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Project 2 involves finding images in a given dataset that match with a target image by constructing feature vectors. We use features such as color, texture and spatial layout to create these feature vectors. After creating these feature vectors, a distance metric is calculated and the top "N" matches are picked based on the lowest distance. One simple feature used is simply the color pixels in a region of interest. Some of the other features used include creating a color histogram based on chromaticity and a texture histogram using Sobel filters. The overall goal of this project is to work with different color spaces, histograms, spatial features, and texture features.

Figure 1: Above: Original image for baseline matching. Below: Top 3 matches for baseline matching.

Method 1 was to use a 9x9 square in the middle of the image as a feature vector and results are shown in Fig. 1. The distance metric was sum-of-squared-difference. The original image was pic.1016.jpg. My top three matches are pic.0986.jpg, pic.0641.jpg, and pic.0233.jpg.

Figure 2: Above: Original image for single normalized color histogram matching. Below: Top 3 matches for the same matching.

Method 2 was to use a single normalized color histogram as a feature vector and results are shown in Fig. 2. I used a 2D histogram with 32 bins. The histogram was created using the red and green color channels. The distance metric was histogram intersection. The original image was pic.0164.jpg. My top three matches are pic.0933.jpg, pic.0268.jpg, and pic.0110.jpg.

Method 3 was to use two color histograms as feature vectors and results are shown in Fig. 3. The first one was the same as Method 2. The second one was method 2 but used on a 100x100 region of interest in the certain of the

Figure 3: Above: Original image for multi normalized color histogram matching. Below: Top 3 matches for the same matching.

image. The distance metric was histogram intersection. The original image was pic.0274.jpg. My top three matches are pic.0273.jpg, pic.0409.jpg, and pic.0426.jpg.

Figure 4: Above: Original image for color and texture based histogram matching. Below: Top 3 matches for the same matching.

Method 4 was to use a whole image color histogram and a whole image texture histogram as the feature vector and results are shown in Fig. 4. The color histogram was the same as Method 2. The texture histogram was created by binning the results of passing a Sobel filter (in the x and y direction) over my image. The distance metric was a modified histogram intersection in which both the color histogram and texture histogram distances were weighted equally. The original image was pic.0535.jpg. My top three matches are pic.0605.jpg, pic.0733.jpg, and pic.0853.jpg.

5 shows the same target image as Fig. 4 but uses method 2 and 3 (which both yielded the same results). While method 2 and 3 do appear to be sufficient at matching the color of the target image (particularly with the color brown), it does not seem to match the texture very well. We see the biggest different in the 3rd highest match in which our target image is incorrectly matched with what appears to be outside ground with leaves and twigs. Method 4 though does a better job of matching some of the textures since it includes a texture histogram. It still does include some outdoor leaves but the edges on that picture are (albeit very slightly) more similar to the target image.

Overall, this project was very useful in learning how to do basic feature matching and creating feature vectors. Additionally, I feel like I have a better intuition for textures/gradients and the Sobel filter now that I've used it to match pictures. While my understanding of feature matching has increased I think I still lack some intuition for

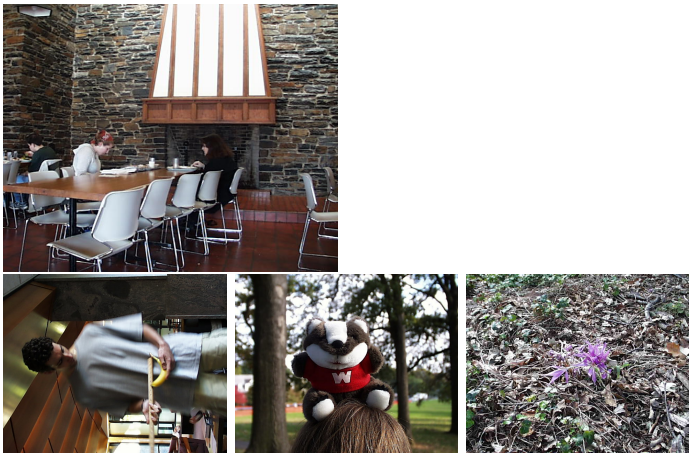

Figure 5: Above: Original image for matching. Below: Top 3 matches for both single and multi histogram color matching (results were same for both)

how different color spaces match up images. For example, I don't have an intuition for how a single color histogram which used blue and green image channels would match up images. I think this sort of intuition would develop with exploring the different color spaces though.