IOSR Journal of Electronics and Communication Engineering (IOSR-JECE)
e-ISSN: 2278-2834,p- ISSN: 2278-8735.Volume 13, Issue 2, Ver. II (Mar. - Apr. 2018), PP 27-35
www.iosrjournals.org

Optimization and Alignment of Multiple Images to Construct a Panoramic Images

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Abstract: *With The Prevalence Of Smart Phones, Sharing Photos Has Become Popular. Since Cameras Generally Have A Limited field Of View, Panoramic Shooting Mode Is Provided, Where The User Can Capture Images Under Guidance To Generate A Panorama. Panorama Fused Image Will Be Help The User To View The Wide Angle Image. But Still Panorama Images Are Not Homogenous And It Affects Viewing Experience. If Panorama Images Can Be Brought Homogenous, It Reconstructed Image Is Of Good Clarity. In This Project We Solve The Problem Of Getting Good Quality Panorama Even In Presence Of Occlusions.*
Keywords*: Image Stitching, Multi-View Panorama, Image Alignment, Wide-Baseline Images*

Date of Submission: 27-03-2018 Date of acceptance:10-04-2018

I. Introduction

With The Prevalence Of Smart Phones, Sharing Photos Has Become Popular. Since Cameras Generally Have A Limited field Of View, Panoramic Shooting Mode Is Provided, Where The User Can Capture Images Under Guidance To Generate A Panorama. Panoramic Stitching From A Single Viewpoint Has Been Maturely Studied. It Is Difficult However To

Generate Reasonable Results From A Set Of Images Under Wide Baselines. To Produce A Large field-Of-View Image For A Close Object, The Camera Needs To Assistant Professor, Dept. Of Electronics And Communication Engineering, Pesitm, Shivamogga, India.

Be Shifted To Capture Various Regions, Which Causes Trouble For General Panorama Construction. Images Captured From Multiple Cameras Raise Similar Challenges. All Such Applications Require Panorama Techniques Considering Non-Ignorable Baselines Among Different Cameras. Many Previous Image Stitching Methods Require Simple Camera Rotation, Or Planar Scene. Violation Of These Assumptions May Lead To Severe Problems. Recent Methods Relaxed These Constraints By Dual-Homography, Or Smoothly Varying Affine Or Homography. They Work For Images With Moderate Parallax, But Are Still Problematic In The Wide-Baseline Condition. In This Project, We Propose A Stitching Approach For Wide Baseline Images. Our Main Contribution Is A Mesh-Based Framework Combining Terms To Optimize Image Alignment. A Novel Scale Preserving Term Is Introduced To Make Alignment Nearly Parallel To Image Plane But Still Allow Local Perspective Correction. A New Seam-Cut Model Reduces Visual Artifacts Caused By Misalignment That Is Difficult To Be Handled By Traditional Seam-Cutting Algorithms.

II. Literature Survey

R. Szeliski Et Al [1] Presents A Novel Approach To Creating Full View Panoramic Mosaics From Image Sequences. R. Szeliski [2] Explains Image Stitching Is A Fairly Mature Field With A Variety Of Commercial Products, There Remains A Large Number Of Challenges And Open Extensions. M. Brown Eta L [3] Concerns The Problem Of Fully Automated Panoramic Image Stitching. Though The 1d Problem (Single Axis Of Rotation) Is Well Studied, 2d Or Multi-Row Stitching Is More Difficult. Agarwala Et Al. [4] Constructed Multi-Viewpoint Panoramas For Approximately Planar Scenes. Structure-From-Motion Was Used To Recover Camera Poses And Sparse 3d Points. J. Gao Et Al [5] Describes A Method To Construct Seamless Image Mosaics Of A Panoramic Scene Containing Two Predominate Planes: A Distant Back Plane And A Ground Plane That Sweeps Out From The Camera's Location. W.-Y. Lin Et Al [6] Explains Traditional Image Stitching Using Parametric Transforms Such As Homography, Only Produces Perceptually Correct Composites For Planar Scenes Or Parallax Free Camera Motion Between Source Frames. J. Zaragoza Et Al [7] Investigate Projective Estimation Under Model Inadequacies, I.E., When The Underpinning Assumptions Of The Projective Model Are Not Fully Satisfied By The Data. V. Kwatra Et Al [8] Introduce A New Algorithm For Image And Video Texture Synthesis. Agarwala Et Al [9] Describe An Interactive, Computer-Assisted Framework For Combining Parts Of A Set Of Photographs Into A Single Composite Picture, A Process We Call "Digital

Photomontage". S. M. Seitz Et Al [10] Presents A Quantitative Comparison Of Several Multi-View Stereo Reconstruction Algorithms. G. Zhang Et Al [11] Presents A Novel Method For Recovering Consistent Depth Maps From A Video Sequence. V. H. Hiep Et Al [12] Boosted By The Middlebury Challenge, The Precision Of Dense Multi-View Stereovision Methods Has Increased Drastically In The Past Few Years.

III. Design Styles

1.1 System Architecture

The System Architecture Is Shown Below.

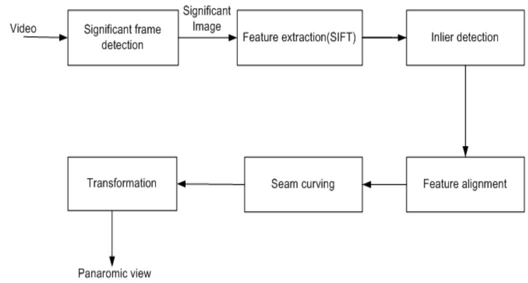


Fig 1.1:- System Architecture

Input Of A Project Is A Video Or A Group Of Images, Video Means From The Video We Will Adding A Significant Feature And Form This Group Of Images, So Once The Group Of Images Is Given To The Feature Extraction Module It Will Compute For Each Image Shift Feature. Once We After Compute A Shift Feature For Each Image There Will Be A Inlier Detection For Each Image Who Are All Is Neighbors That Will Be Directed In Inlier Detection Module, So Once The Neighbors Are Detected Alignment Will Be Happening That Will Be Happening In The Alignment Module Where In The Features Will Be Correlated With Each Other Based On An Energy Function And We Will Try To Optimize The Function That Will Be Done In Feature Alignment. Once The Alignment Is Happen At The Borders To Improve A Smooth Transition We Will Be Applying A Seam Carving Technique And Once After Applying Seam Carving Technique For Final Image Transition Is Done. Transition Is Mainly For Scalability. Once This Is Done We Will Get A Panoramic Image.

1.2 Sequence Diagram for Upload Review

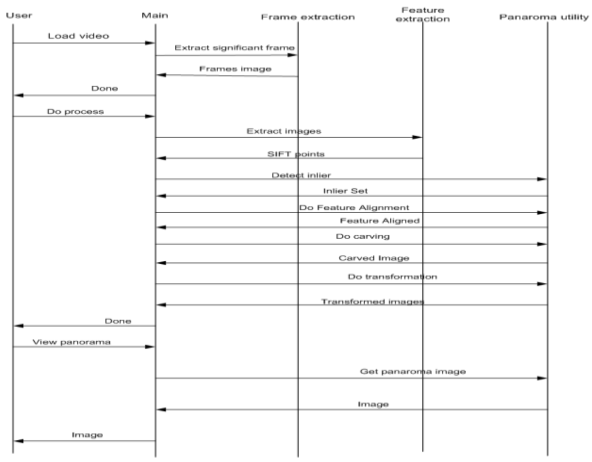


Fig 1.2:- Sequence Diagram

Sequence Diagram Will Say If Use Does One Action How All The Classes Will Be Will Interact With Each Other That Is Documented In Sequence Diagram. So First Is A User On The Main Say Load Video, So Once We Load A Video From The Main, Frame Extraction Class Function Extract Significant Frames Will Be Called And This Will Be Giving The Frames. Only Certain Image Frames Are Significant Frame Images. Once A Frame Are Return, System Will Get Acknowledgement ,Then Call Do Processafter Main Process To Call On The Feature Extraction Module, Extract Shift Points For Each Images It Will Give A Group Of Images And The Call Extract Shift Points So This Will Give For Each Image What Are The Shift Points ,Once A Shift Points Are Return It Will Do Then Call To Panorama Util Class Detect Inlier Will Compute For Each Image Who Are Inlier Image Than It Will Give A Inlier Set, Once A Inlier Set Is There,The Panoramautil Class Called Do Feature Alignment So That Inlier Set Images Done In Feature Alignment,So Feature Alignment Is Done In

Inlier Set. Once A Feature Alignment Is Done After This Call The Panorama Util Class, Do Carving On Borders Of The Grid System Will Do A Carving, So Once The Carved Image Is There System Will Do Transformation On It To Preserve The Scale, Now The System Call On The User. The Acknowledgement Will Be Returned. After This The User Will Call View Panorama Image. Main Will Call The Get Panorama Image Function In Panorama Util Class. Panorama Util Class Return The Panorama Image To The Main. User Will Get The Panorama Image By Main.

1.3 Data Flow Diagram Of The System

The Input , Output And The Process Flow In The System Is Given In This Section.

Level 0 Data Flow Diagram

Panorama Construction Is The Main Process Of The System

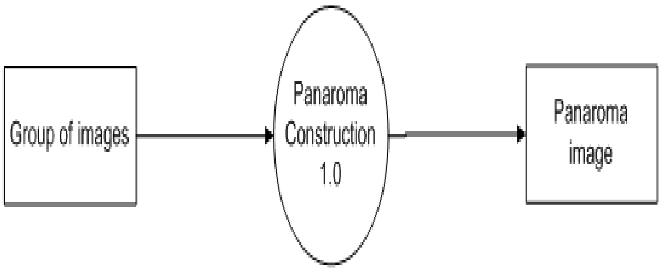


Fig 1.3:- Level 0 Data Flow

Input Is Group Of Images. Panorama Construction Is The Process, For Every Process We Have To Give The Numbers. The Output Is The Panorama Image.

Level 1 Data Flow Diagram

The Panorama Construction Process Is Split To Sub Process In This Section.

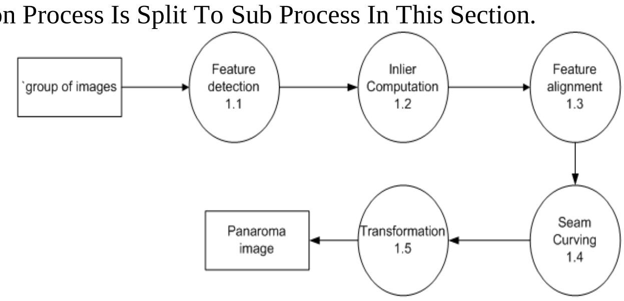
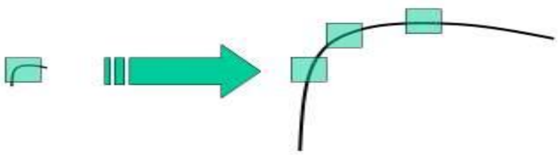


Fig 1.4:- Level 1 Data Flow

Break The Panorama Construction Into Sub Process. The Sub Processes Are:
A). Feature Detection: Detect The Objectives In Each Image.
B). Inlier Computation: Finding The Neighboring Set For Each Pair Of Them.
C). Feature Alignment: Align The Image To Obtain The Output Image.
D). Seam Curving: It Work Only For Borders.
Transformation: It Works For The Scalability.
E). Panorama Image: Due To These Sub Processes We Can Obtain The Panoramic Image.

1.4 Shift Feature Extraction

In Last Couple Of Chapters, We Saw Some Corner Detectors Like Harris Etc. They Are Rotation-Invariant, Which Means, Even If The Image Is Rotated, We Can Find The Same Corners. It Is Obvious Because Corners Remain Corners In Rotated Image Also. But What About Scaling? A Corner May Not Be A Corner If The Image Is Scaled. For Example, Check A Simple Image Below. A Corner In A Small Image Within A Small Window Is Flat When It Is Zoomed In The Same Window. So Harris Corner Is Not Scale Invariant.

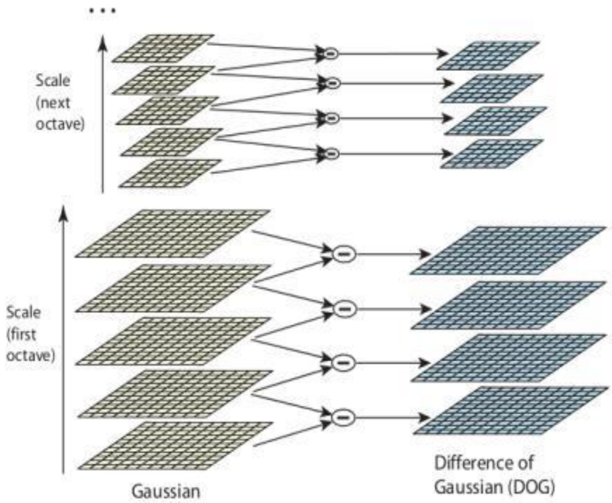


So, In 2004, **D.Lowe**, University Of British Columbia, Came Up With A New Algorithm, Scale Invariant Feature Transform (Sift) In His Paper, **Distinctive Image Features From Scale-Invariant Keypoints**, Which Extract Keypoints And Compute Its Descriptors. *(This Paper Is Easy To Understand And Considered To Be Best Material Available On Sift. So This Explanation Is Just A Short Summary Of This Paper)*.
There Are Mainly Four Steps Involved In Sift Algorithm. We Will See Them One-By-One.

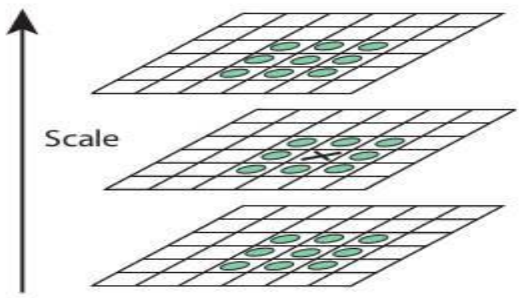
1. Scale-Space Extrema Detection

From The Image Above, It Is Obvious That We Can't Use The Same Window To Detect Keypoints With Different Scale. It Is Ok With Small Corner. But To Detect Larger Corners We Need Larger Windows. For This, Scale-Space Filtering Is Used. In It, Laplacian Of Gaussian Is Found For The Image With Various σ Values. Log Acts As A Blob Detector Which Detects Blobs In Various Sizes Due To Change In σ. In Short, σ Acts As A Scaling Parameter. For Eg, In The Above Image, Gaussian Kernel With Low σ Gives High Value For Small Corner While Gaussian Kernel With High σ Fits Well For Larger Corner. So, We Can Find The Local Maxima Across The Scale And Space Which Gives Us A List Of (x, y, σ) Values Which Means There Is A Potential Keypoint At (X,Y) At σ Scale.

But This Log Is A Little Costly, So Sift Algorithm Uses Difference Of Gaussians Which Is An Approximation Of Log. Difference Of Gaussian Is Obtained As The Difference Of Gaussian Blurring Of An Image With Two Different σ, Let It Be σ And $k\sigma$. This Process Is Done For Different Octaves Of The Image In Gaussian Pyramid. It Is Represented In Below Image:



Once This Dog Are Found, Images Are Searched For Local Extrema Over Scale And Space. For Eg, One Pixel In An Image Is Compared With Its 8 Neighbors As Well As 9 Pixels In Next Scale And 9 Pixels In Previous Scales. If It Is A Local Extrema, It Is A Potential Keypoint. It Basically Means That Keypoint Is Best Represented In That Scale. It Is Shown In Below Image:



Regarding Different Parameters, The Paper Gives Some Empirical Data Which Can Be Summarized As, Number Of Octaves = 4, Number Of Scale Levels = 5, Initial $\sigma = 1.6, k = \sqrt{2}$ Etcas Optimal Values.

Panorama Construction Algorithm

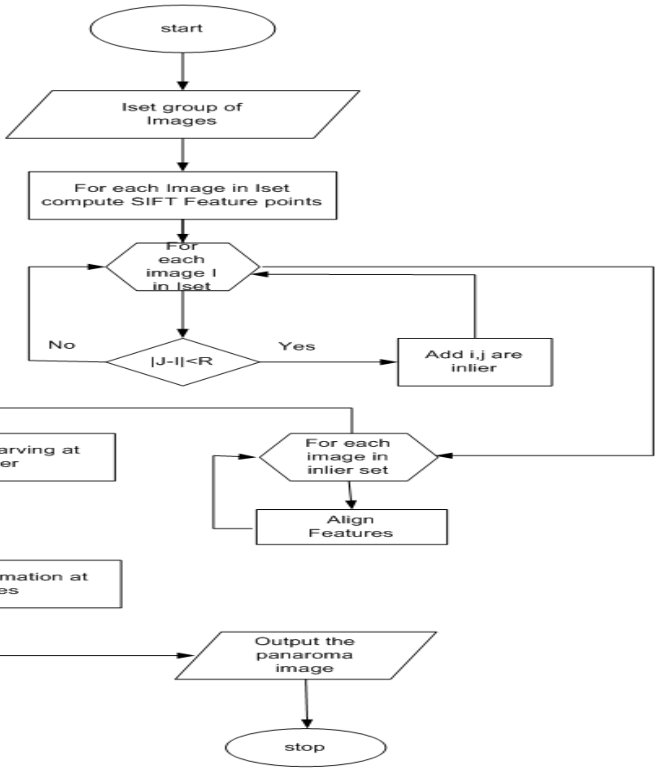
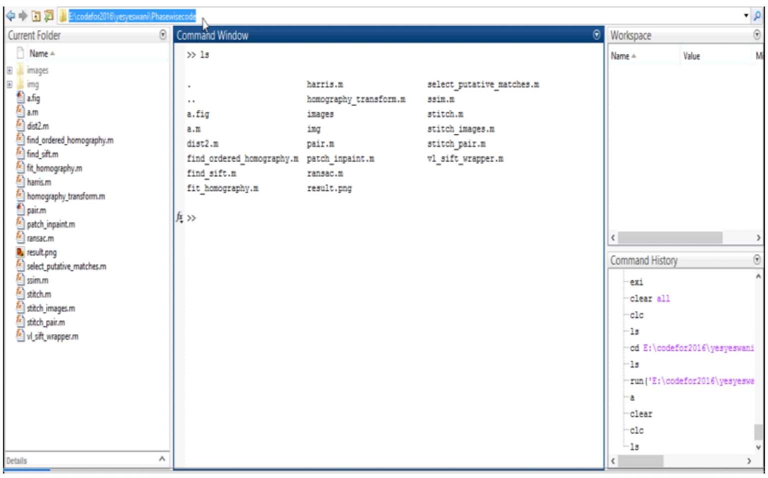


Fig 1.5:- Panorama Construction Step

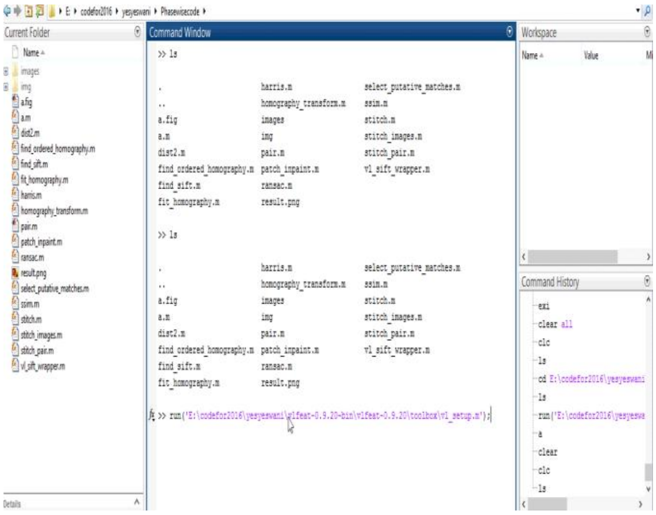
Step 1: Every Flow Chart Should Have A Start State, Input Is Iset Group Of Images
Step 2: For Each Image In The Iset Compute Sift Points.
Step 3: After Finding The Sift Points For Each Image I In Iset.
Step 4: Calculate The Distance, If The Distance Between The Ith Image And Jth Image Is Less Than The R, Than They Are Inlier Where R Is The Distance.
Step 5: Once We Get All The Inliers In The Image Are Detected. From These Points Form The Feature Alignment, For Each Image In Inlier Set. If The Images Are Inlier Than Only Perform Feature Alignment.
Step 6: Once The Feature Alignment Is Over For Each Alignment, Next Do Seam Curving At Borders After Doing Seam Curving Do Transformation At The Edges. At The Edge Of The Image Transformation.
Step 7: Output Is The Panorama Image.
Step 8: Stop State.
Iv Results And Discussions.

The Following Snapshots Define The Results Or Outputs That We Will Get After Step By Step Execution Of All The Modules Of The System.

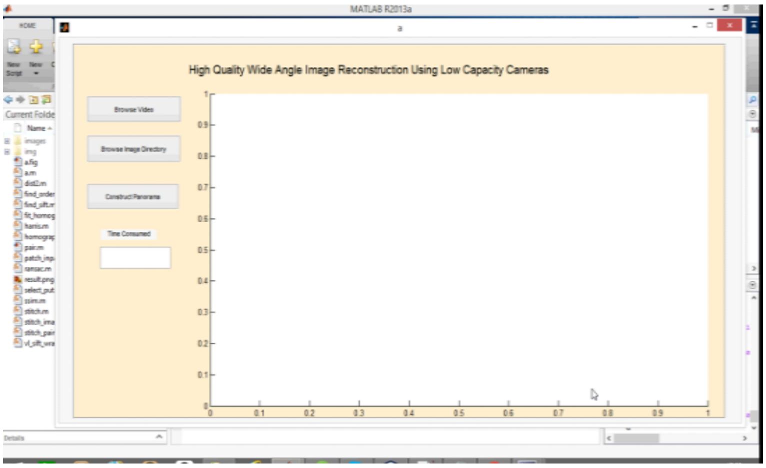
Interpretation:



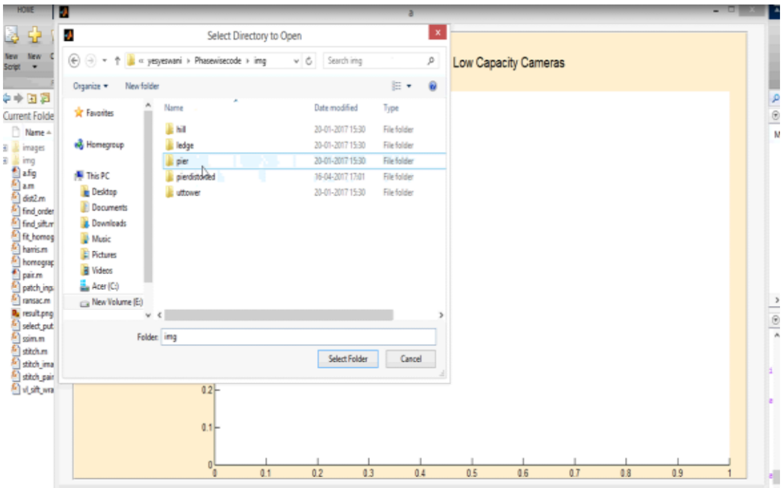
Start The Matlab And Move To The Directory Where The Project Source Code Is Kept.



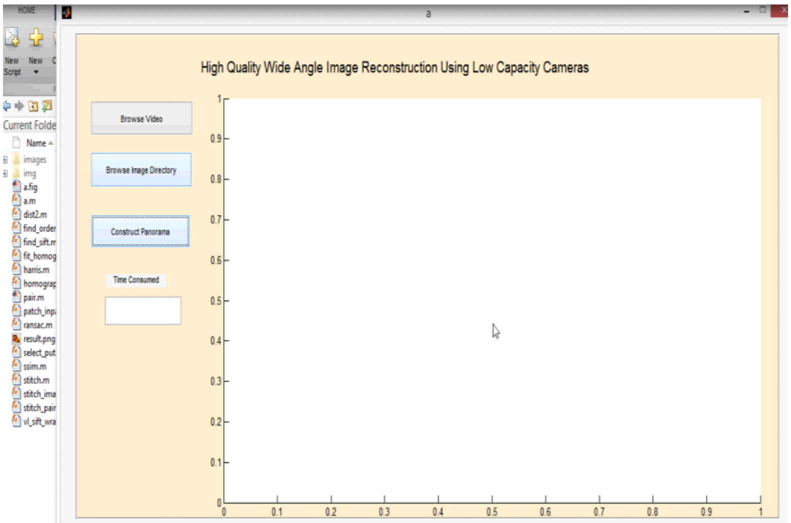
Install The Vl_Feat Toolbox , Because All The Sift Feature Extraction Utilities Are Available In This Tool And Without This Tool , The Code Will Not Work.



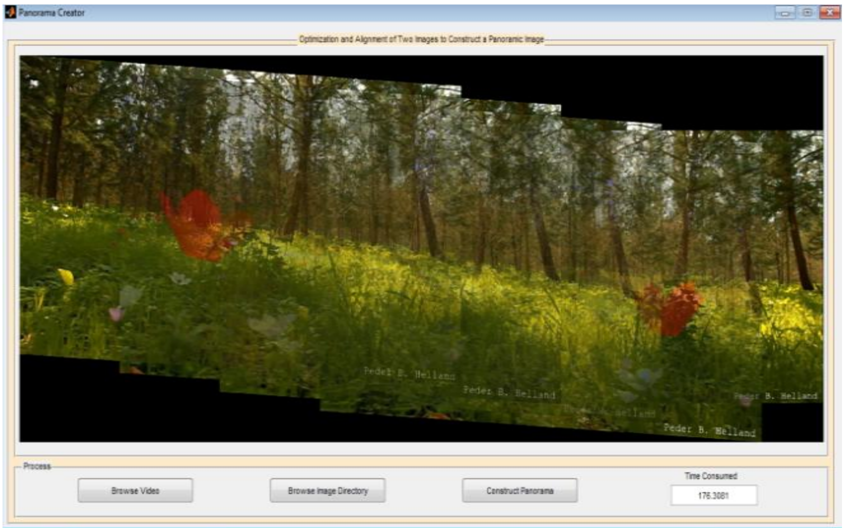
The Gui Of The Project Opens And Browse



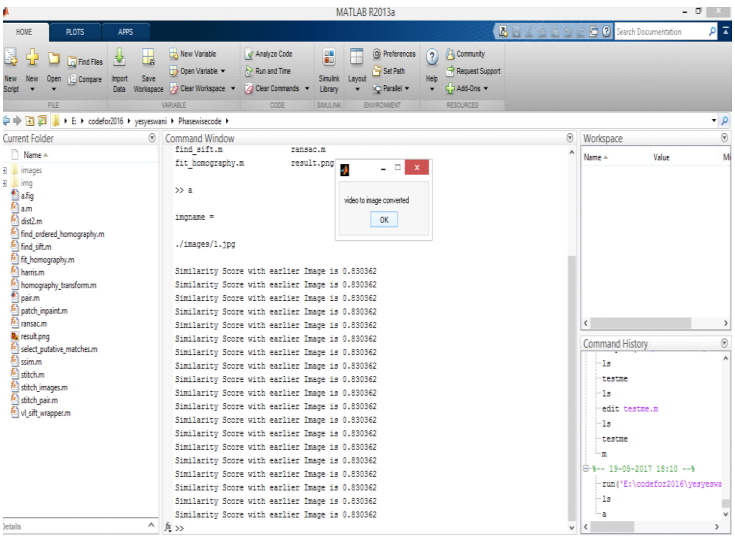
Choose The Image Directory Where The Individual Images Are Available For Panorama Construction Process.



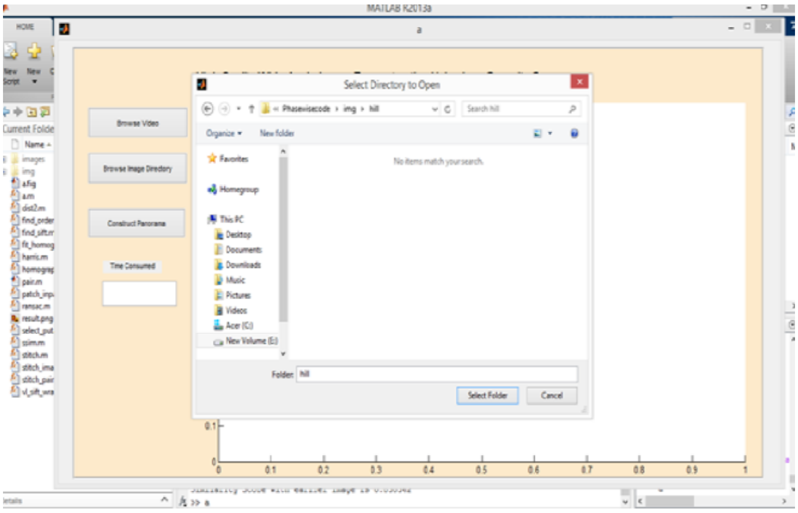
After The Image Directory Is Selected , Press Construct Panorama Button.



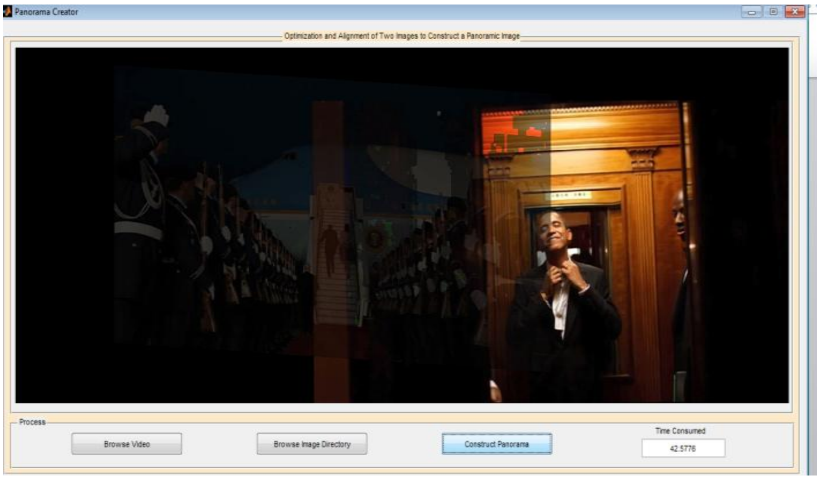
The Constructed Panorama Is Displayed And The Time Taken To Construct Panorama Is Also Displayed.



From The Video Most Significant Frames Are Extracted And Saved In Images Folder, So That Panoramacan Be Constructed For Those Image Just Like Other Images.



For Natural Scenery Panorama Is Constructed And Demonstrated By Choosing The Scenery Of Images Directory.



The Constructed Panorama For Natural Scenery Is Displayed.

IV. Conclusion

We Have Presented A New Image Stitching Approach For Wide-Baseline Images. With The flexibility Of A Mesh-Based Model, Our Method Can Accommodate Moderate Deviation From The Planar Structures. By Combining Feature Alignment, Regularization, Scale Preservation And Other Extra Constraints, A Reasonable Multi-Viewpoint Panorama Is Accomplished Without Explicit 3d Reconstruction. Our Approach Still Has Limitations. If A Straight Line Spans Across Multiple Images, Our Method Can Only Preserve The Local Straightness In Each Image. This Problem Can Be Addressed Either By Performing Line Matching Or Manually Specifying Feature Match Along The Lines If The Corresponding Matches Are Not Automatically Found. In Addition, If The Input Images Are With Significant Occlusion – One Region Appears In One Image But Is Occluded In Others – The Occluded Parts May Not Be Aligned Correctly, Such As The Highlighted Red Circle Region.This Problem Can Be Alleviated With User Interaction And Seam Cut. Our Future Work Will Be Using The Multi-Homography Model.

Acknowledgement

The Authors Would Like To Thank The Management, The Principal, And The Department Of Electronics And Communication Engineering Of Pesitm, Shivamogga For All The Support And Resources Provided.

References

[1] R. Szeliski And H.-Y. Shum, “Creating Full View Panoramic Image Mosaics And Environment Maps,” In Proc. Siggraph, 1997, Pp. 251–258.
[2] R. Szeliski, “Image Alignment And Stitching: A Tutorial,” Found. Trends Comput. Graph. Vis., Vol. 2, No. 1, Pp. 1–104, 2006.

[3] M. Brown And D. G. Lowe, "Automatic Panoramic Image Stitching Using Invariant Features," Int. J. Comput. Vis., Vol. 74, No. 1, Pp. 59–73, Aug. 2007.
[4] A. Agarwala, M. Agrawala, M. Cohen, D. Salesin, And R. Szeliski, "Photographing Long Scenes With Multi-Viewpoint Panoramas," Acm Ntrans. Graph., Vol. 25, No. 3, Pp. 853–861, 2006.
[5] J. Gao, S. J. Kim, And M. S. Brown, "Constructing Image Panoramas Using Dual-Homography Warping," In Proc. Ieee Conf. Comput. Vis. Pattern Recognit., Jun. 2011, Pp. 49–56.
[6] W.-Y. Lin, S. Liu, Y. Matsushita, T.-T. Ng, And L.-F. Cheong, "Smoothly Varying Affine Stitching," Inieee Conf. Comput. Vis. Pattern Recognit., Jun. 2011, Pp. 345–352.
[7] J. Zaragoza, T. Chin, Q. Tran, M. S. Brown, And D. Suter, "As-Projective-As-Possible Image Stitching With Moving Dlt," Ieee Trans. Pattern Anal. Mach. Intell., Vol. 36, No. 7, Pp. 1285–1298, 2014.
[8] V. Kwatra, A. Schödl, I. Essa, G. Turk, And A. Bobick, "Graphcut Textures: Image And Video Synthesis Using Graph Cuts," Acm Trans. Graph., Vol. 22, No. 3, Pp. 277–286, 2003.
[9] Aseem Agarwala, Mira Dontcheva, Maneesh Agrawala, Steven Drucker And Alex Colburn "Interactive Digital Photomontage," Acm Trans. Graph., Vol. 23, No. 3, Pp. 294–302, 2004.
[10] S. M. Seitz, B. Curless, J. Diebel, D. Scharstein, And R. Szeliski, "A Comparison And Evaluation Of Multi-View Stereo Reconstruction Algorithms," Inproc. Ieee Conf. Comput. Vis.Pattern Recognit., Jun. 2006, Pp. 519–528.

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Ms. Manjula G B "Optimization and Alignment of Multiple Images to Construct a Panoramic Images".IOSR Journal of Electronics and Communication Engineering (IOSR-JECE) 13.2 (2018): 27-35.