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SURVEY ON PRESERVING THE CONTENT VIA IMAGE STITCHING

Miss Janhvi Bobhate[1], Prof. V. M. Lomte[2]

[1]Student, TE Computer Engineering, RMD Sinhgad School of Engineering, Warje, Pune-58, Maharashtra, India.
[2]Head Of Department, RMD Sinhgad School of Engineering, Warje, Pune-58, Maharashtra, India.

Abstract- *Image/Video stitching stitches multiple overlapping images or merges two or more image into seamless view. The stitched image/video generates wide-field-of-view(fov).The image stitching which is also called as image mosaicing is widely used in the areas like sports broadcasting, video surveillance, google street view, aviation photography,360-degree panaroma and also field of image processing. Image processing refers to processing of information via images .This survey review is about preserving the content via image stitching with rectangular boundary constraints. With the help of unified optimization, regular boundary is formed by image stitching. Firstly, initial stitching based on traditional warping method is achieved which produces composition of warped meshes, on it polygon Boolean operations are performed for getting the irregular boundaries. The image stitched framework should be of rectangular boundary maintaining its content with reduced unwanted distortions. So, the irregular boundaries are analyzed to line and regular boundary making the content preservable in its constraints with less distortions. This image stitching method is extended to video stitching. Video stitching is more complicated as there are many factors hinderance like shakiness of camera, moving objects, blurring of images, ghosting effect, temporal coherence.*

Key Words: Image stitching, panaroma, content preserving image stitching, video stitching, warping.

Motivation: The key aspect for the author to research in this topic is that the wide-field- of- view(fov) which is generated by image/video stitching. The image/video stitching stitches the overlapping images into seamless view. This is due to avoiding the unwanted distortions and maintaining the content making it more natural panaromic image with the help of unified global optimization, which is used to regulate regular boundary, line and shape preservation. The image stitched framework is obtained with piecewise rectangular boundary preserving its content.

1. INTRODUCTION

As day by day the technology is expanding so, does we all are dependent on it. We use varied technologies to achieve peculiar task. In computer science and technology, expeditiously growth in the field of computer vision and computer graphics has been done. As it is matter of cumulative interest and rigorous exploration for decades now. The computer vision is field of artificial intelligence which uses digital images and videos to train computers to interpret and understand the visual world. The computer graphics is branch of computer science which is core technology in digital photography and media, also many specified applications.

One of the most widely used modern application is image stitching. Image/video stitching is the process to stitch multiple overlapping images or merging of two or more image into seamless view or high-defined image. This has expanded the scope of image stitching and can be deployed in a wide range of applications in different industries. Also one of the standard application of image stitching is used in smartphone devices to achieve wide-field of view(fov) using panaroma. A panaroma is feature in camera to take multiple images resulting into one wide ranged image by movement of camera. This feature is well admired by photographers. The image stitching algorithms has vastly increased the productivity and are used in producing digital maps, satellite photos, sports broadcasting, video surveillance, google street view, aviation photography, 360-degree panaromas. Also there are softwares using image stitching algorithms like Hugin[21], AutoStitch[21], PTGUI Pro[21], Image Composite Editor[21], PhotoStitcher[21] and many more. Some video stitching software such as VideoStitch[22], Studio[22], AutoPano[23] are also available.

We can crop the image to have the rectangular boundary. But cropping of image results to mislaying of content .While taking panaromic images by movement of the camera in a particular direction, it causes misallingments and diminishes the broad angle photography. Due to this, the image has irregular boundary and cropping idea is dropped. This survey reviews that approach to the method is to assign the stitched panaroma into regular rectangular boundary sustaining as much as content possible and making it more natural. The method comprises of both rectangling and stitching and work in synchoronous manner.

Now, a question may come what exactly a piecewise rectangular boundary refers to. A piecewise rectangle boundary point's out to outlying boundary of the aspect and it is delineate as combination of rectangles.

2. OVERVIEW

This survey gives the overview of the image stitching algorithm.

2.1 Approach: Firstly, initial stitching based on traditional warping method is done which produces composition of

warped meshes, thereon polygon Boolean operations are performed on it. By polygon Boolean operation the irregular boundaries are acquired so that apt boundary for piecewise rectangling is accessed. For maintaining the stitched framework, global optimization is used to regulate regular boundary, line and shape preservation reducing the unwanted distortions. As we acquire the rectangular boundaries, then iteratively merge the other boundaries to get the desired unified framework. Finally, both rectangling and stitching is done synchronously to yield the panaroma with rectangular boundary. Thus, we get enhanced piecewise rectangular boundary of the image, preserving the content while avoiding the distortions precisely as natural image.

2.2 Video Stitching: This image stitching method is extended to video stitching. A video can be taken from static camera or from moving camers like a smartphones or UAVs. With fixed camera array regular boundary panaromic video is manageable but with moving cameras strenuous efforts has to be taken. In general, Video stitching is more complicated as there are many factors hindarance like shakiness of camera, moving objects, blurring of images, ghosting effect, temporal coherence.

3. ARCHITECTURE

The survey architecture explains the following methods to describe the working structure of the system [1].

3.1. Preprocessing: Basically, processing of image is rendered to compute the image match graph as proposed in [13]. This operation coordinates with the overlaps of image to get stitched. Thus, first step i.e., preprocessing of image is done.

3.2. Initial Image Stitching: The basic idea for this step is to evaluate rectangular boundary for preserving the content. For this, application of APAP [15] for feature alignment, for preserving the shape ARAP warping [24] and shape preservation term inspired in [25], also global similarity term described in [8] is used for maintaining less distortions.

3.3. Piecewise Rectangular Stitching: It is important part and performed as likewise:

3.3.1. Irregular Boundary Extraction: The warped meshes of the stitched images produces the irregular boundaries. Hence, the irregular boundaries are drawn out. For extraction of irregular boundaries, an algorithm based on polygon Boolean union operations is achieved. According to [26]Boolean operation computes in time O((n+k)log(n)) where n is the total number of edges of all the polygons involved in a Boolean operation and k is the number of intersections of all the polygon edges.

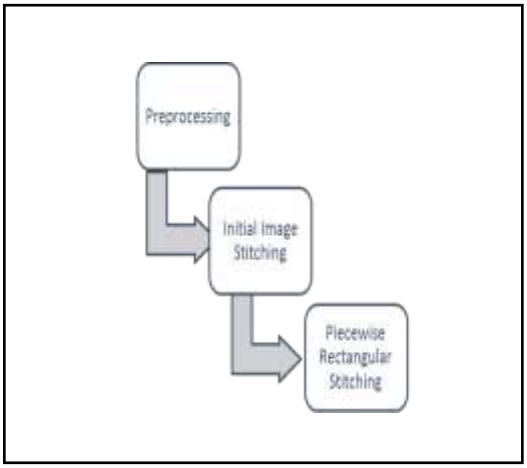

Fig: 1: Existing Architecture of the System.

3.3.2. Piecewise Rectangular Boundary Constraints: By polygon Boolean operation the irregular boundaries are acquired thus apt boundary for piecewise rectangling is accessed by Piecewise rectangular boundary analysis algorithm.

3.3.3. Piecewise Rectangular Stitching: Furthermore, it is carried out for regular boundary and line preservation in the role of averting the distortions when rectangling irregular boundaries. Then iteratively refining the piecewise rectangular boundary to obtain the unified stitched framework.

3.3.4. Refinement of Piecewise Rectangular Boundaries: In this step, we get optimized result with less distortions and rectangular boundary preserving the content natural panaroma is generated.

4. LITERATURE SURVEY

The Literature survey defines background study of the system with its related outcome.

Sr No.	Published Year	Published By	Research Topic	Research Gap	Outcomes
1.	2009	Connelly Barnes, Eli Shechtman,Adam Finkelstein & Dan B Goldman [2].	Patchmatch: a randomized correspondence algorithm for structural image editing.	For future work, hope to implement completion, retargeting, and reshuffling for video and also additional speed gains to be realized for applications in real-time vision and video processing.	It computes approximate nearest-neighbor fields between pairs of images or image regions and wide variety of patch-based optimization approaches for image synthesis.
2.	2013	K. He, H. Chang, & J. Sun [3].	Rectangling panoramic images via Warping.	The method fails : 1] When the scene is not completely shot, 2] Distortion can occur near very concave boundaries. 3] It may not preserve all lines and bend undetected lines.	It adopted the warping for rectangling panoramic images and proposed an automatic content aware method for warping irregular panoramas
3.	2015	S. Yen, H. Yeh, and H. Chang [4].	Progressive completion of a panoramic Image.	It still involves computational inefficiency & the amount of time that it requires.	It defined the progressive way to apply Markov Random Field (MRF) model, priority term to guide the filling order and proposed modified priority belief propagation (MPBP) method to complete a stitched panorama image with a rectangular boundary.
4.	2016	Yu-Sheng Chen and Yung-Yu Chuang [5]	Natural Image Stitching with the Global Similarity Prior.	The method results into showing artifacts with obliqueness and non-uniform deformation.	It precisely accomplish alignment, reduces shape distortion, naturalness and without a limiting view.
5.	2017	Jing Li, Zhengming Wang, Shiming Lai, Yongping Zhai and Maojun Zhang [6].	Parallax-Tolerant Image Stitching Based on Robust Elastic Warping	It is not capable in image aligning with severe occlusions also future work on robust occlusion handling and video stitching is too established.	The method is based on Robust Elastic Warping, performing accurate alignment and efficient processing simultaneously.
6.	2018	Yongwei Nie, Tan Su, Zhensong Zhang, Hanqiu Sun and Guiqing Li [7].	Dynamic Video Stitching via Shakiness Removing	Performance efficiency is little slow, and cannot run on a smartphone in real-time and needs to research on it.	For improving the effectiveness and robustness, background identification component, and false feature elimination loop scheme is proposed as auxiliary components.

7.	2018	Zhe Zhu, Jiaming Lu, Minxuan Wang, Songhai Zhang, [8].	A Comparative Study of Algorithms for Realtime Panoramic Video Blending	It needs to improve the efficiency of modified Poisson blending and other kinds of artefacts should be considered in evaluation terms in a new metric.	The 6 blending algorithms are analyzed for time and memory needed by CPU and GPU implementations.
8.	2018	Triyanna Widiyaningtyas, Didik Dwi Prasetya, & Aji P Wibawa[9]	Web-based Campus Virtual Tour Application using ORB Image Stitching	For providing information in the virtual tour manner, Google Virtual Tour can be used but due to uncover specific locations it couldn't and needs to modify for better experience.	With web-based campus virtual tour 360-degree application, pictures of buildings and campus environment is visualized as if real.
9	2018	Sourabh Yadav, P. ChoudharyS. Goel, S. Parameswaran,[10].	Selfie Stitch: Dual Homography Based Image Stitching For Wide-Angle Selfie	For future work, the proposed method is extended for more than two planes.	The proposed method generates Wide- Field-of-View (FoV) for photographs like selfies.
10.	2019	Mohamad Ghanoumy Asem M. Ali Y, Salwa Elshazly, [11].	Frame Stitching In Human Oral Cavity Environment Using Intraoral Camera	Lack of features region correspondence can occur due to low lighting condition and saliva in oral environment and need to be checked.	The method approach is image stitching of human teeth that are captured by an intra-oral camera to improve the matching in these low texture regions.

5. ALGORITHM SURVEY:

Sr. No.	Access Parameter	Algorithm	Complexity
1.	It extends the core matching algorithm to find k nearest neighbors (k-NN) [2].	PatchMatch Algorithm.	1. Naïve approach- O(mM^2). 2. kd-tree-O(mM logM) time. where image regions and patches of size M and m pixels.
2.	A content-aware warping algorithm is proposed to generate rectangular images from stitched panoramic images [3].	Warping algorithm.	--

3.	Defined an approach to apply a Markov Random Field (MRF) model to complete panoramas and priority term [4].	Modified Priority Belief Propagation (MPBP).	--
4.	The global similarity prior is introduced to reduce distortion while keeping good alignment [5].	It adopts the local warp model.	--
5.	Accurate alignment and efficient processing is achieved and also analytical warping function is determined to eliminate the parallax error [6].	Bayesian refinement of feature matches and Multiple image stitching based on robust elastic local alignment	$O(Ln^3 + nC_xC_y+XY)$ where n is matches, L is the maximum number, For input images of size X × Y and uniform grid mesh of C_x × C_y cells.
6.	In this method, computation of unified video stitching and stabilization of video optimization is achieved simultaneously [7].	Unified Video Stitching and Stabilization.	O(n) where n is number of pixels.
7.	Evaluated the time and memory for both CPU and GPU implementations and also visual quality provided by the algorithms [8].	1. Feather Blending. 2. Multiband Blending. 3. MVC Blending 4. Convolution Pyramid. 5. Multi-spline blending. 6. Poisson Blending.	1. Feather Blending - O(n). 2. Multiband Blending - O(n). 3. MVC blending - O(n). 4. Convolution pyramid - O(n). 5. Multi-spline blending- O(n). 6. Poisson Blending-O(nlog(n)). where n is the number of pixels.
8.	Using ORB image stitching algorithm generates panoramic image in virtual tour manner [9].	ORB algorithm	--
9	It focus on the near-field aspect of the face and two dominant Planes and calculate Robust homo-graphics for each plane [10].	Dual Homography	--
10.	It performs the state-of-the art auto-stitching approach to improve the matching in these low texture regions [11].	KAZE algorithm.	$O(n^2)$ where n is the number of input images [27].

The algorithm survey topic explains differentiation applied on various parameters of the existing system with time complexities.

6. LIVE SURVEY

6.1. Simultaneous Localization and Mapping (SLAM) system: A novel approach using SLAM is proposed to determine the location/position of unmanned aerial vehicles (UAVs) in GNSS-denied regions [28] using image stitching technique. As SLAM is one of the important aspect for autonomous robots to navigate in the different environments.

6.2. Image semantic feature extraction by CNN: Convolutional Neural Network (CNN) has impactful aspect for image feature extraction and classification. A new method is proposed by [29] for feature extraction, the CNN model quantifies the semantic feature of each pixel in the image and completes the image mosaic.

7. CONCLUSION

We have conducted survey and observed that its approach performs preservation of image by regular rectangular boundaries with the help of unified global optimization which is used to regulate regular boundary, line and shape preservation reducing the unwanted distortions. The method possess certain limitation like it cannot preserve all lines in the local region and it may produce distortions near the intersection of neighboring meshes when there are primary structures. This image stitching method is extended to video stitching. Video stitching is more complicated as there are many factors hindrance like shakiness of camera, moving objects, blurring of images, ghosting effect, temporal coherence. Future work has to be done for improving video stitching for stabilization of video and adding more features to improve the performance. We hope our survey will motivate new research in the areas of Image/video stitching.

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