Chapter 8
Cloud-Based Image Fusion Using Guided Filtering

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ABSTRACT
Current image coding with image fusion schemes make it hard to utilize external images for transform even if highly correlated images can be found in the cloud. To solve this problem, we explain an approach of cloud-based image transform coding with image fusion method which is distinguish from exists image fusion method. A fast and efficient image fusion technique is proposed for creating a highly generated fused image through merging multiple corresponding images. The proposed technique is based on a two-scale decomposition of an image into a low layer containing large scale variations, and a detail layer acquiring small scale details. A novel approach of guided filtering-based weighted average method is proposed to make full use of spatial consistency for merge of the base and detail layers. Analytical results represent that the proposed technique can obtain state-of-the-art performance for image fusion of multispectral, multifocus, multimodal, and multiexposure images.

INTRODUCTION
Image fusion is an important technique for various image processing and computer vision applications such as feature extraction and target recognition. Through image fusion, different images of the same scene can be combined into a single fused image (A. A. Goshtasby, 2007). The fused image can provide more comprehensive information about the scene which is more useful for human and machine perception. For instance, the performance of feature extraction algorithms can be improved by fusing multi-spectral remote sensing images (Socolinsky, 2002). The fusion of multi-exposure images can be used for digital photography (Shen 2011). In these applications, a good image fusion method has the following properties. First, it can preserve most of the useful information of differ-
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ent images. Second, it does not produce artifacts. Third, it is robust to imperfect conditions such as mis-registration and noise.

Image search has been demonstrated as a successful application on the Internet (Mandic, 2009). By submitting the description of one image, including semantic content (Mandic, 2009), outline (Crow, 1984), (Rockinger, 1997), and local feature descriptors (Zeng, 2012), (Varshney, 2011), one can easily retrieve many similar images. Near and partial duplicate image detection is a hot research topic in this field (Zeng, 2012), (Tang, 2010), (Szeliski, 2008). However, the purpose of image search is not to generate an image from search results. In fact, reconstructing a given image from similar images is tougher than the image search itself.

LITERATURE REVIEW

A large number of image fusion methods (Wang, 2004)–(Mandic, 2009) have been proposed in literature. Among these methods, multi-scale image fusion (Cruz, 2004) and data-driven image fusion (Mandic, 2009) are very successful methods. They focus on different data representations, e.g., multi-scale co-efficient Crow, (Jan. 1984), (Rockinger, 1997), or data driven decomposition co-efficient (Mandic, 2009), (Zeng, 2012) and different image fusion rules to guide the fusion of co-efficient. The major advantage of these methods is that they can well preserve the details of different source images. However, these kinds of methods may produce brightness and color distortions since spatial consistency is not well considered in the fusion process. To make full use of spatial context, optimization based image fusion approaches, e.g., generalized random walks (Shen 2011), and Markov random fields (Rockinger, 1997) based methods have been proposed. These methods focus on estimating spatially smooth and edge-aligned weights by solving an energy function and then fusing the source images by weighted average of pixel values. However, optimization based methods have a common limitation, i.e., inefficiency, since they require multiple iterations to find the global optimal solution. Moreover, another drawback is that global optimization based methods may over-smooth the resulting weights, which is not good for fusion (Varshney, 2011).

SIFT descriptors, proposed by Lowe in Tang, (Sep. 2010), present distinctive invariant features of images that consist of location, scale, orientation, and feature vector. The scale and location of SIFT descriptors are determined by maxima and minima of difference-of-Gaussian images. One orientation is assigned to each SIFT descriptor according to the dominant direction of the local gradient histogram. The feature vector is a 128-dimension vector that characterizes a local region by gradient histogram in different directions. Since SIFT descriptors have a good interpretation of the response properties of complex neurons in the visual cortex (Smith, 1981) and an excellent practical performance, they have been extensively applied to object recognition, image retrieval, 3D reconstruction, annotation, watermarking, and so on.

IMAGE IN CLOUD RESOURCES

The cloud is characterized by a large amount of computing resources, storage, and data (A. A. Goshtasby, 2007). Imagining a cloud that collects a huge number of images, e.g., Google street view images (Socolinsky, 2002), when you randomly take a picture with your phone on the street, you can often find some highly correlated images in the cloud that were taken at the same location at different viewpoints and angles, focal lengths, and illuminations. If you try to share the photo with friends through the cloud, it is problematic to use conventional image coding (e.g., JPEG) that usually provides only 8:1 compression ratio (Shen 2011). It will consume a lot of precious power and network bandwidth to transmit such