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Image Mosaicing

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Abstract: *Image mosaicing is a technique for combining many images of the same scene to generate a larger, seamless panoramic image. Image mosaicing can be traced back to the days of manually piecing images. Image-mosaicing techniques have been created to automate the process since the introduction of computer technology. The method consists of five phases, including feature matching and estimation of the homography matrix. Image mosaicing is commonly used in virtual tourism, video games, and photo editing. Despite the fact that the image panoramic feature is accessible in digital cameras, there is still potential for improvement, and more research in this sector is required.*

Keywords: Image mosaicing, Panoramic images, Computer vision, Image processing, Feature matching, Homography matrix.

I. INTRODUCTION

Long before the invention of contemporary computers, image mosaicing was a common practice. At that time, the captured photos were manually assembled. As satellites began returning images to earth in later centuries, the demand for mosaicing grew even more. Computer technology advancements developed into a natural driving force to create a computational technique and resolve connected issues. It is extensively used in everyday life by stitching together images to create panoramas or a huge image that can display the dramatic, entire scenarios. For instance, it can be utilized for online virtual travel, creating virtual environments in video games and editing individual photos.

Using the technique of image mosaicing, you can combine smaller photographs of the same scene into a larger one. The union of the different input photos will be the mosaic's final product. To create mosaiced images, image-mosaicing algorithms are utilized. The technique of image mosaicing is essentially broken down into five steps which include capturing the image, feature detection and matching, transformation estimation, image alignment and blending.

In this paper, we investigate the present state of the art in picture mosaicing research and examine the challenges and prospects for future progress in this intriguing field of image processing. We look at recent changes to classic algorithms that have enhanced field of view and visual resolution, as well as potential future research and algorithm development areas. Our goal is to present a complete overview of image mosaicing's current condition and to inspire new developments in this fast-expanding subject.

II. LITERATURE REVIEW

[1] Erik Makino Bakken and Oivind Midtgaarda introduced a new technique for automatically choosing the best image segments for an underwater optical mosaic. Underwater optical pictures' quality is substantially impacted by poor lighting, strong light absorption, and light dispersion. For enhancing the photographs' contrast, intensity distribution, and colour harmony, we have created a revolutionary mix of techniques. In addition, we have shown how to choose the best portions of overlapped photos using a relative quality metric. The Tile Cam colour and grayscale photos were collected by HUGIN AUVs in a variety of underwater environments, and the mosaic processing chain has been successfully tested on these images. We intend to use image-based matching in subsequent work to enhance coregistration for big mosaics. Additionally, we will try to enhance the range-dependent illumination model by taking into consideration the inclination of the nearby scene planes.

[2] Qiang Chen et al perform a technique of Image mosaic based on rectification is proposed. The image is Preprocessed and rectified through plane homograph. In the last two images are stitched through feature point matching and image fusion which contains Harris corner detection and SIFT feature matching algorithm. The purpose of this is to

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Use In Traffic Accident Scene Diagramming. The accident scene map is created using the accident mosaic image as a background through traffic accident analysis, and the relative inaccuracy of the measured value is less than 2%. This makes it simple for investigators to map the whole accident scene and guarantee the accuracy of data collection.

[3] Xiangyan Lan et al proposed a technique to improve the matching performance of the algorithm, an improved UAV aerial image registration algorithm based on GMS-RANSAC is proposed. The characteristics of the GMS algorithm to improve the RANSAC algorithm, reduce the number of iterations of the algorithm, and reduce the time complexity of the algorithm. Images are first divided into a grid image then extraction of extract feature points is done using Brute Force Matching Algorithm. Finally, GMS algorithm is used to verify whether all feature pairs extracted using Brute Force Matching Algorithm match exactly. GMS-RANSAC algorithm introduced in this paper improves the matching performance of the algorithm by improving the stitching speed and matching accuracy.

[4] Yi Zheng et al proposed an effective automatic sorting and mosaic method based on Fourier-Mellin transforms and SIFT proposed and studied deeply. Some intuitive and persuasive simulation experiments have been carried out by using the proposed automatic sorting and mosaic method. The experimental results show that the proposed method can sortand stitch unordered overlapping images automatically. The purpose is for use in the fields of three-dimensional reconstruction, cooperative augmented reality and teleoperation robots.

[5] Pooja Deshmukh et al perform Quantitative analysis of two algorithms. A mosaic image is created by mixing a variety of image fragments to create a whole image. Videos, photographs, and documents with images can all use this technology. The major objective of this work is to employ stitching images for information retrieval and restoration from documents or photo images. In this paper, we review the numerous image mosaicing techniques. Techniques for integrating numerous photos into one whole and a broader view of the image are known as image mosaicing. There are still many prospects for study in this area. Numerous applications are used in a wide range of industries, including forensic science, photography, archaeology, the preservation of historical documents, and corporate domains.

[6] AbderrahmaneLaraqui et al performs a technique to generate mosaic image from video. A key area of study in the field of computer vision is video mosaic. A crucial area of study in the realm of computer vision is the picture mosaic. In this article, real-time video scenes were compressed using picture mosaics. The experiment demonstrated that our approach greatly reduces storage size using a database of eight video sequences. A compression ratio that is between 81.7 and 92.30 percent less than the original video size. In addition, the mosaic's quality is good.

[7] KhellalAtmane et al performed a technique in which it consists in aligning multiple images to construct a single large image of a 3D scene allowing the operator to view images that offer a wider field of view than standard images. To build a mosaic image from a sequence of images (obtained from a set of images, a movie or a real video stream) three basic steps are required: Image Acquisition, Image Registration and Perspective Warping. The purpose is quantitative analysis of image mosaicing algorithms is established. First, a new projection approach for image registration is applied. Then, two algorithms of images mosaicing are implemented and compared using accurate quantitative analysis. Experimental validation shows that the mosaicing algorithm-based SURF gives much better results compared to KLT. Such a conclusion is expected since the robustness of SURF detector and descriptor.

[8] Yuping Feng Shuguang Li proposed a technique to enhance the conventional ORB algorithm without scaling based on SURF and refine the technique of image feature point extraction, which essentially enhances the proper matching logarithm under changing scale. The experimental results demonstrate that the enhanced ORB method described in this study, which combines the resilience of the SURF algorithm with the efficiency of the ORB algorithm, has the advantages of the two algorithms. The algorithm uses the multi-scale space of the SURF algorithm to extract the feature points.

III. ALGORITHMS USED

Image mosaicing is used to make a larger image with a wider field of view, whereas image stitching is used to make a panoramic image. Two algorithms are employed in this paper to stitch the images together: Sift and Ransac.

3.1 SIFT

A computer vision approach called SIFT (Scale-Invariant Feature Transform) is used to find and describe local features in images. Finding keypoints—areas of the image that are unaffected by changes in scale, rotation, and illumination—is how the algorithm operates. Once these keypoints are identified and located, a descriptor is made for each keypoint that describes how the surrounding picture patch looks in general. The utilisation of these descriptors can subsequently be put to use in projects like 3D reconstruction, picture matching, and object recognition.

Applications:

1. Object Detection: The SIFT algorithm can be used to identify and match the features of key points between images, making it a powerful tool for object detection in images and videos.
2. Combining Images: The SIFT algorithm can be used to detect and match features across multiple images, allowing them to be seamlessly combined to create a larger panorama.
3. Forensics: The SIFT algorithm can be used to match the features of different images to determine if they were captured by the same camera or to identify image manipulations.

3.2 RANSAC

An effective approach for fitting models to data in the presence of outliers is RANSAC (Random Sample Consensus). The algorithm selects a selection of the data points at random, and then fits a model to these points. The model is then tested against the remaining data points, and those that fit within a certain tolerance are regarded as inliers. The procedure is performed several times, and the model that best fits the data is the one with the greatest number of inliers.

Applications:

1. Object detection: The RANSAC algorithm can be used to detect and localize objects in images by fitting models (such as circles, ellipses, or lines) to the detected features.
2. Structure from motion: The RANSAC algorithm can be used to estimate the relative camera poses and 3D structure of a scene from a set of 2D images.
3. Stereo vision: The RANSAC algorithm can be used to match features between a pair of stereo images and estimate the 3D depth of the scene.
4. Robotics: The RANSAC algorithm can be used in robot navigation and localization, such as matching features between a map of the environment and real-time sensor data.

IV. SUGGESTED MODEL

The procedure for stitching photos together consists of numerous steps. The photos are first put into the algorithm and transformed to single grayscale images. The keypoint indices of each image are then identified using a SIFT detector. Then, using their SIFT descriptors, the main points of each image are matched. RANSAC is used to determine the most likely transformation between the images while also removing any outliers in order to stitch the images together. The transformation is then applied to the following image, which is then stitched together. This procedure is done until all of the photos have been stitched together.

If the number of photographs is an odd number, the method begins with the exact middle image and stitches it with the image to its right. The two stitched images are then patched together with the image to its left. The remaining photos are stitched together in an alternating right and left pattern. If the number of photos is an even number, the process begins with the middle-left image and stitches it with the image to its left. The two stitched images are then patched together with the image on the right. The remaining photos are stitched together in an alternating left and right pattern. Finally, the finished stitched image is outputted and checked for distortion.Finally, the finished stitched image is outputted and checked for distortion. Overall, this process offers a solid method for stitching photos together and producing a seamless final image. Figure 1 depicts the same workflow in flowgraph format

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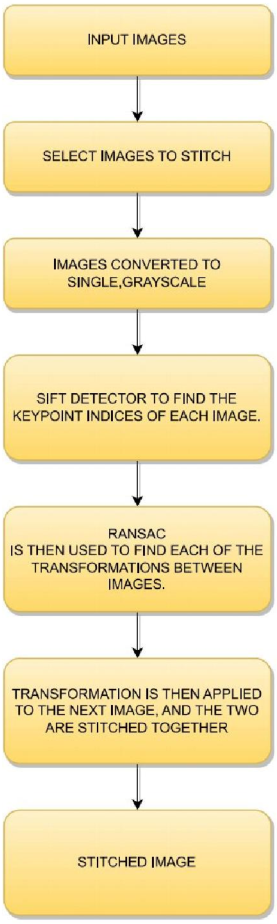

Figure 1: Basic flowgraph depicting the workflow of the system

V. RESEARCH METHODOLOGY

This research is descriptive in nature, and data is gathered using an information retrieval approach.

Problem

The challenge is to combine several high-resolution photos into a single one that covers a larger region without sacrificing quality or adding obvious seams or distortions.

The Study

Edge detection, filtering, and colour correction are just a few of the complicated techniques that must be studied and used in order to stitch several photos together into a high-quality image. These techniques are essential for locating and matching important regions inside images, calculating transformations, and removing distortions. These algorithms can be used methodically to produce stitched photos that faithfully capture the original scene and are seamless and aesthetically consistent.

Research Design

An effective and efficient method for combining photos and producing stitched images is provided by the methods described in this work. The suggested approach can accurately match and stitch images while also removing outliers and minimising distortions by utilising methods like SIFT and RANSAC. A number of industries, including panoramic photography, satellite imaging, and producing high-resolution photographs of vast objects or scenes, may be significantly impacted by this technology. Generally speaking, the suggested technique can offer a dependable and solid solution for stitching together photos and can be a useful tool for a variety of applications

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Preprocessing

An appropriate preprocessing step needs to be carried out in order to get the images ready for stitching. This entails choosing the proper photographs that should be stitched together, such as panoramas or images taken from various viewpoints of a large item. After finding the appropriate photographs, they should be turned into a single grayscale image and kept in a data folder.Making sure that the photographs are of similar sizes is also crucial. In order to ensure that the stitching algorithm can precisely match and stitch the images together, this can be accomplished by scaling or cropping the images. To ensure that the images have comparable resolution, focal length, and distortion properties, it is advised to use a consistent camera and lens setup while taking the pictures. The photos will be in a format that the stitching algorithm can process if these pretreatment steps are followed. This can make it more likely that the algorithm will successfully match the photos and stitch them together to produce a high-quality stitched image.

VI. RESULTS

Figure 2 depicts the user interface for entering the photos to be mosaiced. It takes the input images and renames them as img1, img2, img3, and so on. The photos are then saved in the data folder. Figure 3 shows the final result of mosaicing, or stitching the images together.

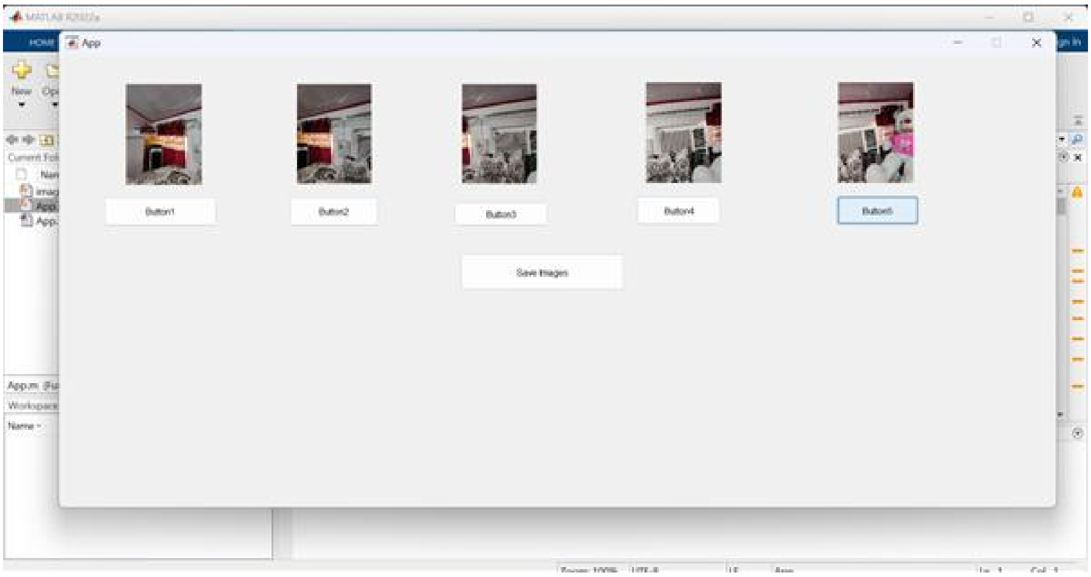

Figure 2: Selecting the input images for the mosaic

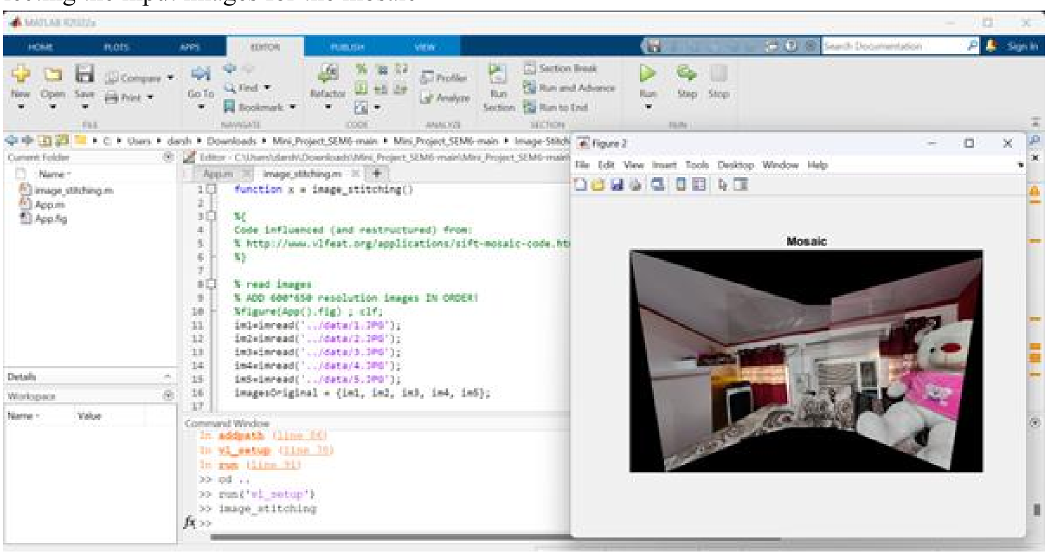

Figure 3: Output of the mosaiced image

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VII. CONCLUSION

To summarize, image mosaicing is a fascinating and continually expanding subject of image processing that has been substantially advanced by advances in computer technology. Using feature detection and matching algorithms like SIFT and transformation estimation techniques like RANSAC, it is now possible to seamlessly stitch together several images into a bigger, more detailed picture. However, difficulties persist, particularly in the areas of image alignment and blending. We expect exciting future opportunities for image mosaicing as we continue to investigate new algorithm development areas, such as improved field of view and higher resolution. Finally, this technology has become a vital tool for constructing simulated environments, online virtual travel, and modifying individual photographs, resulting in a more rich and immersive experience.

VIII FUTURE ENHANCEMENT

There are several potential research directions for improving image mosaicing. Some of them are as follows:

- Large-scale mosaicing: While picture mosaicing is normally used to combine a small number of photographs, there is growing interest in constructing mosaics that include hundreds or even millions of images. Future research could look into ways to scale SIFT and RANSAC to handle big datasets, for as through distributed computing or by lowering memory needs.
- Multi-modal mosaicing: The majority of current picture mosaicing techniques are intended to work with photos from a single modality, such as visible light photography. Future research could concentrate on creating methods for combining images from several modalities, such as infrared or depth sensing, to build more extensive and accurate mosaics.

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