Multi-View Stereo for Bran Image using PatchMatch Algorithm

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Abstract— Multi-view stereo (MVS) has traditionally been a topic of interest in computer vision for decades. It can be defined as establishing dense correspondence between multiple calibrated images, which results in a dense 3D reconstruction. Over the last few years, much effort has been put into improving the quality of dense 3D reconstruction and some work has achieved impressive visual effect. We planned to implement that multi view stereo in medical data to identify the accurate result for the image data which is affected or not. An efficient multi-view stereo method with asymmetric checkerboard propagation was used in this paper and identifies the multi-hypothesis joint view selection. Image were segregate by many frames, by identifying each frames and provide a multi view stereo for brain image to help the doctor to recognize it easily and provide a better result.

Key words: Medical Data, Brain Image, Multi-View Stereo and Patchmatch Algorithm

I. INTRODUCTION

Nowadays health care, image scanning plays an important role throughout the entire clinical process from diagnostics and treatment planning to surgical procedures. Since most imaging modalities facing with continually increasing resolution, medical image processing has to face the challenges arising from large data volumes of scanned data. Medical Image Processing is the fast growing and challenging field now a day. Medical Image techniques are used for Medical diagnosis. We narrow the discussion in this paper to the medical image analysis tasks. Medical image analysis has evolved over these last 20 plus years from a variety of directions, ranging from efforts that were natural follow on to the development of the image acquisition equipment to those that were motivated from work in the parallel fields of pattern recognition, image processing, and computer vision. In Bibliometric analysis shows that there is an increasing trend in the research work undertaken in 3D view application in the medical field, this also explains future potential and contribution. Image processing which helps to get multi-dimensional imaging procedure [1]. It primarily deals with image reconstruction .In early stage hospital maintains a two dimensional (2D) dataset view and provide human body information as a slice, but the human body has three-dimensional (3D)view. If we should simulate this 3D morphology, we might be able to obtain more information about the body as well as contribute in the clinical environment to both treatment and surgical outcomes. In 3D view models were made as follows: the segmented images were simultaneously expanded onto the next images to build several small volume models, referred to as volume reconstruction. Finally, all volume models were combined. From the combined volume models, a surface model was extracted, which was referred to as the surface reconstruction [2]. The common source of dense point clouds for 3D modeling purposes due to their easiness, speed and ability to capture millions of points. Dense point clouds for 3D documentation, mapping and visualization purposes at various scales. Photogrammetric reconstruction of large-scale objects based on the optimization of the procedures for camera image acquisition. Number of photos to assure the desired overlapping, and the surface reconstruction accuracy were related to grid shapes, image rate, and camera framing at different heights [3]. The brain imaging analysis is main objective in the field of medical image analysis. Magnetic resonance (MR) imaging have many benefits over the medical imaging modalities such as a useful noninvasive technique for assisting in clinical diagnoses, the high level of contrast resolution, multispectral characteristics and ability to provide rich information about human soft tissue. Dense image matching methods enable efficient 3D data acquisition. Digital are available at high resolution, high geometric and radiometric quality and high image repetition rate. They can be used to acquire imagery for photogrammetric purposes in short time. Photogrammetric image processing methods deliver 3D information. For example, *Structure from Motion* reconstruction methods can be used to derive orientations and sparse surface information. Structure-from-Motion algorithms, the existing relationships between the grid shapes, the acquisition grid parameters, the image overlap, and the accuracy of reconstruction were evaluated and discussed. In order to retrieve complete surfaces with high precision, *dense image matching* methods can be applied. However, a key challenge is the selection of images, since the image network geometry directly impacts the accuracy, as well as the completeness of the point cloud [4]. Thus, the image stations and the image scale have to be selected according carefully to the accuracy requirements. Furthermore, most *dense image matching* solutions are based on *multi-view stereo* algorithms, where the matching is performed between selected pairs of images. Thus, stereo models have to be selected from the available dataset in respect to geometric conditions, which influence completeness, precision and processing time. Within the paper, the selection of images and the selection of optimal stereo models are discussed according to photogrammetric surface acquisition using *dense image matching*. The established relationships allow choosing the best combination of grid shapes and acquisition grid geometric parameters to obtain the desired accuracy for the required. Photogrammetric, at that time, could not efficiently deliver dense and detailed 3D results similar to those achieved with range instruments and consequently they became the dominant technology for dense 3D recording, replacing photogrammetric in many application areas. Further, many photogrammetric scientists shifted their interest to 3D reconstruction view in medical [5]. In particular photogrammetric methods for dense point (“dense image matching”) are increasingly available for professional and amateur applications with performances that cover a wide variety of applications. But a key point is the selection of the most appropriate method and algorithm able to achieve the desire accuracy and completeness.

II. LITERATURE REVIEW

Qingshan Xu, Wenbing Tao (2018) [6], in computer vision domain, how to fast and accurately perform multiview stereo (MVS) is still a challenging problem. In this paper we present a fast yet accurate method for 3D dense reconstruction, called AMHMVS, built on the PatchMatch based stereo algorithm. Different from the regular symmetric propagation scheme, our approach adopts an asymmetric checkerboard propagation strategy, which can adaptively make effective hypotheses expand further according to the confidence of current neighbor hypotheses. In order to aggregate visual information from multiple images better, we propose the multi-hypothesis joint view selection for each pixel, which leverages a cost matrix based on the multiple propagated hypotheses to robustly infer an appropriate aggregation subset parallel. Combined with the above two steps, our approach not only has the capacity of massively parallel computation, but also obtains high accuracy and completeness. Experiments on extensive datasets show that our method achieves more accurate and robust results, and runs faster than the competing methods

Bryan Morse, Joel Howard [7], this paper presents a method for completing target stereo pairs. It builds complete single images by matching to and then blending source patches drawn from the rest of the image. A method is introduced for first completing the respective disparity view using a coupled partial differential equation based on that of Bertalmio, extended to create mutual disparity consistency. Estimated disparities are then used to guide completion of the missing color image texture. An extension to the coherence-based objective function introduced by Wexler, et al. is then introduced, which not only encourages coherence of the respective images with respect to source images but also stereoscopic consistency between the two. The Patch Match algorithm of Barnes, et al. is extended to cross-image searching and matching. This matching is capable of automatically copying from corresponding unoccluded portions of the other image without requiring an explicit preliminary warping step. It gives preference to matches with cross-image consistency when blending source patches. Results demonstrate that this method produces better completion than either single-image completion or previous methods for stereo completion.

Li Yan, Liang Fei [8], Multi-view dense matching is a crucial process in automatic 3D reconstruction and mapping applications. In this paper, we present a robust and effective multi-view dense matching algorithm for high-resolution images. The overlap ratio and intersection angle between image pairs are used to find candidate stereo pairs. A Coarse-to-Fine strategy based on an improved Semi-Global Matching algorithm is applied for disparity computation across stereo pairs. Based on the constructed graph, point clouds of base views are generated by triangulating all connected image nodes, followed by a fusion process with the average reprojection error as a priority measure. The proposed method was successfully applied in experiments on aerial image test dataset provided by the ISPRS of Vaihingen, Germany and an oblique nadir image block of Zürich, Switzerland, using three kinds of matching configurations. The results demonstrate that the proposed method delivers matches at higher completeness, efficiency, and accuracy than the other methods tested; the RMS for average reprojection error reached the sub pixel level and the actual positioning deviation was better than 1.5 GSD.

Connelly Barnes (2011) [9], this thesis presents a novel fast randomized matching algorithm for finding correspondences between brain images. We also explore a wide variety of applications of this new fast randomized matching technique. The core matching algorithm, which we call PatchMatch, can find similar regions or “patches” of an image one to two orders of magnitude faster than previous techniques. The algorithm is motivated by statistical properties of nearest neighbors in side images. We observe that neighboring correspondences tend to be similar or “coherent” and use this observation in our algorithm in order to quickly converge to an approximate solution. Our algorithm in the most general form can find k -nearest neighbor matchings, using patches that translate, rotate, or scale, using arbitrary descriptors, and between two or more images. Speed-ups are obtained over alternative techniques in a number of these areas. We analyze convergence both empirically and theoretically for many of these image matching algorithms

Niedfeldt, Peter C., Brandon [10], recent advances in biomedical image processing have frequently been reviewed. Usually, such review articles are driven by classifying the methods that are used for processing pixel and voxel data, e.g., image segmentation, or their applications in diagnostics, treatment planning and follow up studies. In contrast, this paper focuses on processing large data volumes of medical images .In this paper, we discuss Kilo- to Terabyte challenges regarding (i) medical image management and image data mining, (ii) bio-imaging, (iii) virtual reality in medical visualizations (iv) neuro imaging. Due to the increasing amount of data, image processing and visualization algorithms have to be adjusted. Scalable algorithms and advanced parallelization techniques using graphical processing units have been developed. They are summarized in this paper. While such techniques are coping with the Kilo- to Terabyte challenge, the Petabyte level is already looming on the horizon. For this reason, medical image processing remains a vital field of research.

III. PROBLEM STATEMENT

Multi-view stereo algorithms are able to construct highly detailed 3D models from images alone. They take a possibly very large set of images and construct a 3D plausible geometry that explains the images under some reasonable assumptions, the most important being scene rigidity. The tutorial frames the multiview stereo problem as an image/geometry consistency optimization problem. It describes in detail its main two ingredients: robust implementations of photometric consistency measures, and efficient optimization algorithms. It then presents how these main ingredients are used by some of the most successful algorithms, applied into real applications, and deployed as products in the medical industry. An MVS algorithm is only as good as the quality of the input images parameters. Moreover, a large part of the recent success of MVS is due to the success of the underlying Structure from Motion (SfM) algorithms that compute the view. Different applications may use different implementations of each of the main blocks, but the overall approach is always similar: Collect images, Compute each parameters and Reconstruct the 3D geometry of the scene from the set of images and corresponding parameters. Segmentation of images is a challenging task. Every image has to be matched to every other image, which is computation all very expensive. A myriad of different methods have been proposed and implemented in recent years. In spite of the huge effort invested in this problem, there is no single approach that can generally solve the problem of segmentation for the large variety of image modalities existing today.

IV. PROPOSED WORK

In this paper we have to propose a fast yet accurate method for 3D dense reconstruction, called AMHMVS, built on the PatchMatch based stereo algorithm. Different from the regular symmetric propagation scheme, our approach adopts an asymmetric checkerboard propagation strategy, which can adaptively make effective hypotheses expand further according to the confidence of current neighbor hypotheses. In order to aggregate visual information from multiple images better, we propose the multi-hypothesis joint view selection for each pixel, which leverages a cost matrix based on the multiple propagated hypotheses to robustly infer an appropriate aggregation Subset parallel. Combined with the above two steps, our approach not only has the capacity of massively parallel computation, but also obtains high accuracy and completeness. PatchMatch main idea is to randomly initialize a correspondence field and then iteratively propagate the good correspondence between neighbors, was first introduced into stereo matching to efficiently find a good 3D plane at each pixel. The studies have demonstrated that, the propagation scheme and pixel wise view selection is a core component in fast and accurate. PatchMatch based multi-view stereo methods. Experiments on extensive datasets show that our method achieves more accurate and robust results, and runs faster than the competing methods. The standard PatchMatch propagation scheme propagates information diagonally cross the image, and alternates between a pass from top left to bottom right and a pass in the opposite direction. Distinguished from the standard PatchMatch propagation scheme, Gipuma stereo method exploits the diffusion like scheme to do message-passing. It considers all pixels of the reference image as the red-black grids of the checkerboard. Then it updates all black ones by leveraging the individual hypotheses from their local regular red neighbors. The all red ones are updated in a similar way. It avoids the sequential nature of other parallel propagation scheme.

A. Image Enhancing

Poor contrast is one of the defects found in acquired image. The effect of that defect has great impact on the contrast of image. When contrast is poor the contrast enhancement method plays an important role. In this case the gray level of each pixel is scaled to improve the contrast. Contrast enhancements improve the visualization of the MRI images.

B. Edge Detection

Edge detection is an image processing technique for finding the boundaries of objects within images. It works by detecting discontinuities in brightness. Edge detection is used for image segmentation and data extraction in areas such as image processing, computer vision, and machine vision. Common edge detection algorithms include methods like Sobel, Canny, Prewitt, Log, and Zero cross. Edge detection methods are used for finding object boundaries from MRI images.

C. Segmentation

Image segmentation is the process of partitioning a digital image into multiple segments. Image Segmentation is typically used to locate objects and boundaries in image, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics.

D. Patchmatch Algorithm

PatchMatch is a fast algorithm for computing dense approximate nearest neighbor correspondences between patches of two images. This paper generalizes PatchMatch in three ways: To find k nearest neighbors, as opposed to just one, to search across scales and rotations, in addition to just translations, and to match using arbitrary descriptors and distances, not just sum-of-squared-differences on patch colors. Cross-image copying happens automatically as part of the searching and synthesis process. In addition, we offer new search and parallelization strategies that further accelerate the method, and we show performance improvements over standard techniques across a variety of inputs.

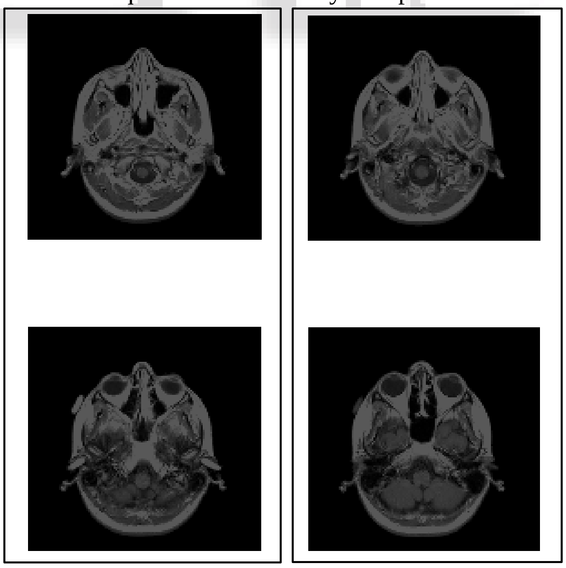

Fig. 1: Multi View Stereo

In contrast to many previous matching algorithms, which for efficiency reasons have restricted matching to sparse interest points, or spatially proximate matches, our algorithm can efficiently find dense matches the patient image, even while matching across all scales and rotations. This is especially useful for computer vision applications, where our algorithm can be used as an efficient multi view purpose.

V. CONCLUSION

MVS method used for planning the operation, morphometric studies and has more reliability in Medical field. It can match patches in a way that allows for cross-image copying in the case of regions that are originally half-occluded without requiring an explicit pre-copying step. This allows it to gracefully handle loosely marked masks without requiring that they correspond in the two images. There are four possible matching operators: propagation, random search, enrichment, and binning. These permit efficient matching of dense image descriptors, potentially across various scales and rotations. It takes less cost and more efficient than previous techniques.

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