Stained Glass Photo Collages

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ABSTRACT

We developed a novel technique for creating visually pleasing collages from photo regions. The technique is called "stained glass" because the resulting collage with irregular shapes is reminiscent of a stained glass window. The collages reuse photos in novel ways to present photos with faces that can be printed, included in Web pages, or shared via email. The poster describes the requirements for creating stained glass visualizations from photos of faces, our approach for creating face stained glass, and techniques used to improve the aesthetics and flexibility of the stained glass generation. Early user feedback with face stained glass have been very positive.

KEYWORDS: Digital photo collections, face detection, image collages, user interface design, home users.

INTRODUCTION

As personal digital photo collections become more prevalent, demand increases for new ways to present and share those photos. We developed a technique for creating visually pleasing collages from photo regions. We take advantage of automatic face detection [6] to locate faces in photos and to combine them into a collage with irregular shapes reminiscent of a stained glass window. After placing the faces in the collage, the gaps between faces are filled with pixels from outside the extracted faces in the original photos. Such collages highlight people in a novel and attractive way and are well-suited for printing or for sharing as images.

RELATED WORK

Collections of images are commonly used as video summaries [7]. Our stained glass presentation [2] is a way to create aesthetically pleasing yet highly compact video summaries. Fogerty et al. [3] developed the Kandinsky system for generating aesthetic information collages, information displays in decorative objects. The Kandinsky system emphasizes certain aesthetic properties in creating image collages over the effective conveyance of information. Hudson and Smith [5] created a collage of faces as a synthetic group photo. They placed images of the most important people in the front row and created a perspective view with scaled down and partially obscured images of other people in the back rows. The goal of their face collage was to provide background awareness information. In contrast, the main goal of our face stained glass collages is to provide an aesthetically pleasing presentation. Abdel-Mottaleb and Chen [1] generate collages consisting of a photo and four face thumbnails to summarize photos belonging to an event.

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STAINED GLASS

We originally developed stained glass visualizations as a means to summarize videos by combining regions of interest in video shots into a collage [2]. To create collages of faces extracted from photos, we had to adapt our technique. For example, we place the images in video summaries in temporal order to provide additional information. For face images, the temporal order is not desirable because it does not add much information and can lead to less attractive collages. Instead, we create a permutation that maximizes the differences between neighboring faces.

To determine the face bounds, we use the eye positions returned by the face detector [6]. We align an ellipse to the connection between the eyes. The rectangular bounding box of that ellipse determines the face bounds. Faces to be included in the stained glass are grouped into rows. To avoid having rows with few faces, faces are distributed among rows such that the number of faces per row varies only by one. Furthermore, rows with even and odd number of faces are alternated as much as possible to generate a less uniform layout. In each row, extra horizontal space is divided evenly among the faces without extending any face beyond its photo dimensions.

Initially, we made all faces the same size and centered them in the cell created by dividing the canvas into rows and columns. This approach produced an overly regular layout (see Figure 1). To make the collage less regular and thus more aesthetically pleasing, we increase the zoom factor for faces that cover more of their original photos (close-ups) and randomly place faces within their cells instead of centering them (see Figure 2).

To fill the spaces between regions, we assign each point on the canvas to the closest face for which the point is inside the photo bounds. To measure the distance between a face and a point in the canvas, we compute the Euclidian distance between the point and the center of the face and subtract the radius of the circle enclosing the face (or the radius of the face ellipse for better results). This distance measure gives larger faces more coverage and creates slightly curved borders between areas. This process is illustrated in Figure 3. A point with the same distances to the three faces d_1, d_2, and d_3 lies on the border of those faces.

If a photo contains faces in addition to the selected face, those extraneous faces are excluded by covering the photo region so that partial faces are not displayed. The faded face labeled "another face" in Figure 3 marks the position of

Figure 1: Stained glass with uniform face sizes and positions.

Figure 2: Stained glass with varied face sizes and positions and with elliptic borders.

another face from the same photo as the face with radius r_2. The border is shifted towards r_2 to avoid showing that face. Figure 1 shows our earlier approach of using the rectangular bounding box determined from the ellipse to exclude extra faces whereas in Figure 2 the face ellipse is used directly, making the shift shown in Figure 3 unnecessary and introducing a round border in the bottom row. If several faces from the same photo are selected, they are handled independently. Grouping neighboring faces might be preferable.

CONCLUSIONS

The collages reuse photos in novel ways to present photos with faces that can be printed, included in Web pages, or emailed to other people. We included the ability to create those collages in our photo organizer [4]. Early user reactions to the face stained glass have been very positive. Users appreciate the improved aesthetics and flexibility provided by the stained glass generation. They also commented that the stained glass visualization would let them present photos in a new way and allow them to highlight people.

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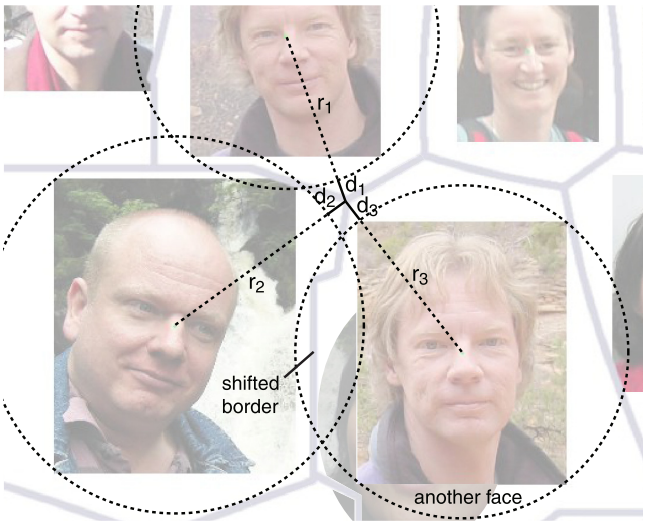

Figure 3: Determining stained glass boundaries.