS) websites nowadays (e.g. online dating sites, online matchmaking sites), we focus on the fact that most of the online users may be interested in the strangers whose appearances are somehow attractive according to their own preferences. In this paper, we present a friend recommendation system based on the appearances on photos. The system is built upon 5000 portraits photos as source dataset with another 50 photos as training set. Once the user provides rating to several photos in the training set, we first build his/her appearance preference model based on face detection and multi-features cooperation. Then, the images in the source are ranked according to different features respectively. Finally, the results of multi-features are fused via the method of Borda count. The system is a useful complement to the conventional psychological tests based friend recommendation scheme. It is easy to play with and of a lot of fun.

Categories and Subject Descriptors
H.5.2 [**Information Interfaces and Presentation**]: User Interfaces – *User-centered design*

General Terms
Design, Human Factors.

Keywords
Appearance Preference, Friend Recommendation.

1. INTRODUCTION
With the rapid development of internet, Social Network Service (SNS) (e.g. online dating sites, online matchmaking sites), which links the virtual experiences to real lives, has blossomed into a worldwide popularity nowadays. Since 2001, online personal sites have already taken half of the marriage market share in USA and it is forecasted that the online dating and marriage market scale will reach 1.2 billion RMB with an average growth rate 84.7% per year in China [1].

Once the user enters into the online personal sites, tens of thousands of strangers' information soon flourishes in front of him/her. How to help the user effectively find potential friends has become a key issue which constrains the further development of such websites. Intuitively, most of the sites ask the user to do a set of psychological tests and they implement friend recommendation according to the users' answers. However, those tests usually require the users to passively answer hundreds of questions. This is tiresome and not succinct. What the users are looking forward to is an interesting and visualized way to make their new friends.

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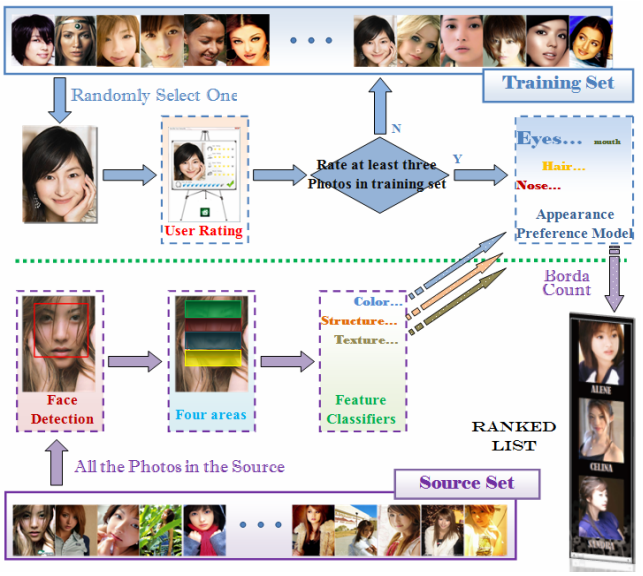

Figure 1. Flowchart of our framework

In this paper, we present a friend recommendation scheme which focuses on people's appearances on portraits photos. Our idea derives from the general process of friend making. While facing a stranger, we are inclined to make a first impression about him/her. Appearances on photos, which are the most direct way that we can obtain first impressions from others, are important because they are the very source of interests we hold to strangers. In other words, we suppose to recommend friends to the users in a "friendship at first sight" way.

The proposed system can be a useful complement to the conventional psychological tests based friend recommendation scheme. Besides, in the area of SNS, it still has more applications. With the calculated model, we could recommend the users their potentially preferred stars and do film/fashion recommendation. Also, we could use the model in elections and help to recommend candidates. The proposed approach and demo system will be described in section 2 and 3. Figure 1 illustrates the flowchart of our framework.

2. APPEARANCE BASED FRIEND RECCOMMENDATION
The friend recommendation scheme rank the photos according to their distances from the appearance preference model which is built after the user rates some representative portraits photos as training data. The appearance preference model consists of three feature classifiers: color feature classifier, structure feature classifier, and texture feature classifier. The feature values with the highest rating scores are selected into the model. Then, each of the images to be

ranked (we call them source set) is sorted by the three classifiers respectively. Finally, the ranked lists are fused together based on Borda Count voting scheme [2].

The extraction of model features is based on an automatic face detection preprocessing module [3]. Then, the detected face is divided into four areas: hair, eyes, nose, and mouth (the hair area should include the region little above the upper boundary of the face as shown in Figure 1). We extract the three feature classifiers for all of the four areas as following:

- ***Color features:*** $8\times3\times3$ bins HSV histogram with 8 bins for hue, 3 bins for saturation, and 3 bins for intensity.
- ***Structure features:*** Hu set of invariant moments $I_1 \sim I_7$ on grayscale images.
- ***Texture features:*** Gabor wavelet transform with four scales $S = 4$ and six orientations $K = 6$, resulting in feature vector $\overline{f} = [\mu_{00}\ \sigma_{00} \ldots \mu_{35}\ \sigma_{35}]$, where μ is the mean and σ is the standard deviation of the magnitude of the coefficients [4].

For each of the three classifiers (C^{Color}, $C^{Structure}$, $C^{Texture}$), we use it to rank the photos in the source set and obtain the ranked list (L^{Color}, $L^{Structure}$, $L^{Texture}$). Intuitively, these feature classifiers describe a photo in their different ways. To effectively fuse the results, we employ voting algorithm -"Borda Count" to suit the multi-features cooperation here [2].

Supposing there are M images to be ranked upon K different classifiers ($C^1 \cdots C^K$), the classifiers sort the images respectively as:

$$\begin{aligned} C^1 &: \quad L^1 = \{S_0^1, S_1^1, S_2^1, \cdots S_{M-1}^1\} \\ C^2 &: \quad L^2 = \{S_0^2, S_1^2, S_2^2, \cdots S_{M-1}^2\} \\ &\cdots \qquad\qquad \cdots \\ C^K &: \quad L^K = \{S_0^K, S_1^K, S_2^K, \cdots S_{M-1}^K\} \end{aligned} \tag{2.1}$$

where S_m^k stands for the ranking position of image m according to the kth classifier ($1 \le S_m^k \le M$). The Borda count for image m is set as: (here we set the weights ω equally in the demo system)

$$Borda(m) = \sum_{k=1}^{K} \omega^k \times (M - S_m^k) \qquad 0 \le m < M \tag{2.2}$$

$$\sum_{k=1}^{K} \omega^k = 1 \qquad \omega \text{ are the weights} \tag{2.3}$$

Intuitively, the larger the Borda count of one image is, the better chance it has to be accepted by the user. Thus, we obtain a fused result for the multi-features situation.

3. DEMO SYSTEM

The demo system is called "Meet My Juliet". For the purpose of demonstration, we assume that the user can only "meet" female friends on it currently. It is based on a source dataset of 5000 female portraits photos downloaded on the web, and these are the exact "potential friends' photos" to be ranked. Besides, we build a training dataset upon 50 representative pictures with no overlapping to the source set. The user is asked to provide rating to at least 3 pictures randomly selected from the training set.

Once the user enters the system, he/she is asked to rate a photo in 5 aspects – hair, eyes, nose, mouth, and overall. The photo should be rated step by step. The higher the rating is, the more appreciative the user is for the photo. Figure 2 illustrates a typical photo rating process.

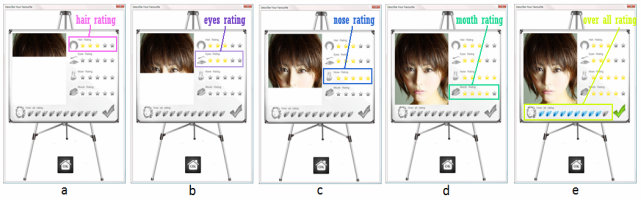

Figure 2. Typical photo rating process

a) Rate the hair on the training photo. b) Rate the eyes. c) Rate the nose. d) Rate the mouth. e) Rate the overall impression of the training photo.

After rating at least 3 photos randomly selected from the training dataset, the system build an appearance preference model and rank all the photos in the source as mentioned above. The result interface of the system is shown in Figure 3.

Figure 3. Result interface of "Meet My Juliet"

To verify the effectiveness of the proposed system, we invite twenty SNS website users to do a validity test. All of the users find the system useful and claim that it provides a fast and interesting way for them to make new friends.

4. CONCLUSION

We demonstrate a friend recommendation scheme in this paper. Being different from the traditional psychological tests using in the online dating websites, we aim to recommend friends for the users according to their appearance preferences. The prototype system "Meet My Juliet" can be a good complement to the conventional questionnaires for friend recommendation. It is impressive and easy to use. Future work will focus on a more exquisite appearance preference model and be deployed on larger dataset including both male and female photos.

5. REFERENCES

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