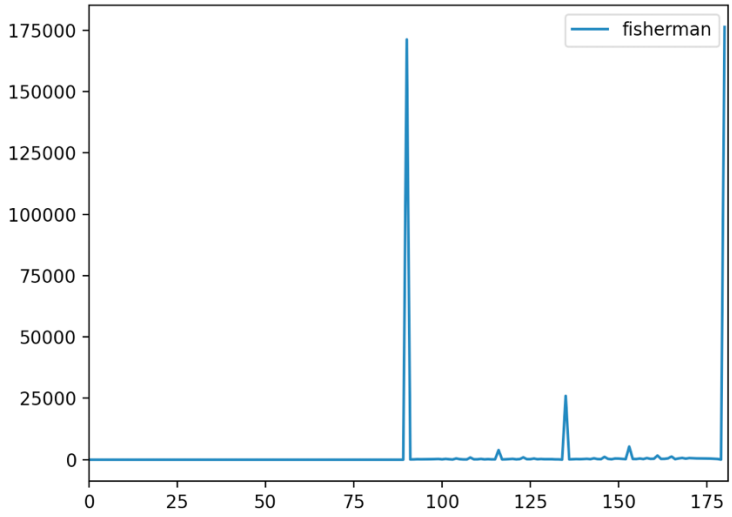
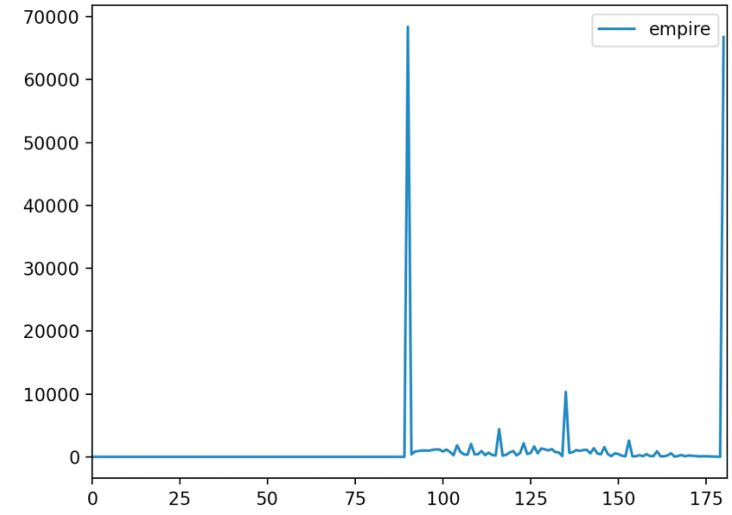
Task 2.2C

Histogram for fisherman

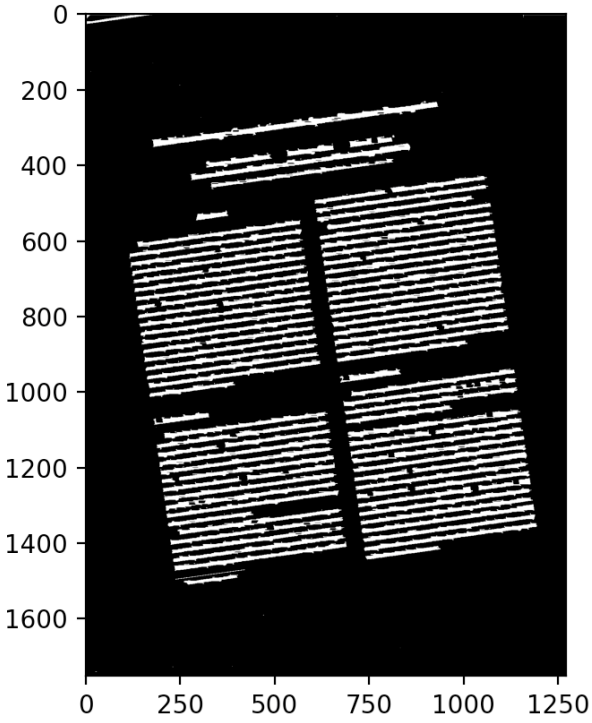


Histogram for empire

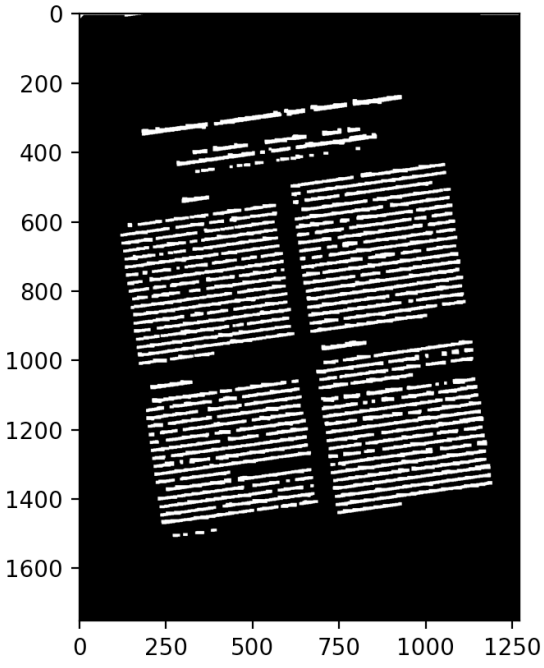


From 0 degrees to about 90 degrees, the number of pixels at that degree are similar for both the fisherman.jpg and empire.jpg. From about 100 degrees onwards, there are pixels with different orientations for the empire.jpg as compared to the fisherman.jpg

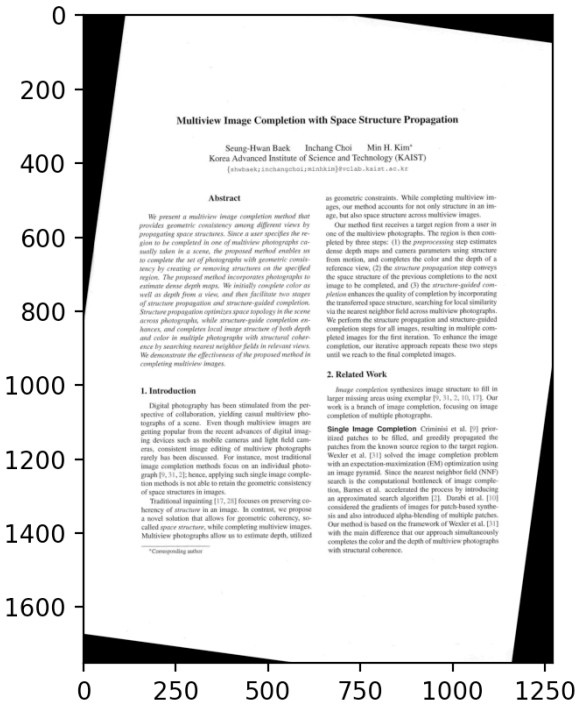
Closing_doc_gray



Opening_doc_gray



Deskewed_doc



Multiview Image Completion with Space Structure Propagation

Seung-Hwan Baek Inchang Choi Min H. Kim*
Korea Advanced Institute of Science and Technology (KAIST)
{shwbaek,inchangchoi,minhkim}@vclab.kaist.ac.kr

Abstract

We present a multiview image completion method that provides geometric consistency among different views by propagating space structures. Since a user specifies the region to be completed in one of multiview photographs casually taken in a scene, the proposed method enables us to complete the set of photographs with geometric consistency by creating or removing structures on the specified region. The proposed method incorporates photographs to estimate dense depth maps. We initially complete color as well as depth from a view, and then facilitate two stages of structure propagation and structure-guided completion. Structure propagation optimizes space topology in the scene across photographs, while structure-guide completion enhances, and completes local image structure of both depth and color in multiple photographs with structural coherence by searching nearest neighbor fields in relevant views. We demonstrate the effectiveness of the proposed method in completing multiview images.

1. Introduction

Digital photography has been stimulated from the perspective of collaboration, yielding casual multiview photographs of a scene. Even though multiview images are getting popular from the recent advances of digital imaging devices such as mobile cameras and light field cameras, consistent image editing of multiview photographs rarely has been discussed. For instance, most traditional image completion methods focus on an individual photograph [9, 31, 2]; hence, applying such single image completion methods is not able to retain the geometric consistency of space structures in images.

Traditional inpainting [17, 28] focuses on preserving coherency of *structure* in an image. In contrast, we propose a novel solution that allows for geometric coherency, so-called *space structure*, while completing multiview images. Multiview photographs allow us to estimate depth, utilized as geometric constraints. While completing multiview images, our method accounts for not only structure in an image, but also space structure across multiview images.

Our method first receives a target region from a user in one of the multiview photographs. The region is then completed by three steps: (1) the *preprocessing* step estimates dense depth maps and camera parameters using structure from motion, and completes the color and the depth of a reference view, (2) the *structure propagation* step conveys the space structure of the previous completions to the next image to be completed, and (3) the *structure-guided completion* enhances the quality of completion by incorporating the transferred space structure, searching for local similarity via the nearest neighbor field across multiview photographs. We perform the structure propagation and structure-guided completion steps for all images, resulting in multiple completed images for the first iteration. To enhance the image completion, our iterative approach repeats these two steps until we reach to the final completed images.

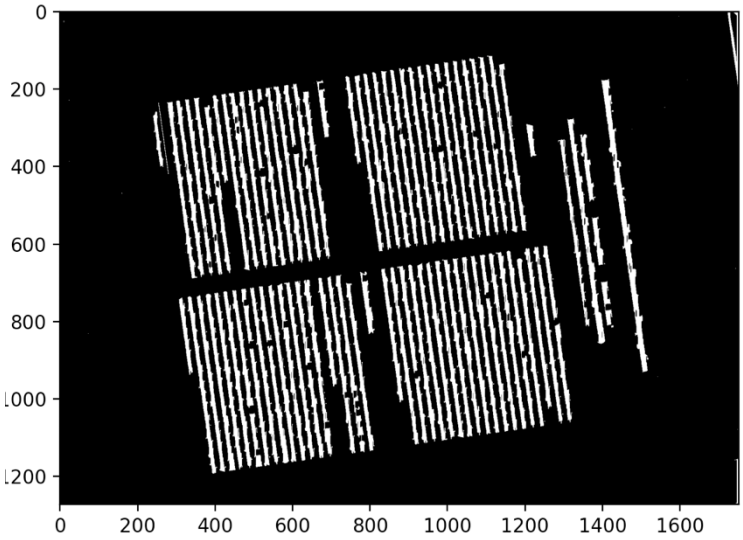
2. Related Work

Image completion synthesizes image structure to fill in larger missing areas using exemplar [9, 31, 2, 10, 17]. Our work is a branch of image completion, focusing on image completion of multiple photographs.

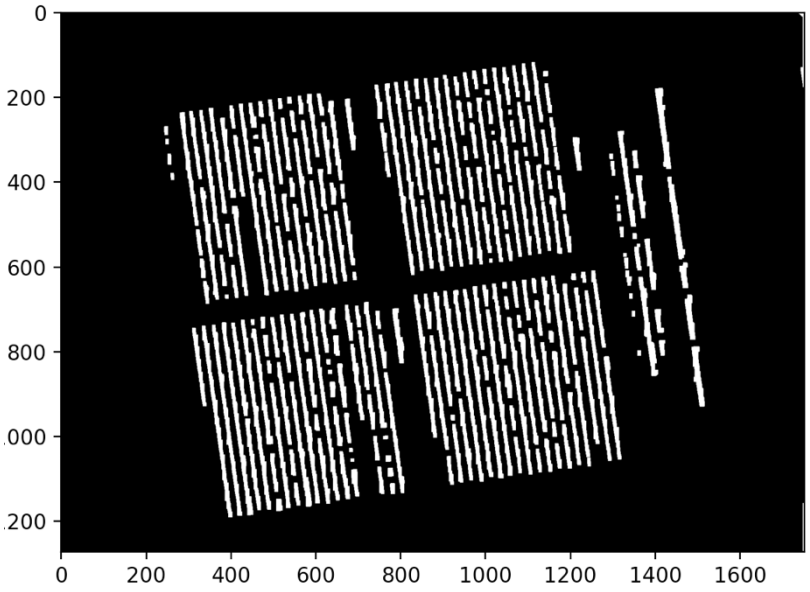
Single Image Completion Criminisi et al. [9] prioritized patches to be filled, and greedily propagated the patches from the known source region to the target region. Wexler et al. [31] solved the image completion problem with an expectation-maximization (EM) optimization using an image pyramid. Since the nearest neighbor field (NNF) search is the computational bottleneck of image completion, Barnes et al. accelerated the process by introducing an approximated search algorithm [2]. Darabi et al. [10] considered the gradients of images for patch-based synthesis and also introduced alpha-blending of multiple patches. Our method is based on the framework of Wexler et al. [31] with the main difference that our approach simultaneously completes the color and the depth of multiview photographs with structural coherence.

*Corresponding author

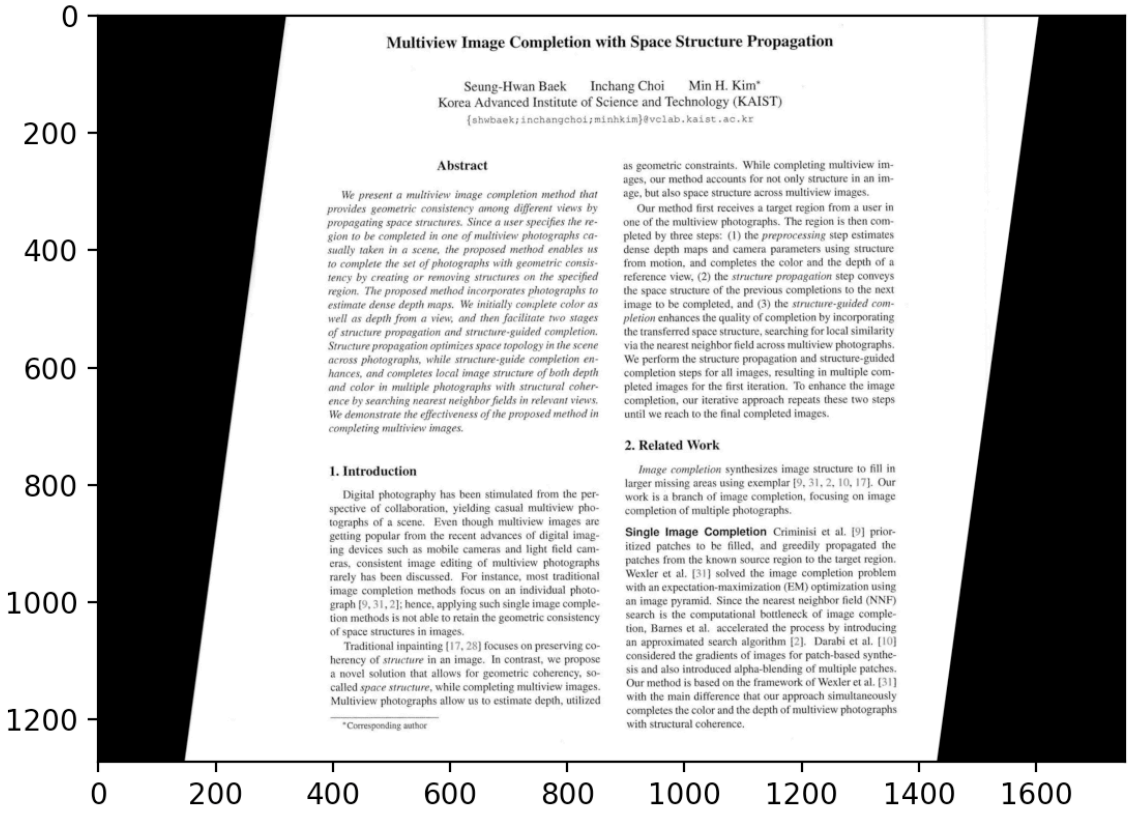
Closing_doc_1_gray



Opening_doc_1_gray



Deskewed_doc_1



Multiview Image Completion with Space Structure Propagation

Seung-Hwan Baek Inchang Choi Min H. Kim*
Korea Advanced Institute of Science and Technology (KAIST)
{shwbaek;inchangchoi;minhkim}@vclab.kaist.ac.kr

Abstract

We present a multiview image completion method that provides geometric consistency among different views by propagating space structures. Since a user specifies the region to be completed in one of multiview photographs casually taken in a scene, the proposed method enables us to complete the set of photographs with geometric consistency by creating or removing structures on the specified region. The proposed method incorporates photographs to estimate dense depth maps. We initially complete color as well as depth from a view, and then facilitate two stages of structure propagation and structure-guided completion. Structure propagation optimizes space topology in the scene across photographs, while structure-guide completion enhances, and completes local image structure of both depth and color in multiple photographs with structural coherence by searching nearest neighbor fields in relevant views. We demonstrate the effectiveness of the proposed method in completing multiview images.

1. Introduction

Digital photography has been stimulated from the perspective of collaboration, yielding casual multiview photographs of a scene. Even though multiview images are getting popular from the recent advances of digital imaging devices such as mobile cameras and light field cameras, consistent image editing of multiview photographs rarely has been discussed. For instance, most traditional image completion methods focus on an individual photograph [9, 31, 2]; hence, applying such single image completion methods is not able to retain the geometric consistency of space structures in images.

Traditional inpainting [17, 28] focuses on preserving coherency of *structure* in an image. In contrast, we propose a novel solution that allows for geometric coherency, so-called *space structure*, while completing multiview images. Multiview photographs allow us to estimate depth, utilized as geometric constraints. While completing multiview images, our method accounts for not only structure in an image, but also space structure across multiview images.

Our method first receives a target region from a user in one of the multiview photographs. The region is then completed by three steps: (1) the *preprocessing* step estimates dense depth maps and camera parameters using structure from motion, and completes the color and the depth of a reference view, (2) the *structure propagation* step conveys the space structure of the previous completions to the next image to be completed, and (3) the *structure-guided completion* enhances the quality of completion by incorporating the transferred space structure, searching for local similarity via the nearest neighbor field across multiview photographs. We perform the structure propagation and structure-guided completion steps for all images, resulting in multiple completed images for the first iteration. To enhance the image completion, our iterative approach repeats these two steps until we reach to the final completed images.

2. Related Work

Image completion synthesizes image structure to fill in larger missing areas using exemplar [9, 31, 2, 10, 17]. Our work is a branch of image completion, focusing on image completion of multiple photographs.

Single Image Completion Criminisi et al. [9] prioritized patches to be filled, and greedily propagated the patches from the known source region to the target region. Wexler et al. [31] solved the image completion problem with an expectation-maximization (EM) optimization using an image pyramid. Since the nearest neighbor field (NNF) search is the computational bottleneck of image completion, Barnes et al. accelerated the process by introducing an approximated search algorithm [2]. Darabi et al. [10] considered the gradients of images for patch-based synthesis and also introduced alpha-blending of multiple patches. Our method is based on the framework of Wexler et al. [31] with the main difference that our approach simultaneously completes the color and the depth of multiview photographs with structural coherence.

*Corresponding author

The image for doc is able to be de-skewed while the image for doc_1 is not able to due to the original orientation of the image. When applying the same de-skewing technique for doc_1, the closing method connect the pixels of the image to get the connected component, leading to a merging of the text lines in that orientation. The opening method will then remove some of the connectedness of the image to remove the noise but is not able to do it efficiently due to the merging of the text lines in that orientation. Thus, the image for doc_1 cannot be de-skewed properly when the initialized array was “np.ones(1,15)”, meaning 1 row and 15 columns. However, when the rows was switched to 15 rows and column is switch to 1, ““np.ones(15,1)”, the closing and opening will result is better segregation of the connected components and pixels, thus allowing the words to be skewed correctly.