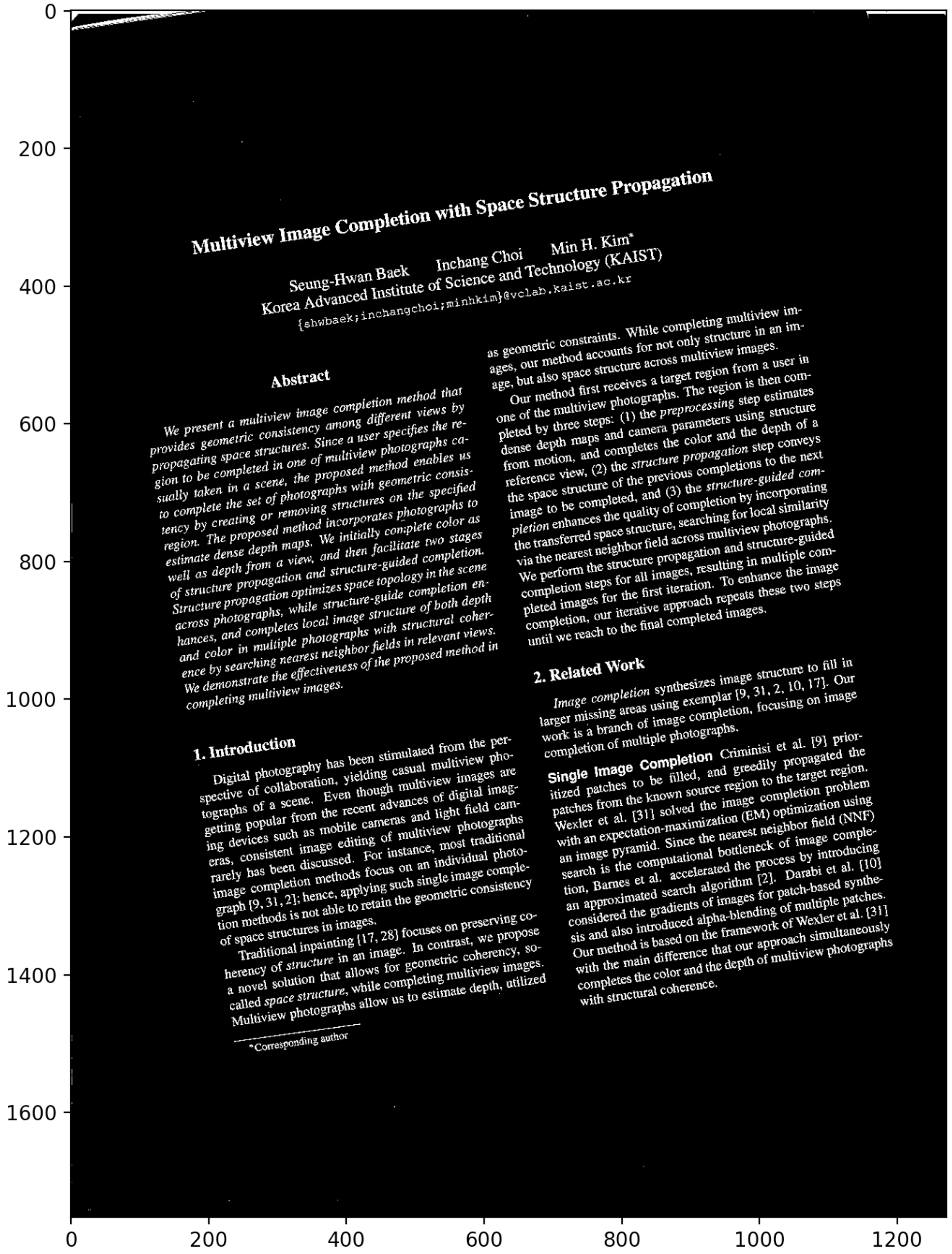
Task 2.3D

Foreground_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.

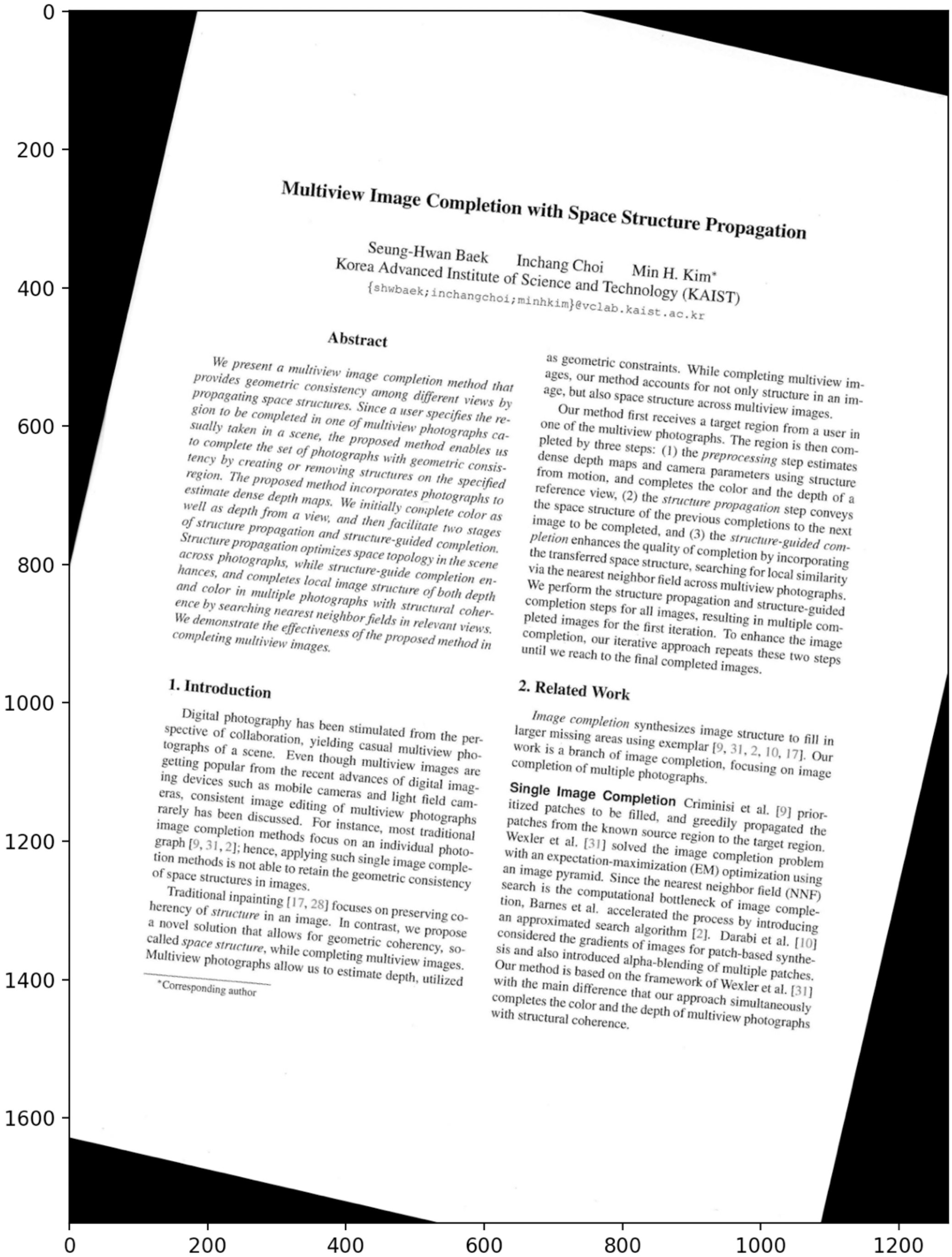
2. Related Work

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

Deskewed_foreground_doc



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Abstract

We present a multiview image completion method that
provides geometric consistency among different views by
propagating space structures. Since a user specifies the re-
gion to be completed in one of multiview photographs ca-
sually taken in a scene, the proposed method enables us
to complete the set of photographs with geometric consis-
tency 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 en-
hances, and completes local image structure of both depth
and color in multiple photographs with structural coher-
ence by searching nearest neighbor fields in relevant views.
We demonstrate the effectiveness of the proposed method in
completing multiview images.

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eras, consistent image editing of multiview photographs
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image completion methods focus on an individual photo-
graph [9, 31, 2]; hence, applying such single image comple-
tion methods is not able to retain the geometric consistency
of space structures in images.

Traditional inpainting [17, 28] focuses on preserving co-
herency of *structure* in an image. In contrast, we propose
a novel solution that allows for geometric coherency, so-
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Multiview photographs allow us to estimate depth, utilized
as geometric constraints. While completing multiview im-
ages, our method accounts for not only structure in an im-
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Our method first receives a target region from a user in
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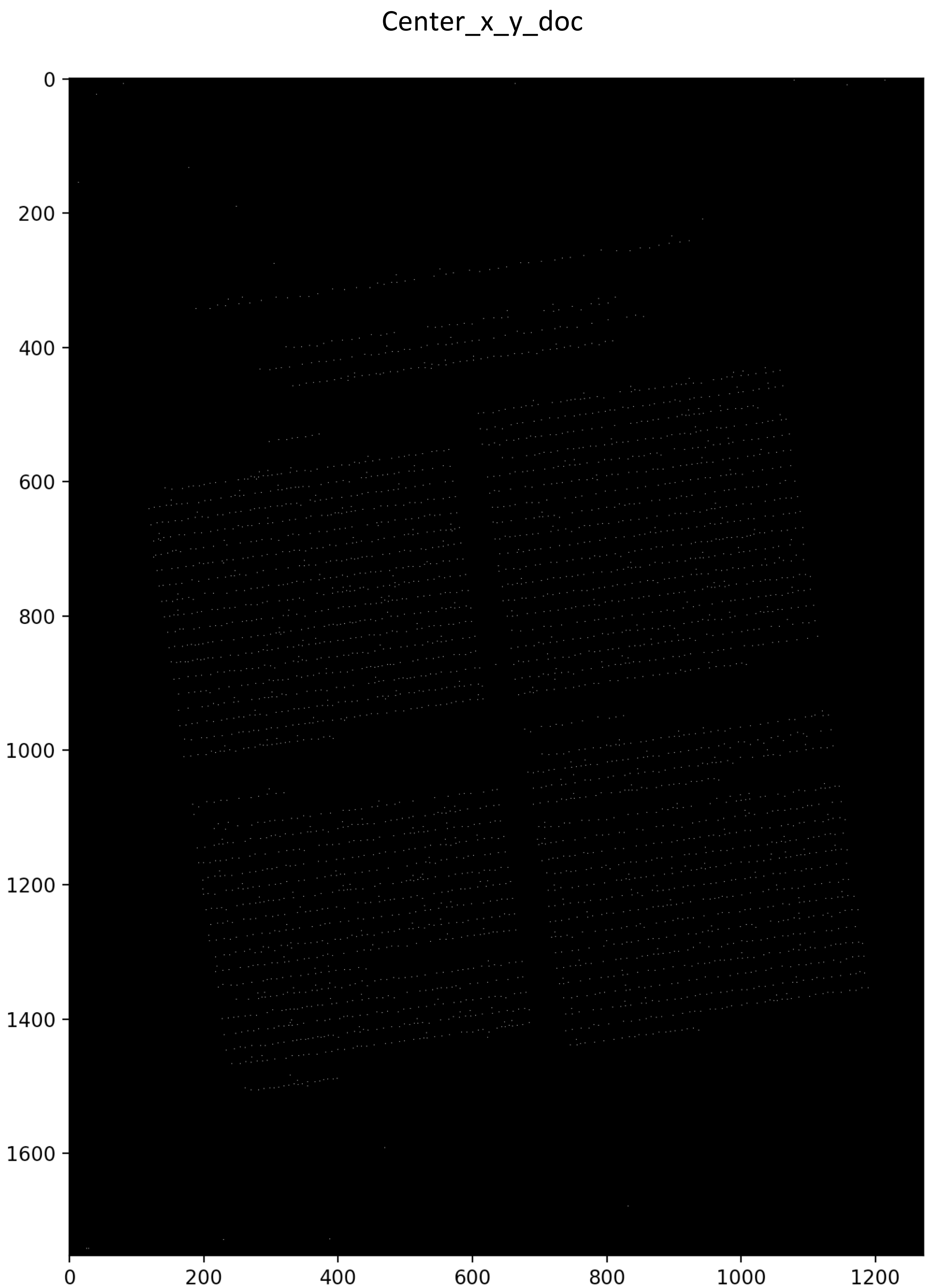
with structural coherence.

Time taken is 6.02s
Deskewed: - 12.999998995644646 degrees


Center_x_y_doc
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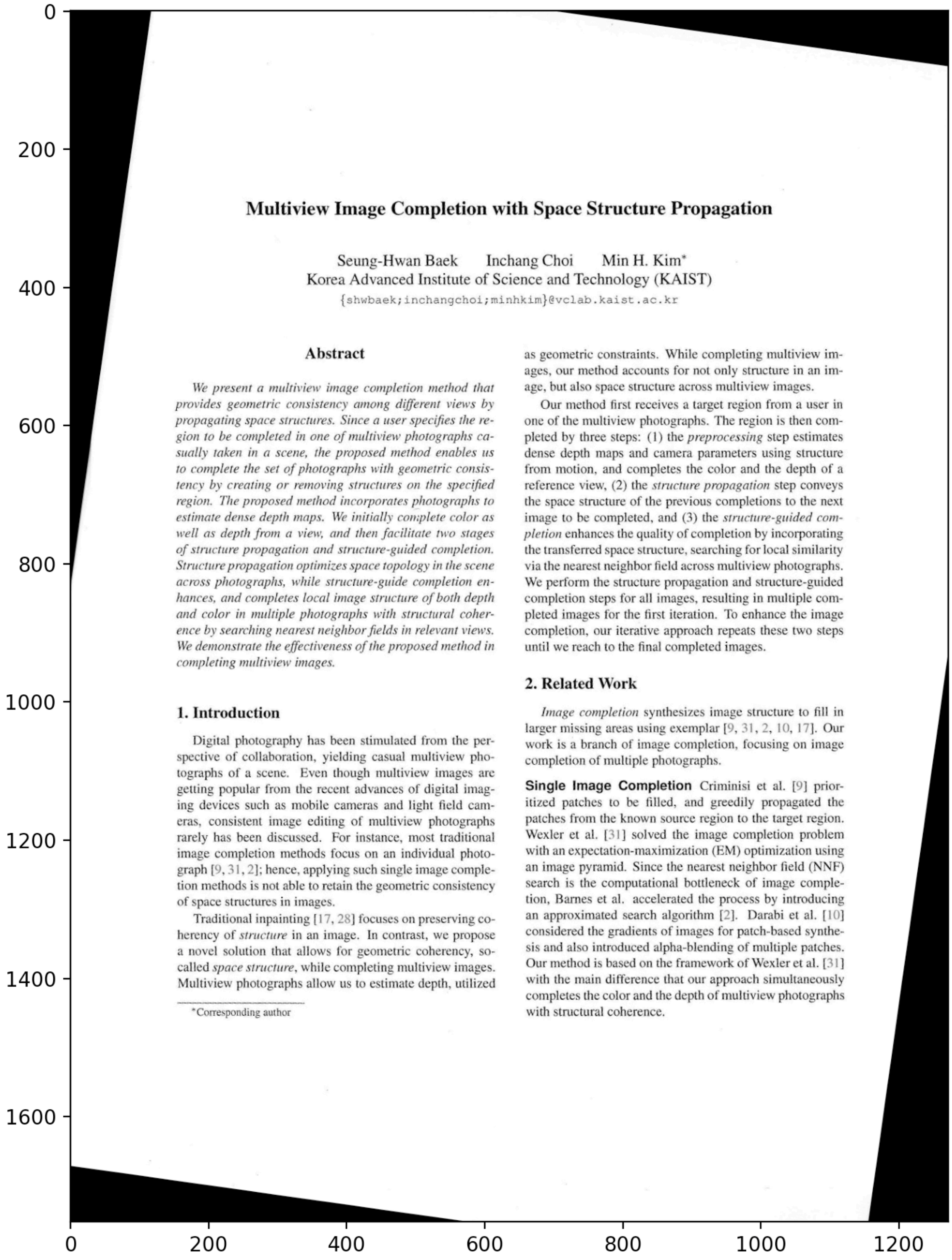
Deskewed_center_x_y_doc



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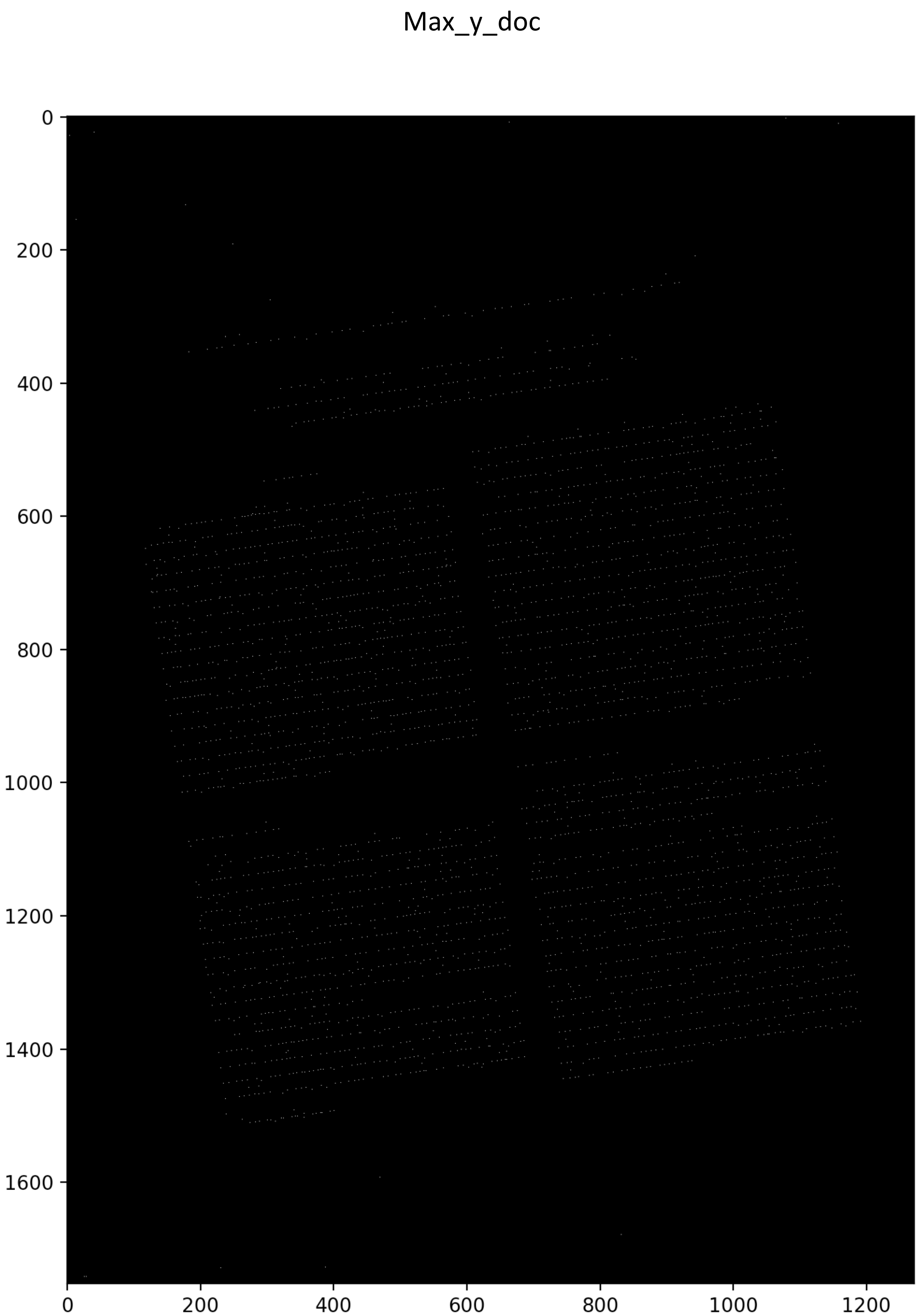
Time taken is 6.59s
Deskewed: -7.9999999948718425 degrees


Max_y_doc
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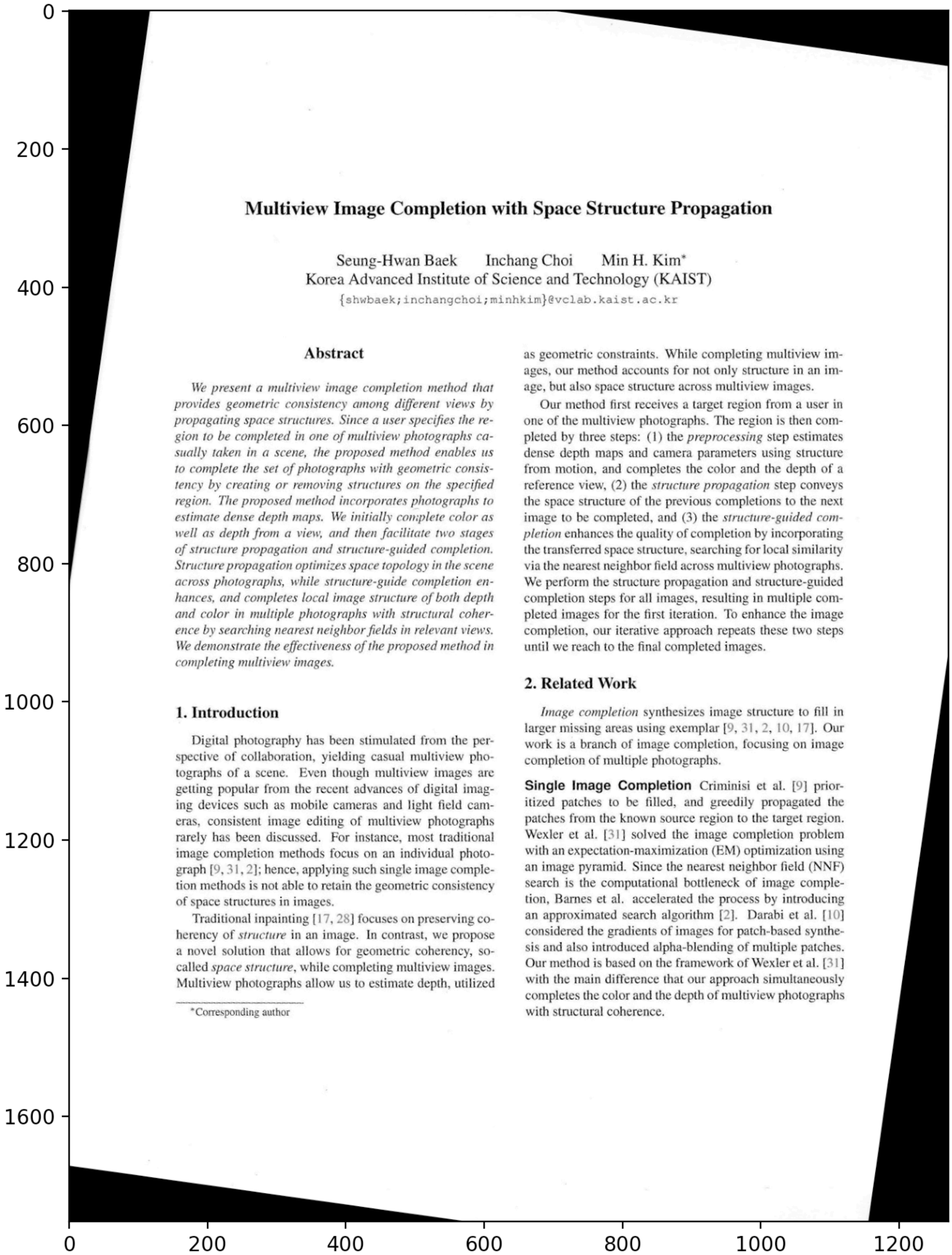
Deskewed_max_y_doc



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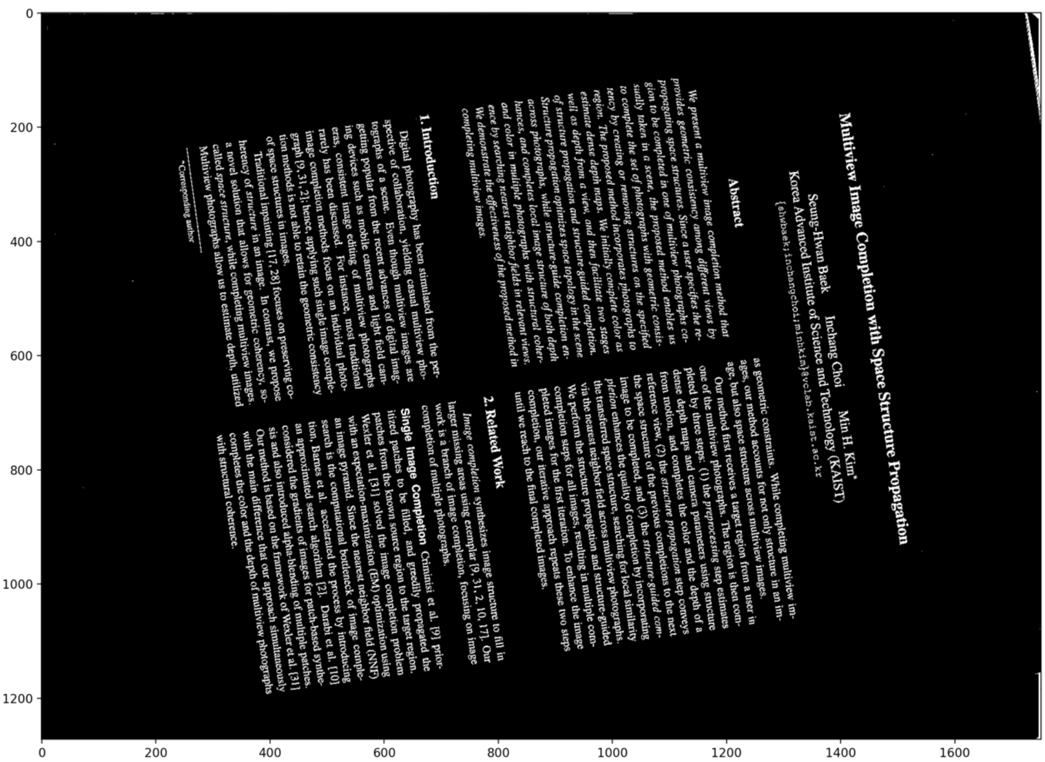
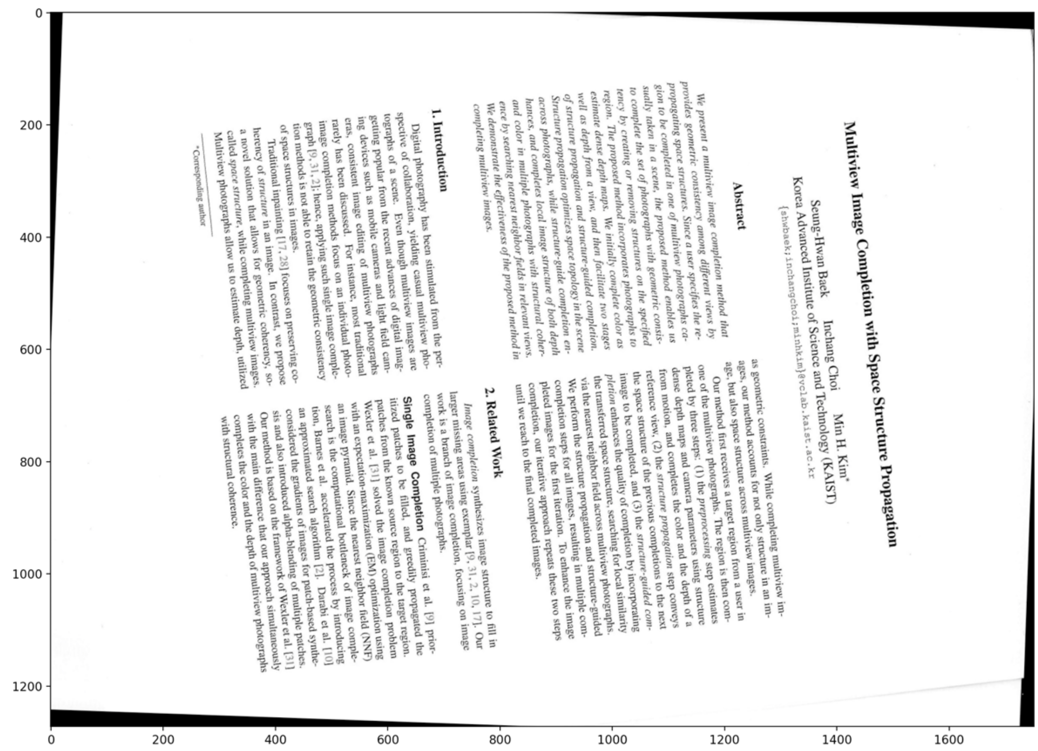
Time taken is 6.92
Deskewed: -7.9999999948718425 degrees

Foreground_doc_1



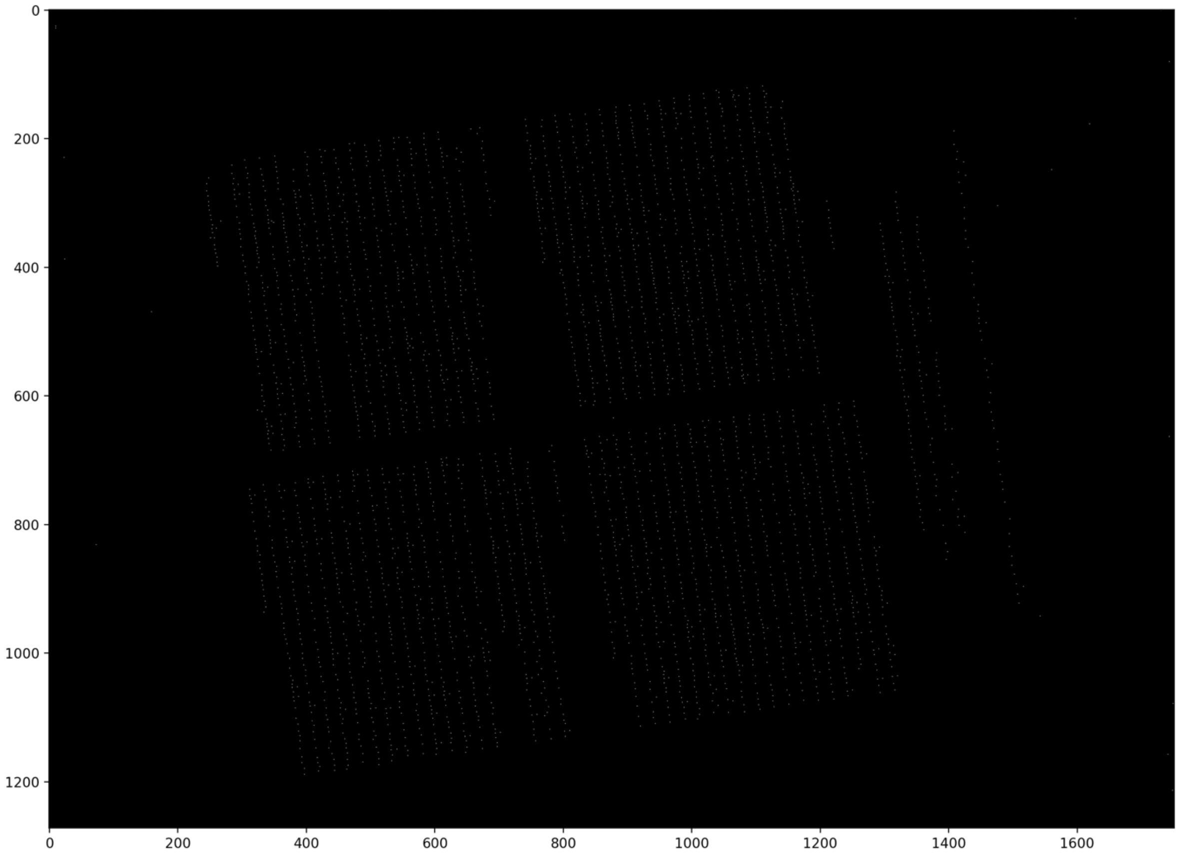
Deskewed_foreground_doc_1



Time taken is 6.59s

Deskewed: -1.9999998279066205 degree

Center_x_y_doc_1

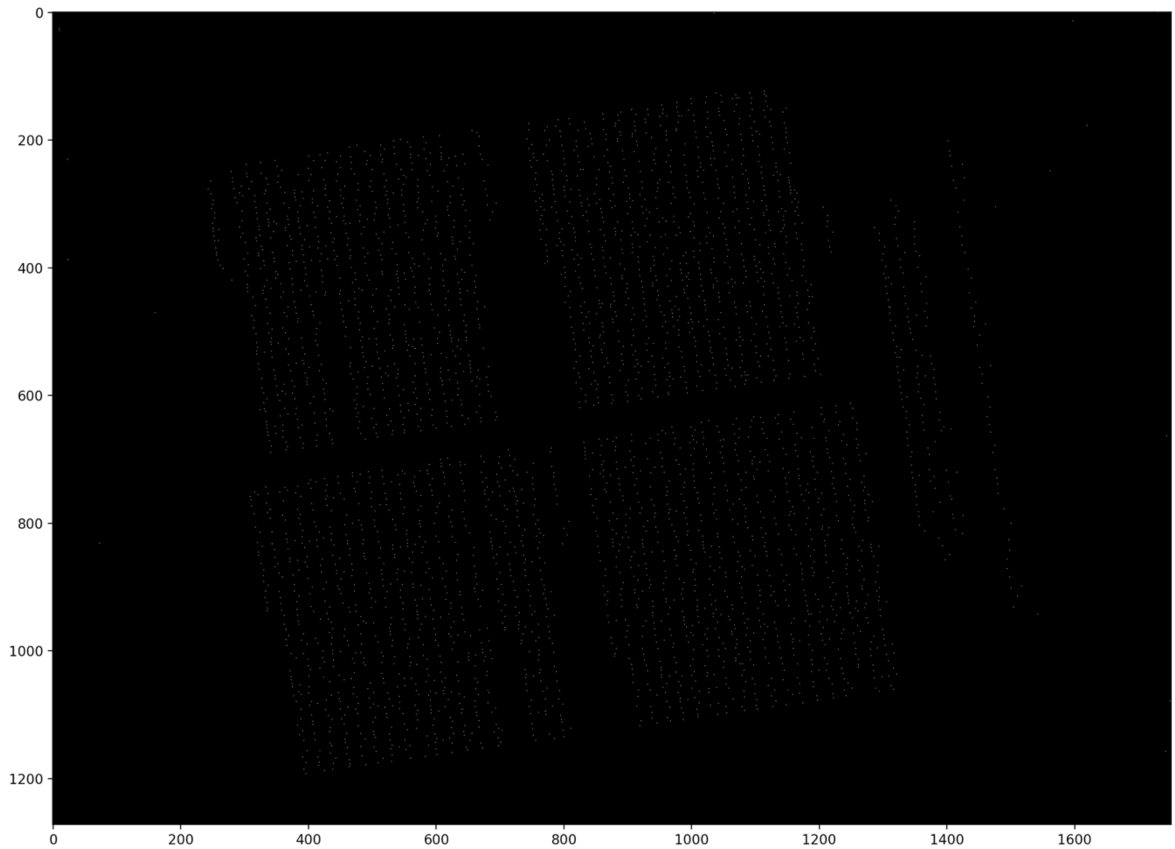


Deskewed_center_x_y_doc_1

Time taken is 7.01s

Deskewed: -35.99999667608026 degrees

Max_y_doc_1



0
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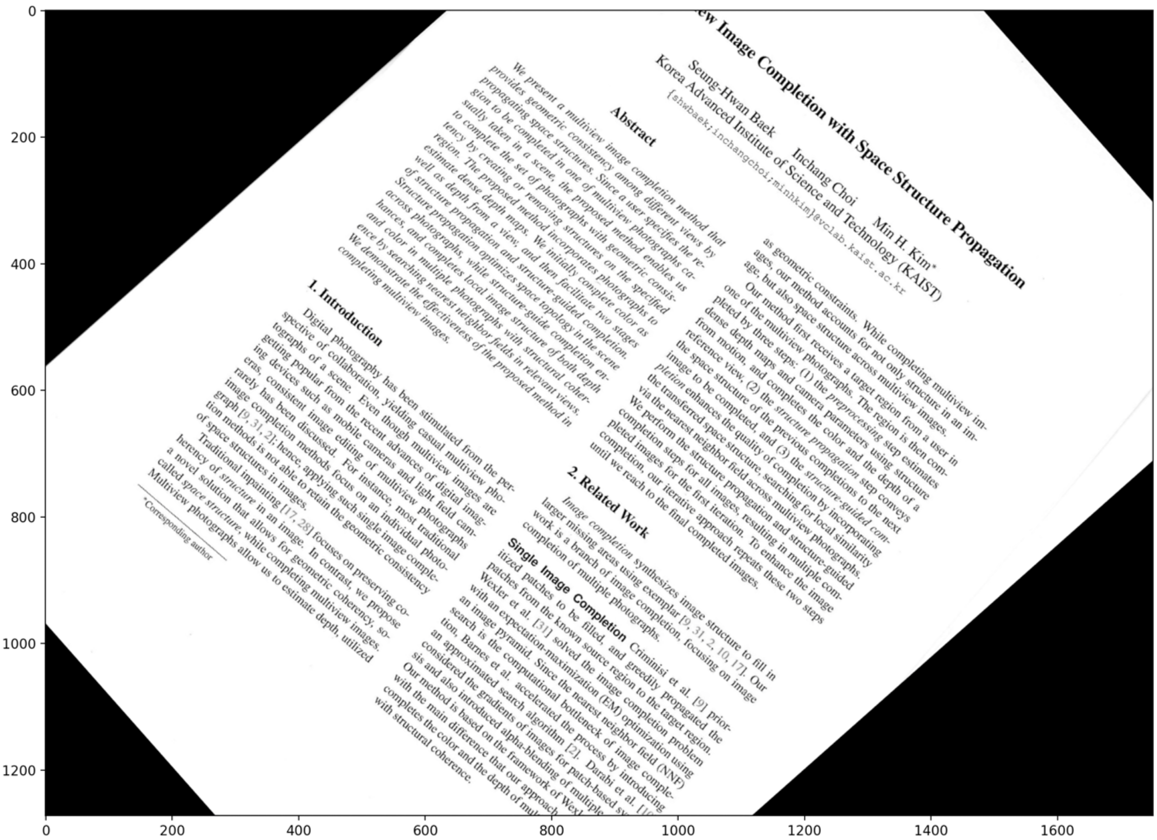
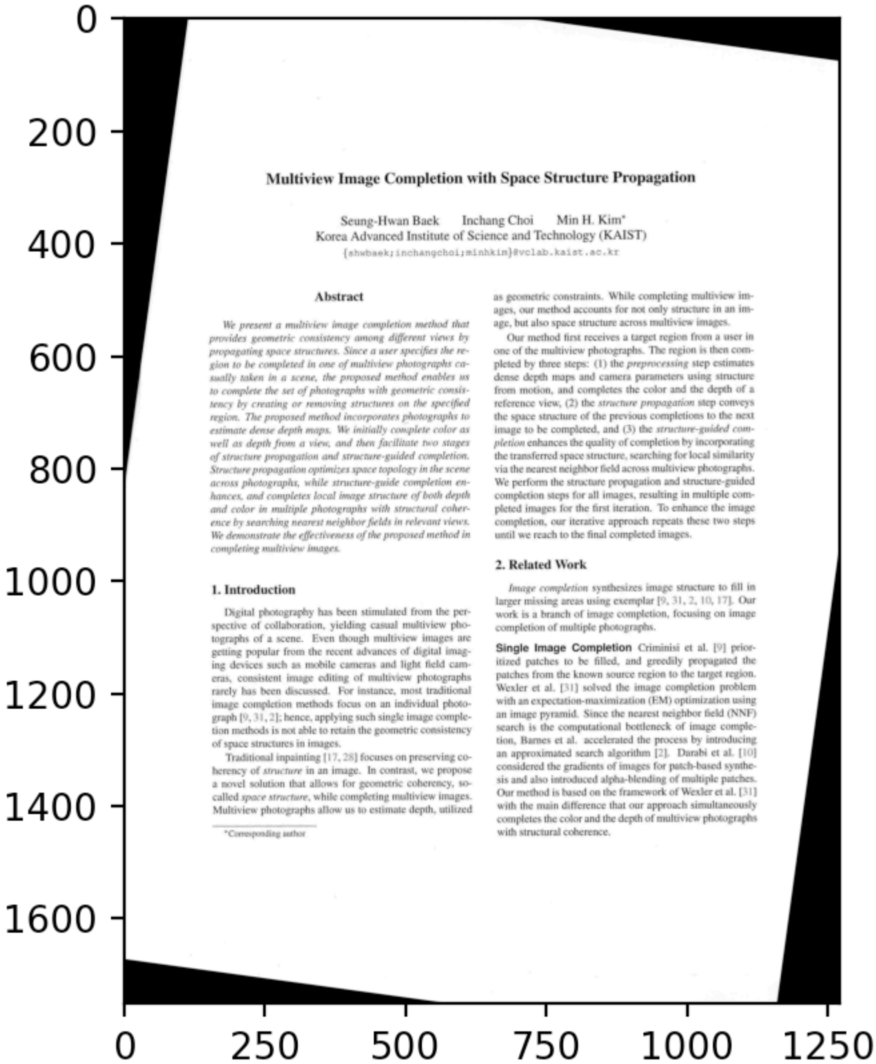
Deskewed_max_y_doc_1



Time taken is 6.01s
Deskewed: -41.49999967504387 degrees

Initial image



The Hough Transform method does not work for doc_1.jpg due to the larger orientation of the image. The orientation of the image should turn in an anti-clockwise motion to be de-skewed properly. This is seen in the above images for doc_1, the de-skewed images are not fully skewed. This can be addressed by doing another Hough transform method on the new image.