ISSN No. 0976-5697
Volume 6, No. 2, March-April 2015
International Journal of Advanced Research in Computer Science
TECHNICAL REPORT
Available Online at www.ijarcs.info

Operative use of Image Stitching Algorithm Based on Feature Extraction

Dalwai Azhar Khan Afzal Khan
Department of Computer Engineering
AIKTC,Panvel
Navi Mumbai, India

Ansari Mohd.Manzoor Maqsood
Department of Computer Engineering
AIKTC,Panvel
NaviMumbai, India

Prof. Khan Mubashir Abdul Rashid Khan
Department of Computer Engineering
AIKTC,Panvel
NaviMumbai, India

Abstract: To produce a segmented panorama or high resolution image, the image stitching or photo stitching is used. In this process multiple photographic images are overlapped on each other and generates a single image .By using Canny Detection Algorithm in our proposed architecture we detect overlapping fields of segmented panorama.

Canny Algorithm is able to determine mathematical model of related pixel coordinator in one image to pixel coordinator in another for image alignment.

By estimating correct alignment of various parts of images our implemented software is able to combine direct pixel to pixel comparison with gradient descent. Our software is also able to design the final composition surface on which align images is going to placed.

This paper will focus on basic overview of image segmentation and also introduced without implemented software for image stitching.

Keywords: Image stitching/mosaicing, panoramic image, features based detection, SIFT, SURF, image blending.

I. INTRODUCTION

To producing segmented panorama or high segmented image, image stitching process is used; By combining multiple photographic images with the overlapping field this goal can be achieved.[1]

Most common approaches of image stitching require exact overlaps between images and identical exposures to produce unified results. In addition of using image stitching in computer vision and computer graphics applications, there are some digital cameras can stitch their photos internally.

On the other hand, the human visual system has a field of view of around 55 x 250 degrees, but a typical camera has a field of view of only 35 x 50 degrees. Therefore, panoramic image mosaicing works by taking lots of pictures from an ordinary camera and stitching them together to form a composite image with a much larger field of view. [2]

The quality of image stitching is measured by the similarity of the stitched image to each of the input images. It also can be measured by the visibility of the seam between the stitched images.[3]

A. Scope of Project:

The use of image stitching in real time applications is considered as a challenging field for image processing experts. It has wide use in the field of video matting, video conferencing, 3D image reconstruction, video stabilization, satellite imaging, video summarization, video compression, and several medical uses. [3]

An interesting application of image stitching is the ability to summarize and compress videos taken with a panning camera. For videos, the applications of image stitching were extended to additional uses such as video compression and video indexing. While these early approaches used effective motion designs as they were therefore restricted to long focal lengths.[3] Video stitching is in many ways a straight forward generalization of multiple-image stitching. The potential presence of large amounts of independent motion, camera zoom, and the desire to visualize dynamic events impose additional challenges to image stitching.

Videos can also be used to create animated panoramic video textures. In which, different portions of a panoramic scene are animated with independently moving video loops, or to shine “video flashlights” onto a composite mosaic of a scene. Video can also provide an interesting source of content for creating panoramas taken from moving cameras. Medical image stitching has many applications in clinical diagnosis, such as diagnosis of retinal scan, cardiac scan, renal, pelvic, abdomen, tissue, liver, and some other disorders.[3]

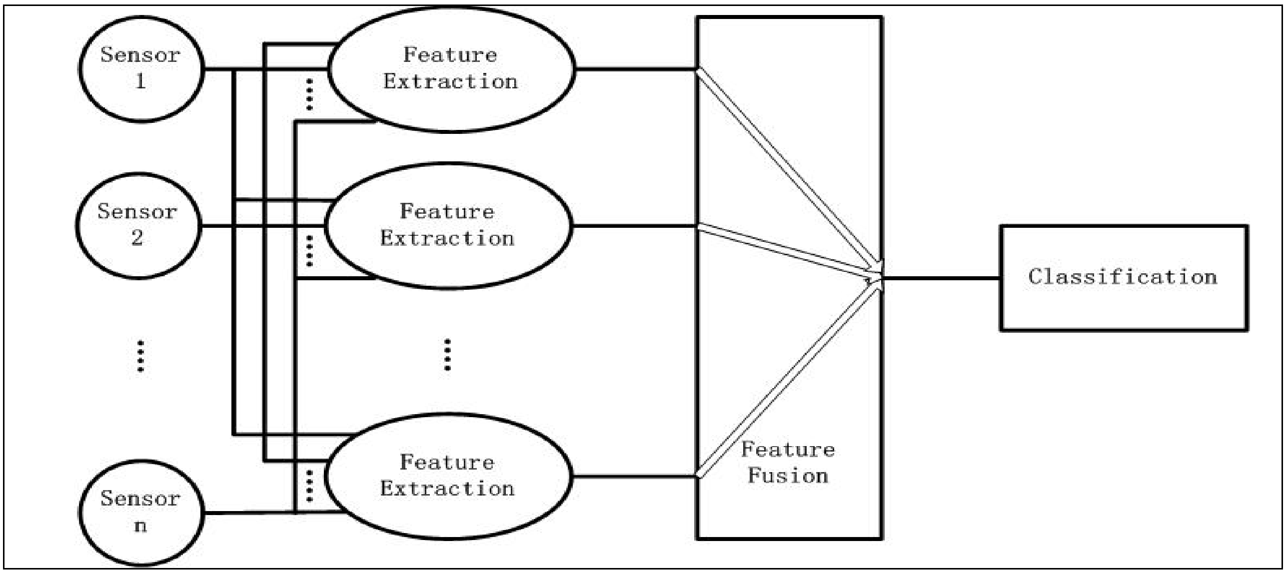


Figure1. System Architecture

Advances in computer science have led to reliable and efficient image processing methods useful in medical diagnosis, treatment planning, and medical research. In clinical diagnosis, integration of useful data obtained from separate images is often desired. The images need to be geometrically alignment of better observance. This procedure of mapping points from one image to corresponding points in another image is called image registration.

B. Motivation:

Panorama is wide view image usually obtained by stitching two or more images in proper alignment with each other so that the resultant picture/ image gives an effect of a single image. The alignment and putting together the pictures produces a problem as the input images can just be placed together only when the input images are captured with at most accuracy, a highly impossible rather a unified task. The algorithm tries to solve this task by modeling overlapping regions by translational and any rotation that was induced while capture relative to each other and warping them to produce a single image. Also the process of image stitching and alignment can be extended to applications such as summarization and video stabilization.

C. Proposed system architecture:

a. Fusion framework in feature-level.

b. Effective multi-sensor image data fusion methodology on the basis of discrete wavelet transform theory

c. Self-Organizing Neural Network

In this project a new image stitching technology based on feature points matching is researched on the basic of previous studies .It is different as region based image stitching, feature based image stitching technology estimated the transformation between the image by the distinctive feature of image but no the all information of image.[4] In the premise of ensuring the quality of stitching, this algorithm reduced the computational and had some practical value. The main idea of this method is detecting image's edge and then extracting the feature points for its edge point. The third step is searching the suture point from the corresponding feature point which is used to determine the matching location of the image; finally the algorithm is used to achieve the seamless stitching of image.

II. RELATED STUDY

In the last two decades, there are many researchers implemented and proposed some image stitching systems. For example, Levin and Weiss[5] introduced several formal cost functions for the evaluation of the quality of stitching. Their approach is demonstrated in various uses, including generation of panorama images, object blending, and removal of compression artifacts.

The aim of a stitching algorithm is to produce a visually plausible mosaic with two desired properties. First the mosaic should be as similar as possible to the input images that have been taken, both by geometrically and photometrically . Second, the seam between the stitched images should be invisible.

While these requirements are widely acceptable for visual examination of a stitching the result their definition as quality criteria was either limited or implicit in previous approaches. Authors presented by several cost functions for these requirements and define the mosaic image as their optimal image. The stitching quality of image in the seam region is measured in the form of gradient domain. The mosaic image should contain a minimum amount of seam artifacts.

Brown and Lowe [7][8] used the SIFT algorithm to implement a feature-based image stitching system. The first step in the panoramic recognition algorithm is to extract and match SIFT features between all the images. The SIFT features are located at scale-space maxima or minima of a difference of Gaussian function and then the objective of second step image matching is to find all matching (overlapping) images, it is only necessary to match each image to a small number of neighboring images in order to get a good solution for the image geometry.

Then, they used RANSAC to select a set of inliers that are compatible with a Homography between the images. After that, they applied a probabilistic model to verify the match; then they used bundle adjustment to solve for all of the camera parameters jointly; then they used bundle adjustment to solve for all of the camera parameters jointly;

finally they have applied the multi-band blending strategy.

The idea behind multi-band blending is to blend low frequencies over a larger spatial range and high frequencies over a short range. This can be performed over multiple frequency bands using a Laplacians Pyramid.

Eden[3] presented a technique to automatically stitch multiple images at varying orientations and exposures to create a composite panorama that preserves the angular extent and dynamic range of the inputs. The proposed method allows for larger exposure differences of larger scene motion or other misregistrations between frames and requires no extra camera hardware. To do this, they introduced a two-step graph cut approach. The purpose of step1 is to fix the positions of moving objects in the scene. In the second step they fill in the entire available dynamic range available. Low extended his previous by introducing gain compensation and automatic straightened steps. They showed how to solve the photometric parameter namely the overall gain between images from with wich an error function that is defined over all images. The error function is the addition of gained normalized intensity errors for all overlapping pixels.

Deepak Jain [9] proposed a corner technique for image mosaicing. Here, he had used three step methods. In first step, he takes two images and find the corner of both these images. In second step, he removed the false corner from both images. Finally, he used Homography to find matched corner and get mosaic image.

Yanfang[10] concerned on the problem of automatic image stitching which mainly applies to the image sequence even those including noise images. He used a method based on invariant features to realize fully automatic image stitching, in which it includes two main parts one is image matching and other is image blending. As the noises images have larger differences between the other images when using SIFT features to realize the correct and robust matching and it supplies a probabilistic model is measured visually by the similarity between the stitched image to each of the input images and by the visibility of the seam between the two stitched images. In order to define and to get the best possible stitching there are several formal cost functions for the evaluation of the stitching quality of the image that are introduced in this paper. In these cost functions the similarity of the input images and the visibility of the seam are defined in the gradient of an image domain, minimizing the disturbing edges along the seam. A good image stitching will be optimal for these cost functions, overcoming both the photometric inconsistencies in image and geometric misalignments between the two stitched images.

Vimal Singh Bind [11] presented a technique for feature- based image mosaicking using image fusion where the input images are stitched together using the popular stitching algorithms. To extract the best features m from the stitching results, the blending process is done by means of Discrete Wavelet Transform (DWT) using the maximum selection rule for both approximate and the detail components. The robustness and quality of the above stiching techniques are tested by means of three-dimensional rotational images. The performance evaluation of proposed technique is done in terms of PSNR (peak signal-to-noise ratio), FSIM as Quality Measure for Combined similarity, MI (Mutual Information), EME(Enhancement performance measure), NAE (Normalized Absolute Error) and SD. Russol Abdelfatah presented a technique to implement image stitching by adopting feature-based alignment algorithm and blending algorithm to produce a high quality image.

A. *Development of the Canny algorithm:*

Canny's aim was to discover the optimal edge detection algorithm. In this situation, an "optimal" edge detector means:

Good detection – the algorithm should mark as many real edges in the image as possible.

Good localization – edges marked should be as close as possible to the edge in the real image.

Minimal response – a given edge in the image should only be marked once, and where possible, image noise should not create false edges.

a. *Stages of the Canny algorithm:*

Noise reduction

The image after a 5x5 Gaussian mask has been passed across each pixel. The Canny edge detector uses a filter based on the first derivative of a Gaussian ilter, because it is suspectible to noise present on raw unprocessed image data , so to begin with, the raw image is convolved with a Gaussian filter. The result is a little bit blurred version of the original which is not affected by a single noisy pixel to any significant degree of that image.Here is an example of a 5x5 Gaussian filter, used to create the image to the right, with σ = 1.4.

$$\mathbf{B} = \frac{1}{159}\begin{bmatrix} 2 & 4 & 5 & 4 & 2 \\ 4 & 9 & 12 & 9 & 4 \\ 5 & 12 & 15 & 12 & 5 \\ 4 & 9 & 12 & 9 & 4 \\ 2 & 4 & 5 & 4 & 2 \end{bmatrix} * \mathbf{A}$$

b. *Finding the intensity gradient of the image:*

A binary edge map that is derived from the Sobel operator which has a threshold value of 80. The edges have been coloured to indicate the edge direction either yellow for zero degrees or green for 45 degrees or blue for 90 degrees and red for 55 degrees.

An edge in an image may point in a variety of direction so that the Canny algorithm uses four filters to detect horizontal, vertical and diagonal edges in the uncleared image. The edge detection operator (Roberts, Prewitt, Sobel) returns a value for the first derivative in the horizontal direction (Gy) and the vertical direction (Gx). From this the edge gradient and direction can be determined:

$$\mathbf{G} = \sqrt{\mathbf{G}_x{}^2 + \mathbf{G}_y{}^2}$$
$$\mathbf{\Theta} = \arctan\left(\frac{\mathbf{G}_y}{\mathbf{G}_x}\right)$$

The edge direction angle is in the round form to one of the four angles representing vertical, horizontal and the two diagonals (0, 45, 90 and 55 degrees). **Non-maximum suppression**

The same binary map is shown on the left side of non-maximum suppression. The edges are in coloured form to indicate direction. Given estimates of the image gradients are then searched and then carried out to determine if the gradient magnitude assumes a local maxima in the gradient direction. Consider the example:

If the rounded angle is zero degrees then the point will be considered to be on the edge and if its intensity is greater than the intensities in the west and east directions, if the rounded angle is 90 degrees then the point will be considered to be on the edge if its intensity is greater than the intensities in the north and south directions, if the rounded angle is at 55 degrees then the point will be considered to be at the edge of its intensity is greater than the intensities in the north west and south east directions, if the rounded angle is at 45 degrees the point will be considered to be on the edge if its intensity is greater than the intensities in the north east and south west directions.This is worked out by passing a 3x3 grid over the intensity map. From this stage referred to as non-maximum suppression, a set of edge points, in the form of a binary image, is obtained. These are sometimes known to as thinner edges.

B. Tracing edges through the image and hysteresis thresholding:

Intensity gradients which are large are more likely to correspond to that edges that are if they are small. It is in most cases it is impossible to specify a threshold at which a given intensity gradient values switches from corresponding one edge to another edge. Therefore Canny uses thresholding with hysteresis. [5]. Thresholding with hysteresis requires two thresholds that is high and low. Making the assumption of important edges should be along continuous curves in the image which allows us to follow a faint section of a given line and to discard a few noisy pixels that do not constitute a line but have produced large gradients. Therefore we begin by applying a high threshold to an image. This marks out the edges we can find that are genuine. Starting from these values using the directional information derived earlier and the edges can be traced through that image. While tracing an edge, we apply the lower threshold and allowing us to trace faint sections of edges as long as we find a starting point of an image. Once this process is complete we have a binary image where each pixel is marked as either an edge pixel or a non-edge pixel.[6] From complementary output from the edge tracing step, the binary edge map obtained in this way can also be treated as a set of edge curves.

a. Canny Method:

Find edges in grayscale image

BW = edge(I,'canny') specifies the Canny method.

BW = edge(I,'canny',thresh) specifies sensitivity thresholds for the Canny method there is a two element vector in which the first element is the low threshold and the other one element is the high threshold. If you specify a scalar for thresholding value, this scalar value is used for the high threshold and 0.4*thresh is used for the low threshold. If you do not specify thresholding value, or if thresholding value is empty ([]), edge chooses low and high values automatically. The value for thresh is relative to the highest value of the gradient magnitude of the image.

BW = edge(I,'canny',thresh,sigma) specifies the Canny edge detection method, using sigma as the standard deviation of the Gaussian filter present. The default sigma is sqrt(2); the size of the filter is chosen automatically, based on sigma value.

[BW,thresh] = edge(I,'canny',...) returns the threshold values as of that two elements vector of image.

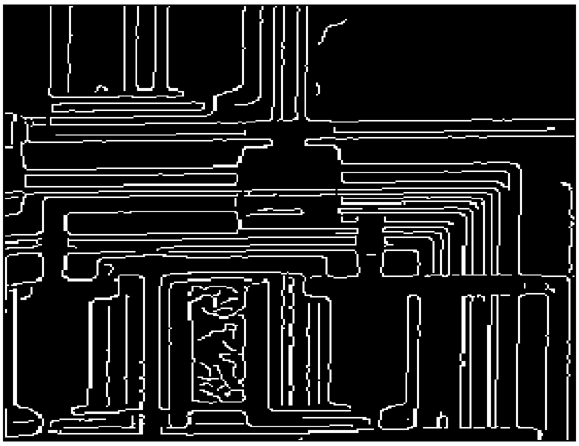


Figure2. Canny Edge Detection

III. IMPLEMENTATION

Figure 3 indicates the graphical user interface design of given problem statement.In that problem statement we require multiple images to apply image stitching algorithm and result and image will displayed a single image such as output for multiple.

Select image1 and Image2 are provided to browser windows which allows you select the two different image to apply the stitching algorithm.

The output file name provides a file path or name of generated output from input images after applying Canny Edge detector.

Process button actually processes the image stitching algorithm in displayed CPU time.

Source Histogram1 and Source Histogram2 are the two histogram represented images and the target histogram is histogram which has to be displayed as the output of the stitching.

The Procedural design shows all the procedures used in this project.

Step 1:Start the application

Step 2:Accept the two different images that are to be stitched

Step3:Extract the feature of the two selected images

Step4:Matching the features of that images

Step 5:Are features of both images matching

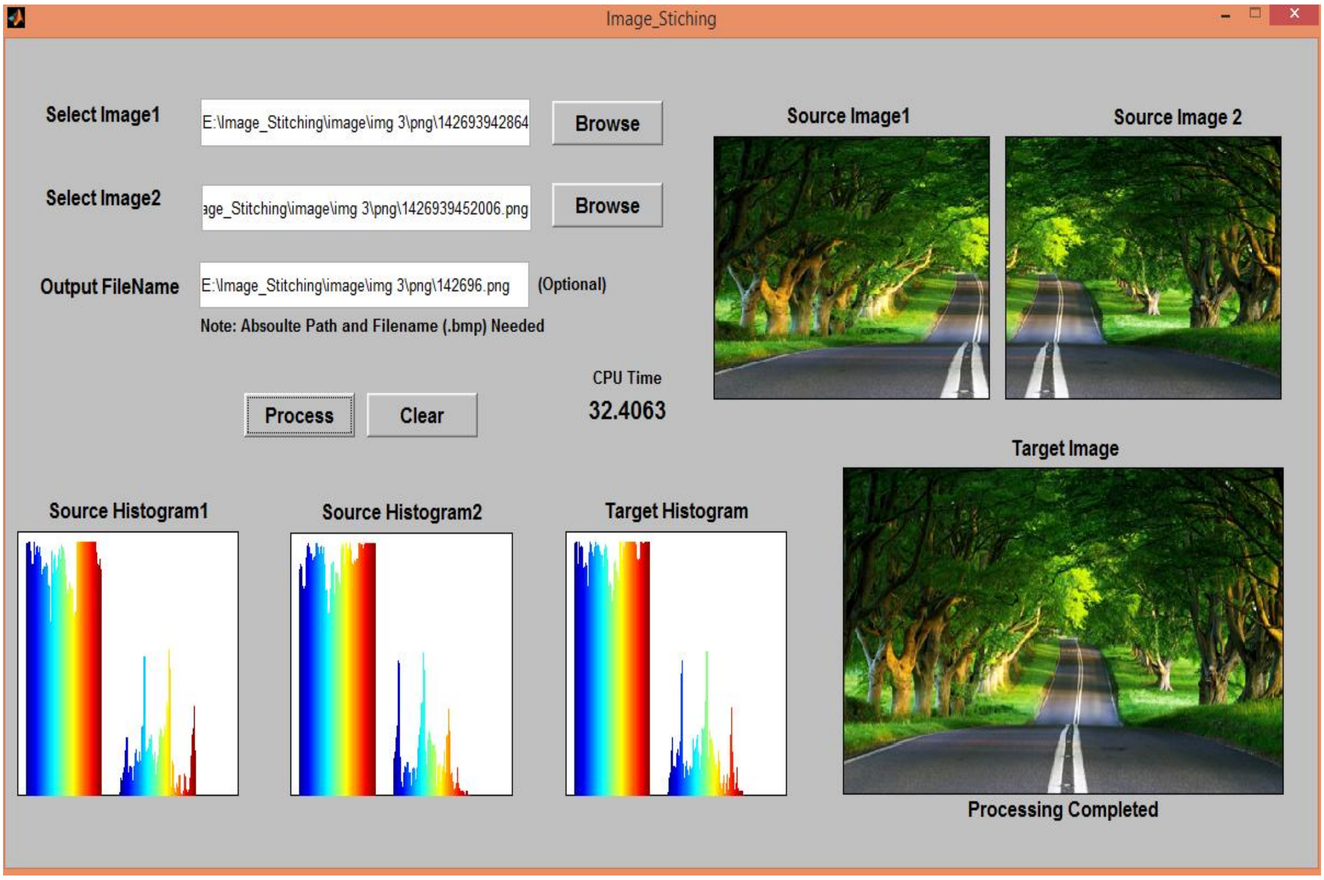
Step6:Stitch both the images

Step 7:Display stitched image

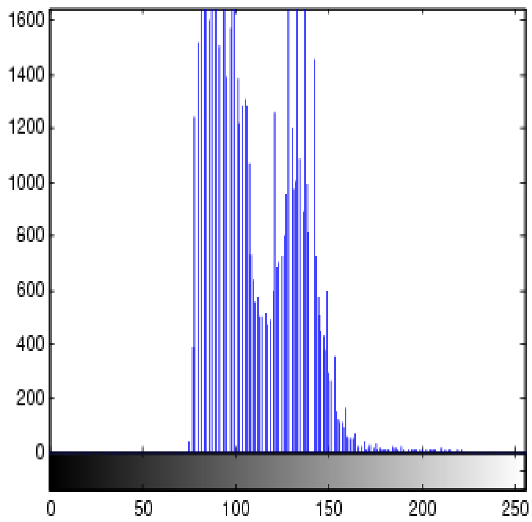
Step8:STOP

IV. RESULT

An image histogram is a type of histogram that acts as a graphical representation of the tonal distribution in a digital image. It plots the number of pixels for each tonal values in histogram. By looking at the histogram for a specific image a viewer will be able to judge the entire tonal distributions at a glance.[12] The horizontal axis of the graph represents the tonal variation, while the vertical axis represents the number of pixels in that particular tonal value.The left side of the horizontal axis represents the black and dark area, the middle represents medium grey and the right hand side represents light and pure white area. The vertical axis represents the size of the areas that is captured in each one of these zones in histogram. Thus the histogram for a very dark image will have the majority of its data points on the left side and center of the graphs. Conversely, the histogram for a very brighter image with few dark areas and or shadows will have most of its data points on the right side and center of the graph in histogram.



Figuger3. GUI representation of Implemented System



Figuge4. Histogram Representation of Target Image

It plots the number of pixels for each tonal values in histogram. By looking at the histogram for a specific image a viewer will be able to judge the entire tonal distribution at a glance at once.

V. CONCLUSION

Image mosaicing is considered as an active research area in the fields of computer vision and computer graphics. It has a large amount of different algorithms for features detection and description. The choice of the feature detector depends on the problem. In this paper, we have offered a comprehensive study on features-based image stitching such as SIFT algorithm which is rotation, scale invariant as well as more effective in presence of noise. It has highly distinctive features. However, it needs high computational time; the SURF algorithm proves superior in terms of execution time and illumination invariance property; The ORB algorithm is rotation and scale invariant with improved execution time but its performance is poor in presence of noise. In future we want to compare between the algorithms we have studied and other feature based image stitching algorithms, Also Stitching videos together to create dynamic panoramas, and stitching videos and images in the presence of large amounts of parallax.

VI. REFERENCES

[1] Ebtsam Adel, Mohammed Elmogy, Hazem Elbakry, Image Stitching based on Feature Extraction Techniques: A Survey, International Journal of Computer Applications (0975 – 8887)Volume 99–No.6,August 2014

[2] Lowe, D. G. Distinctive Image Features from Scale-Invariant Keypoints. International Journal of Computer Vision, 60, 91-110.(2004)

[3] Eden, A., Uyttendaele, M., & Szeliski, R. Seamless Image Stitching of Scenes with Large Motions and Exposure Differences. Proceedings of the 2006 IEEE Computer Society Conference on Computer Vision and Pattern Recognition - Volume 2 (pp. 2498-2505). Washington, DC, US,A: IEEE

Computer Society(2006)

[4] Krishna Paudel, “Stitching of X-ray Images”, Thesis Report,Department of Information Technology, Uppsala University, Nov 2012

[5] Anat Levin, A. Z., & Weiss, Y. Seamless Image Stitching in the Gradient Domain. The Hebrew University of Jerusalem (2000).

[6] Brown, M., & Lowe, D. G. Automatic Panoramic Image Stitching Using Invariant Features. Int. J. Comput. Vision, 74(1), 59-73.(2007, Aug).

[7] Brown, L. G. . A Survey of Image Registration Techniques. ACM Comput. Surv, 24(4), 325-376(1992, Dec).

[8] Brown, M., & Lowe, D. G.). Recognising Panoramas. Proceedings of the Ninth IEEE International Conference on Computer Vision - Volume 2, pp. 1218-. Washington, DC, USA: IEEE Computer Society(2003).

[9] Deepak Jain, G. S. . Image Mosaicing using corner techniques. International Journal of Engineering Research & Technology (IJERT) (2012).

[10] Yanfang Li, Y. W. Automatic Image Stitching Using SIFT(2008).

[11] Vimal Singh Bind, P. R. A Robust Technique for Feature-based Image Mosaicing using Image Fusion(2013).

[12] Pankaj Kumar, Image Enhancement Using Histogram equalization and Histogram Specification on Different Color Spaces, Thesis Report in Department of Computer Science and Engineering National Institute of Technology Rourkela, Jan 2014.