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顔検出と直観的なクエリによる画像検索

Enhanced Image Search Using Face Detection and Visual Queries

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Abstract: We present a scheme for automated retrieval of digital photographs using *faceboxes*. The sizes and locations of faces in each photo are automatically detected and embedded within the image file. An interactive user interface allows querying for photos visually, in a simple and intuitive manner. We demonstrate the system on a personal collection of 10,000 photos.

Keywords: Face Image Search, Visual Queries, Image Retrieval

1. Introduction

Faces are important as a category of content in photographs. Digital cameras detect faces and adjust camera settings to ensure that the faces are in focus and well exposed. Social networks facilitate marking *faceboxes* in images for associating photos with people. We believe that systems for image retrieval will benefit from similar emphasis on faces.

This paper presents an interactive system that utilizes faces as a cue for content based retrieval of digital photos in JPEG format. It allows the user to describe a photo using a visual query that specifies the layout of faces in the photo.

2. System Description

The system consists of two subsystems. The first detects faces in an image and embeds their attributes in the image as metadata. The second provides a user interaction strategy to specify visual queries, and algorithms for searching.

For each image, the system automatically detects the locations and sizes of square faceboxes around the faces in the image. These attributes are stored in the comments area of the JPEG file.

We employ a user interaction strategy that allows fast forming of detailed queries. First, a disk drive, or a hierarchy of folders, containing images to be searched, is selected. The orientation of the image and the number of faces in the image are selected using radio buttons and combo boxes. The interface permits imprecise inputs such as “any orientation”, and “more than 3 faces”.

If the user remembers the layout of the desired image (with respect to faces), or wishes to retrieve images with a particular layout, he/she can specify the layout using an icon-based sketch. If the user chooses to specify face locations and sizes, a canvas that is initialized according to the selected orientation is shown. The canvas contains a set of face icons, corresponding to the number of faces he/she specified. A face icon is selected by placing the mouse cursor over it and clicking the left mouse button. The user can drag the face icons within the canvas to change their locations. The size of a face can be changed either by rotating the mouse wheel (if available) or by adjusting a slider. If the user is more certain/particular about the locations of the faces than their sizes, or vice versa, the “Search priority” can be adjusted accordingly using a slider. After completing the inputs and the visual query, the user clicks a “Search” button to retrieve images.

Upon selecting a folder or a hierarchy of folders, the system extracts the dimensions and metadata of the images in the folder(s). These images are filtered by the orientation and the number of faces, if specified. The remaining candidate images are ordered according to their similarity to the face layout specified in the icon-based sketch, using a matching algorithm. The “Search priority” input controls the weights of the algorithm to adjust the relative influence of face sizes and locations when estimating similarity. The results are ordered according to similarity, grouped into sets of 12 thumbnails, and displayed to the user.

Figure 1 shows an example photo retrieval task. The photo to be searched for is shown in Figure 1a. Figures 1b and 1c show the visual query and the results respectively.

3. Conclusion

We presented an interactive system for retrieval of photos using visual queries regarding faces. The encoding scheme is sufficiently simple to be included in a digital camera capable of face detection. Embedded comments remove the burden of re-indexing images upon transfer, and intensive image analysis during retrieval. The user interaction strategy is intuitive, easy to learn, and fun to use.

References

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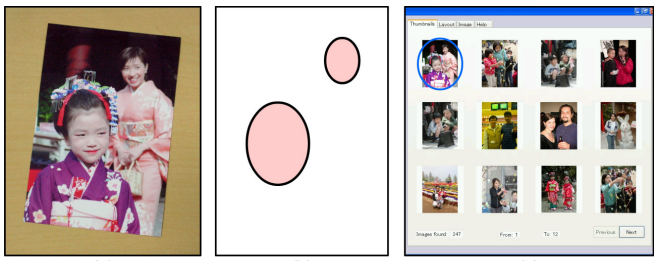

(a) (b) (c)

Figure 1: Using the interface for photo retrieval.