ImLooking: Image-based Face Retrieval in Online Dating Profile Search

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Abstract
Textual search, the approach used by the majority of existing online dating sites, successfully covers a variety of attributes, such as age range and gender, but falls short when searching for facial features. Meanwhile, by using images as the query in a search, current image-based face-retrieval applications ease the challenge of textual description from users, but only focus on finding the same person. We believe there is a gap that needs to be filled in image-based face retrieval to further support the interpersonal search scenarios on Internet dating sites. Therefore, we are introducing a profile search prototype – ImLooking - using an augmented image-based face retrieval filter. First, we present a prototype design and offer technical support. In a user study, participants quickly felt at home in user interface and acclimatized to the way the prototype operates. In addition, they reported they enjoyed the interaction process.

Keywords
User interface design, face detection and recognition, online dating, visual information retrieval

ACM Classification Keywords
H.5.2 [User Interfaces]: Graphical user interfaces (GUI), Prototyping; H.3.3 [Information Search and Retrieval]: Query formulation, Search process.

Introduction

Profile search plays a dominant role in most online dating sites. Most searches on current sites are based on constrained and free-response textual descriptions (See MSN Dating [7], for example). While textual search appears to work well for specific age ranges, gender, and other traits, it seems to be difficult when used to describe specific physical appearances [3], including facial features. This is vital because such features are generally considered the most important and visible identity among human beings [3, 13]. Additionally, many users may misrepresent themselves in text, providing descriptions of themselves as having big or small eyes, thick or thin lips. Further complicating this scenario is that this behavior can vary across individuals and cultures.

Many research and commercial applications [1, 3, 8] already exist to retrieve faces based on image queries. Such systems analyze visual features such as color, texture, and shape, in the effort to retrieve faces of the same individual from different images. The image query releases the difficulty of textual description, and removes the misrepresentation of facial features.

There is a gap that is available to integrate image-retrieval techniques into profile searching at online dating sites. However, we cannot directly copy image-based face retrieval to online dating profile search. Focusing on searching for the same person, the way of current face retrieval techniques does not match with the interpersonal search scenarios at online dating sites. In this paper, we aim to access greater potential and valuable results using similar faces from different individuals. Furthermore, the interpersonal search requires more complicated analysis, such as how to evaluate similarities between two persons' faces and how to understand what people perceive and evaluate when viewing similar faces.

We therefore propose an online dating profile-searching prototype – ImLooking. By providing an augmented filter with image-based face retrieval, the system allows users to search profiles not only with basic textual means, but with using visual elements from facial features in photos.

Contributions

In this paper, we propose two significant modifications:

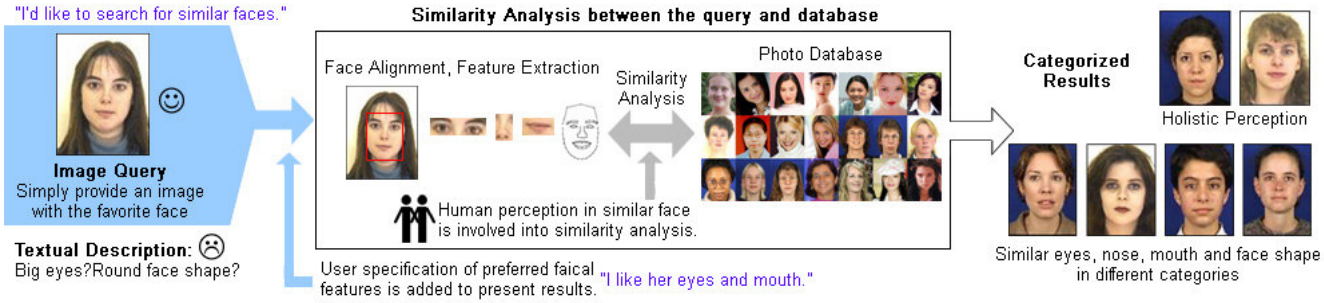


Figure 1 Framework of the augmented filter with face retrieval in Imlooking

Augmented filter with image-based retrieval: This system allows the user to upload a favorite face in a photo as the query, and present preferred facial feature(s). The system can analyze the visual features in the query with the preference weight and return categorized results (Figure 1).

Interpersonal similar face retrieval: The system learns how people perceive similar faces from a user similarity label study and involves the evaluation of human perception into the similarity analysis process.

Prototype Design

An online dating profile search prototype – ImLooking - is designed to search profiles by using an image-based augmented filter.

User interface design

Basic description query: It is easier for textual keyword search techniques to accurately recognize age, gender, and ethnicity in profiles [4]. Thus, these three important queries (age, gender, and ethnicity) remain as the basic text description (Figure 2).

Augmented filter with image-based query: The system provides a link for the user to upload a photo containing preferred faces from a personal collection. The face must be a near-frontal view. Our system can automatically crop the face area and display the cropped image in the left part of the query. (Figure 2)

Preference weight: According to psychological studies, people perceive human faces based on holistic and feature-based perceptions [9, 13]. Holistic perception treats the human face as a whole while eyes, nose, mouth, and face shape are viewed separately in feature-based perception. For people who have clear preferences for some certain facial features, the system provides a specified preference weight for facial feature in image query (From 1 to 7, in which 1 represents the least desirable feature while 7 indicates the favorite feature. Default scale is 4). Our system can offer results with multiple perception modes (holistic perception and feature-based perception) to users.

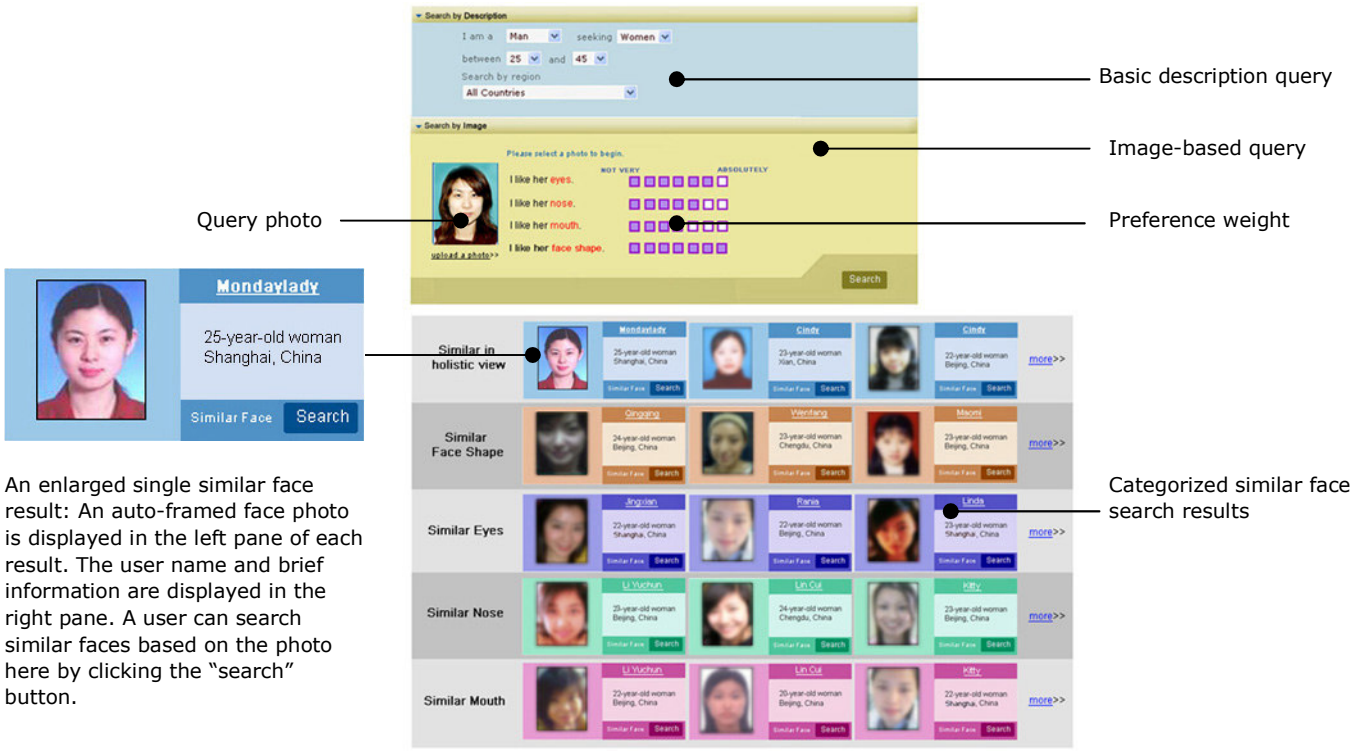
Categorized search result: The system combines the constrained textual input in basic description query and the query photo along with preference weight in augmented filter with image-based query. Then, the system provides categorical results.

The results are clustered in categories using holistic, face shape, eyes, nose, and mouth perception (Figure 2). The category of similar faces in holistic perception is always at the top if the system finds matched results. The ranking of feature-based results (eyes, nose, mouth, and face shape) will be in rank order based on preference weight. The photo in each result is also auto-framed to highlight the face.

Comprehensive Technique Support

The system works in three steps: feature extraction, similarity analysis, and search. Since humans perceive the face in both holistic and feature- based perceptions and uses different evidence for different modes, we extract different features and conduct similarity analyses for each perception mode.

Feature extraction: In the holistic perception, we first use a three-step face detector [11] to find the location of the face in a photo, and then enter the whole face into the system. A bank of Gabor filters with multi-



An enlarged single similar face result: An auto-framed face photo is displayed in the left pane of each result. The user name and brief information are displayed in the right pane. A user can search similar faces based on the photo here by clicking the "search" button.

Figure 2 User interface of Imlooking

scales and multi-orientations is employed to extract texture features [12]. In the feature-based perception, we use a Bayesian tangent shape model [14] after face detection to locate feature points, such as the control points of the eyes, mouth, nose, and face shape.

Then we decompose them into four parts, i.e. eye, nose, mouth and shape [Figure1], and we extract texture, size, and shape for each part.

Similarity analysis: To imitate a human's evaluation of interpersonal similarity, we asked five assessors to label similarity scores between images in 2,360 pairs from five perception modes: holistic, eyes, nose, mouth, and face shape. The score ranges from 0~3. The photos are from part of the ImLooking database. In the database, there are 615 photos collected from three datasets: photos of our lab staff, XM2VTS [6], and ARData [5]. Among them, 220 are female and 395 are

male. The races ranged from Caucasian, Asian to African. All photos are near-frontal. The labeling was independently completed by the assessors.

For each perception mode, we computed the pair-wise vector differences in the feature space of 2360 pairs of photos, and used the Support Vector Machine (SVM) with Radial Basis Function (RBF) kernel [10] to learn the mapping function. It mapped the difference vector to the average score of the five assessors.

Search: For the query face uploaded by the user, we use the above mapping function to calculate its matching score with each photo in the database from five perceptions: holistic, eyes, nose, mouth, and face shape. The results in each perception are ranked based on the matching score from high similarity to low.

Initial User Feedback

A user study was carried out to evaluate the prototype. Eight people (5 males and 3 females, 2 designers, 3 engineers, 2 interns, and a researcher) from our lab were randomly selected to participate, all of whom had no prior knowledge of our system. Each had experienced online dating sites before.

User task

Each participant was asked to bring a favorite person's photo in a near-frontal view in digital format. The face of their favorite was used as the query. Furthermore, the participants were given basic instructions on how to use our system and were allowed time to try out the system before the tasks were completed.

In the tasks, they were first asked to search similar faces based on their favorite faces, and to evaluate the top 3 results of each category provided by the system. In the holistic perception results, the participants evaluated both similarity (Do you think the face looks similar to your query face?) and preference (Do you want to date with this person?) using the Likert scale. In feature-based results, the participants were only required to evaluate the preference rate, as we would provide these results as potentially valuable references.

Results and Discussion

On the Likert scale (1 to 7, 1 for dissimilar and 7 for very similar) based on similarity, 56.25% of the top 3 results in holistic perception were marked with scores higher than 4 (5-7). Moreover, these faces with similarity score higher than 4 were marked with preference scores higher than 4 (5-7). For the preference rate in other categories, 50% of the top 3 results in face shape and 52% in eyes categories were marked with scores higher than 4 (5-7). We believe the user evaluation scores in similarity and preference for the top 3 results in each category our system provided indicate that the participants were likely to accept these results as potential dating partners.

We also observed that most participants reacted quickly to their tasks without much instruction. In addition, most participants found that auto-framed faces and categorized results help them to quickly browse the photos. Most of them expressed their positive feelings about user interaction.

Conclusion and Future Work

In this paper, we have presented an online dating profile search system using an image-based face retrieval augmented filter. It would seem that most users enjoyed this approach and accepted similar faces

our system provided. When we fill the gap between image-based face retrieval and online dating profile search, we find that there remains much to be explored.

Some challenges may be grounded on innovations in face-retrieval technique. For instance, one feature that we would see as a challenge to realize is using facial expressions. Would optimistic people who smile in photos be perceived differently from others? Moreover, users from different parts of the world might concentrate on varying traits. People from Asia are more interested in either single or double eyelids, while people form Western countries might treat eye color as a bonus. On the other hand, we would also improve the system's technical capacity, such as enlarging our database and exploring faces from other perspectives besides a near-frontal face view.

From social perspectives, we also believe that our approach will open doors for both research and commercial community in other social networks. One is to offer an approach for users who are interested in looking for people who look similar to themselves in online social network. Another is to provide fashion and film professionals a visual means for finding desired models or actors who may appear similar within a professional database.

References

[1] Baker E. (1999) "The Mug-Shot Search Problem – A Study of the Eigneface Metric, Search Strategies, and Interfaces in a System for Searching Facial Image Data", PhD Thesis, Harvard University, Available at: http://people.deas.harvard.edu/users/students/Ellen_Baker/papers.html

[2] Fiore A.T., & Donath J.S. (2004) "Online Personals: An Overview", in CHI, p. 1395-1398

[3] Girgensohn A., Adcock J., & Wilcox L. (2004) "Leveraging Face Recognition Technology to Find and Organize Photos" in MIR, p.99-106

[4] Kuchinsky A., Pering C., Creech M. L., Freeze D., Serra B., & Gwizdka J. (1999) "FotoFile: A Consumer Multimedia Organization and Retrieval System" in CHI 1999, p. 496-503.

[5] Martinez A.M., Benavente R. (1998) "The AR Face Database", in CVC Technical Report #24.

[6] Messer K., Matas J., Kittler J., Luettin L., and Maitre G. (1999) "XM2VTSDB: the extended M2VTS database", in Proc. of Int. Conf. on Audio and Video-based Person Authentication, p. 72-77.

[7] MSN Dating: http://dating.msn.com

[8] Navarrete P., Ruiz-del-Solar J. (2002) "Interactive Face Retrieval Using Self-Organizing Maps", in Proc. of Int. Joint Conf. on Neural Networks.

[9] Schwaninger A., Carbon C.C., Leder H. (2003) "Expert Face Process: Specialization and Constraints", in Development of Face Processing, Gottingen: Hogrefe, p. 81-97.

[10] Vapnik V. (1992) "Principles of risk minimization for learning theory," in D. S. Lippman, J. E. Moody, and D. S. Touretzky,(editors), Advances in Neural Information Processing Systems, 3, p.831-838.

[11] Xiao R., Li M. J., Zhang H. J. (2004) "Robust Multi-Pose Face Detection in Images", in IEEE Trans. on CSVT, special issue on Biometrics, 14(1), p.31-41.

[12] Yang Q. (2004) "Research on Appearance-based Statistical Face Recognition", PhD thesis at Tsinghua University, Beijing.

[13] Zhao W., Chellappa R., Phillips P.J., & Rosenfeld A. (2003) "Face Recognition: A Literature Survey", in ACM Computing Surveys, p. 399-458.

[14] Zhou Y., Gu L., Zhang H. J. (2003) "Bayesian Tangent Shape Model: Estimating Shape and Pose Parameters via Bayesian Inference", in Intl. Conf. on CVPR, 1, p.109-11