Enhancing Adaptive Content Based Face Image Retrieval in Database

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ABSTRACT- To address one of the important and challenging problems – large-scale content-based face image retrieval. Given a query face image, content-based face image retrieval tries to find similar face images from a large image database. Large-scale content-based face image retrieval is an enabling technology for many emerging applications. In this method, to utilize automatically detected human attributes that contain semantic cues of the face photos to improve content based face retrieval by constructing semantic codeword’s for efficient large scale face retrieval. By leveraging human attributes in a scalable and systematic framework, it use two orthogonal methods named attribute-enhanced sparse coding and attribute embedded inverted indexing to improve the face retrieval in the offline and online stages. Then SVM classifier is used to classify and predict about the image. This will calculate the Euclidean distance of the both the query and the dataset image. To investigate the effectiveness of different attributes and vital factors essential for face retrieval. By further enhancing, the accuracy of image retrieval can be improved.

The feature vectors of the images in the database form a feature database.

The similarities /distances between the feature vectors of the query example or sketch and those of the images in the database are then calculated and retrieval is performed with the aid of an indexing scheme. Recent retrieval systems have incorporated users' relevance feedback to modify the retrieval process in order to generate perceptually and semantically more meaningful retrieval results.

2. Literature Review

2.1 Face Matching Retrieval Using Soft Biometrics

Unsang Park and Anil K. Jain proposed face matching and retrieval technique to utilize demographic information (e.g., gender and ethnicity) and facial marks (e.g., scars, moles, and freckles) for improving face image matching and retrieval performance. An automatic facial mark detection method has been developed that uses:

- The active appearance model for locating primary facial features (e.g., eyes, nose, and mouth),
- The Laplacian-of-Gaussian blob detection and
- Morphological operators.

Face recognition is the task of recognizing a person using digital face images. A FRS is typically designed to output a measure of similarity between two face images. Automated FRSs typically involve finding key facial landmarks (such as the center of the eyes) for alignment, normalizing the face’s appearance, choosing a suitable feature representation, learning
discriminative feature combinations, and developing accurate and scalable matching schemes.

Facial marks can also be useful to differentiate identical twins whose global facial appearances are very similar. The similarities found from soft biometrics can also be useful as a source of evidence in courts of law because they are more descriptive than the numerical matching scores generated by a traditional face matcher.

Conventional face matching systems generate only numeric matching scores as a similarity between two face images, whereas the facial mark-based matching provides specific and more meaningful evidence about the similarity of two face images. Thus, automatic extraction and representation of facial marks is becoming important in forensic applications. Local techniques first detect the individual components of the human face (i.e., eyes, nose, mouth, chin, and ears), prior to encoding the textural content of each of these components. This system includes,

- Improving the mark detection accuracy
- Extending the automatic mark detection to off frontal face images
- Studying the image resolution requirement for reliable mark extraction

This soft biometric matcher can be combined with any face matcher to improve the recognition accuracy or used by itself when a face matcher fails because of face occlusion. The facial marks can help in discriminating identical twins. With the soft biometric matcher, users can issue semantic queries to retrieve images of interest from a large database. Facial mark detection follows

- Primary Facial Feature Detection
- Mapping to Mean Shape
- Mask Construction
- Blob Detection
- Blob Classification

2.2 Describable Visual Attributes For Face Verification and Image Search

Alexander C. Berg and N. Belhumeur proposed the use of describable visual attributes for face verification and image search. Describable visual attributes for identification has been around since antiquity, it has not been the focus of work by researchers in computer vision and related disciplines.

These face attributes can range from simple demographic information such as gender, age, or ethnicity; to physical characteristics of a face such as nose size, mouth shape, or eyebrow thickness; and even to environmental aspects such as lighting conditions, facial expression, or image quality. In this approach, an extensive vocabulary of visual attributes is used to label a large dataset of images, which is then used to train classifiers that automatically recognize the presence, absence, or degree to which these attributes are exhibited in new images.

The classifier outputs can then be used to identify faces and search through large image collections, and they also seem promising for use in many other tasks such as image exploration or automatic description-generation. Attributes are generalizable. One can learn a set of attributes from large image collections and then apply them in almost arbitrary combinations to novel images, objects, or categories.

Existing labeling efforts such as Image Net and Label Me label large collections of images by category or object name. The use of attributes may provide a significantly more compact way of describing objects. This would allow for the use of much smaller labeled datasets achieving comparable performance on recognition tasks.

2.3 Image Ranking and Retrieval Based on Multi-Attribute Queries

Rogerio S. Feris and Larry S. Davis proposed a novel approach for ranking and retrieval of images based on multi-attribute queries. Existing image retrieval methods train separate classifiers for each word and heuristically combine their
outputs for retrieving multiword queries. These approaches ignore the interdependencies among the query terms.

This method proposed a principled approach for multi-attribute retrieval which explicitly models the correlations that are present between the attributes. Given a multi-attribute query, this method utilizes other attributes in the vocabulary which are not present in the query, for ranking/retrieval. Furthermore, this integrates ranking and retrieval within the same formulation, by posing them as structured prediction problems.

A new framework for multi-attribute image retrieval and ranking is presented, which retrieves images based not only on the words that are part of the query but also considers the remaining attributes within the vocabulary that could potentially provide information about the query. Similarly pictures containing bald people or persons with mustaches and beards, which are male specific attributes, can also be discarded, since one of the constituent attributes of the query is woman.

While an individual detector for the attribute will implicitly learn such features, the experiments show that when searching for images based on queries containing fine-grained parts and attributes, explicitly modeling the correlations and relationships between attributes can lead to substantially better results.

The goal in image retrieval is to return the set of images in a database that are relevant to a query. The aim of ranking is similar, but with additional requirement that the images be ordered according to their relevance to the query. For large scale datasets, it is essential for an image search application to rank the images such that the most relevant images are at the top.

The problem of ranking based on multi-attribute queries is considered to improve the effectiveness of attribute based image search. Instead of treating ranking as a separate problem, we propose a structured learning framework, which integrates ranking and retrieval within the same formulation.

2.4 Face Recognition with Learning-Based Descriptor

Zhimin Cao and Xiaou Tang proposed a pose-adaptive matching method to handle the large pose variation in real-life scenarios that uses pose-specific classifiers to deal with different pose combinations (e.g., frontal v.s. frontal, frontal v.s. left) of the matching face pair.

A novel approach of addressing the representation issue and the matching issue in face recognition (verification) is presented. First this approach encodes the micro-structures of the face by a new learning-based encoding method. Unlike many previous manually designed encoding methods (e.g., LBP or SIFT), this method uses unsupervised learning techniques to learn an encoder from the training examples, which can automatically achieve very good tradeoff between discriminative power and invariance.

Then PCA is applied to get a compact face descriptor. A simple normalization mechanism after PCA can further improve the discriminative ability of the descriptor. The resulting face representation, learning-based (LE) descriptor, is compact, highly discriminative, and easy-to-extract. Face verification is a binary classification problem on an input face pair; there are two major components of a verification approach: face representation and face matching.

A learning-based encoding method is employed to tackle the difficulties, which uses unsupervised learning methods to encode the local microstructures of the face into a set of discrete codes. The learned codes are more uniformly distributed and the resulting code histogram can achieve much better discriminative power and robustness tradeoff than existing handcrafted encoding methods.

The dimension reduction technique, PCA is applied to the code histogram to pursue the compactness and to compress the concatenated histogram to reduce the feature size and call the compressed descriptor as our final learning-based (LE) descriptor. A proper normalization mechanism after PCA can improve the
discriminative ability of the code histogram.

Learning-based descriptor extraction

- Sampling and normalization
- Learning based encoding and histogram representation
- PCA dimension reduction

A pose-adaptive matching at the component level can effectively handle large pose variation and further boost the recognition accuracy. Pose-adaptive matching

- Component level face alignment
- Pose-adaptive Matching
- Evaluations of pose-adaptive Matching

The face micro-pattern encoding is learned in this technique but the pattern sampling is still manually designed.

2.5 Photo Search by Face Positions and Facial Attributes on Touch Devices

Yu-Heng Lei and Yan-Ying Chen proposed a novel system for searching consumer photos by exploiting computer vision technologies in estimating facial attributes and face similarity. Rather than laboriously sketching detailed appearances or typing text, this work allows users to formulate a query canvas by placing icons of desired facial attributes, at desired positions and in desired sizes. Moreover, aesthetics filtering to retain images of better composition, colorfulness, and contrast, are provided thus enhancing visual experience and saving time for reviewing poor photographic (usually unintended) image candidates.

A better solution to organize the increasing number of personal or group photos is highly required. The method is to propose a novel way to search for face images according facial attributes and face similarity of the target persons. A block-based indexing approach enabling rapid on-line retrieval response (0.1 second on average) is proposed to tackle the computation overheads for searching face positions in large-scale datasets.

The system allows the user to graphically specify the face positions and sizes on a query “canvas,” to better match the face layout in mind, where each attribute or identity is defined as an “icon” for easier representation. Moreover, it provides aesthetics filtering to enhance visual experience by removing candidates of poor photographic qualities. The scenario has been realized on a touch device with an intuitive user interface. With the proposed block-based indexing approach, near real-time retrieval (0.1 second on average) in a large-scale dataset (more than 200k faces in Flick images) can be achieved.

Consumer photos naturally lack of annotations, automatic facial attribute and identity recognition techniques would make the scenario more economical and scalable. However, the gap between the user's mind and their specified query can still be large even in such a system. Users with poor drawing skills may have a hard time describing their intention accurately. Details are naturally difficult to sketch, such as the age of a face.

Photo search on touch devices procedure follows:

- User Interface
- Ranking Function
- Block-based Indexing

The work proposes a novel way for effectively organizing and searching consumer photos by positioning attributed faces at desired positions and in desired sizes on a query canvas. Meanwhile, it can automatically detect facial attributes and measure face similarity in the online process to provide rapid on-line photo search. Integrated with aesthetics assessment, it can further save time for browsing photos with poor quality. The scenario has been realized on touch device with an easy-to-use interface and has achieved fast retrieval response by the proposed block-based indexing approach.

4. Conclusion

Thus the content based face image retrieval system retrieves similar images from the large image database when a query image is
provided. The retrieval is followed by initially detecting the face from the image and performing some of the preprocessing steps to remove certain noise which will be present in the image. The preprocessed image contains important high level attributes. Then the images will be separated as distinct patches after detecting the face in order to extract the LBP features. The extracted LBP feature assigns labels to every pixel of the gray converted image. Then SVM classifier is used to classify and predict about the image. This will calculate the Euclidean distance of the both the query and the dataset image. Based upon the distance between the images, the similar image will be retrieved from the dataset. This system greatly reduces the quantization error and can achieve salient gains in face retrieval from the database. And also avoids misclassification of the images with the help of the SVM classifier.

REFERENCE


