Image Epitomes

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In this project you will explore the use of a new probabilistic image representation known as the epitome, introduced by Jojic and Frey, 2003. Epitome can be viewed as a generative model for images which is compact and preserves spatial coherence. Papers and matlab code for learning epitome from image data are linked from the course web site. A minimum project would involve reading this paper and conducting an experiment using epitome for inpainting, synthesis, etc. The remainder of this write-up describes several scenarios. In your proposal, please describe parts you are interested in.
1. Preliminaries
Download and extract the paper and code following the links from the class website. Test the code on the sample image provided and verify that you get the correct epitome. Construct a synthetic image by tiling a single image patch in a grid. Verify that the correctness of the resulting epitome. Sample from the probability model for the epitome and check the output. What aspects of the image pattern does the epitome represent. For a single input image, explore which parts of the epitome correspond to which parts of the input.
2. In-Painting

Explore the use of the epitome representation for inpainting. The idea of inpainting is that you can cut out a region of pixels from an image and then “regrow” them using a model that represents the image content and structure. See the recent SIGGRAPH paper “Image Quilting” by Efros and Freeman for an example that does not involve a generative probabilistic model. In this part, you will explore the use of epitome to accomplish the same task. There are a variety of approaches we can discuss if you are interested.
3. Image Detection/Recognition
The epitome could be useful for parts-based object recognition, in the sense that epitome of a target object provides a compact summarization of its pixel statistics. Explore this idea in the context of detecting a certain type of object or discriminating between two classes of images. Use image categories with well-defined structure, such as faces, flowers, etc. What is the best way to construct a feature vector for recognition from an epitome image? Explore a variety of choices: normalized correlation of the epitomes themselves, histogram and region-based descriptors, etc.
4. Segmentation/Editing Tool
In this part you apply the epitome to create a simple image segmentation and editing tool. Your system should allow the user to select regions in the epitome and automatically link to the corresponding regions in the input image. Your system should support editing operations such as replacing regions of pixels, color-space transforms, etc. Apply your tool to an image with a regular texture (i.e. tiling). Do the texture elements appear in the epitome? By changing the base texture element can you achieve texture replacement in the original image?