



3D Motion Reconstruction & Image Registration from 2 static 2-D Image Sequence

Ayushi Gupta*Computer Science & Engineering
Jayoti Vidyapeeth Women's University
Jaipur, India**Noopur Rastogi**Computer Science & Engineering
Jayoti Vidyapeeth Women's Univers
Jaipur, India**Vandana Dixit Kaushik**Computer Science & Engineering
Harcourt Butler Technological Institute
Kanpur, India

Abstract— A Matlab calculation was created to in part remake a true scene utilizing two static pictures (one is called base image another one is input image) brought of the scene with an un-aligned Polaroid. The calculation shows the fixed base pictures and input picture from image sequence and the client matches comparing focuses in both pictures. From the selected control points a tform structure is created. A tform structure with input image is passes to imtransform function to get a registered image. From the uprooting of the chose picture focuses the calculation evaluates a profundity surface for the scene. The registered picture is then "hung" over the profundity surface to make a profundity field on the picture. The reproduced scene with profundity discernment is then turned and the edges are spared to make a motion picture demonstrating the distinctive perspectives of the scene.

Keywords— 3-D Visualization, Image Registration, Camera Calibration, 3-D Surface Generation.

I. INTRODUCTION

Regularly just 2-D representations of our 3-D world exists. Case in point, satellite pictures taken of remote spots (Mount Everest) and/or barbarous situations (battle region) where it might perilous or unsafe for human's vicinity yet where it might profitable to have learning of the spatial states of nature's domain of interest. Pictures of a scene give extremely significant data, yet they essentially fail to offer the spatial data that we are usual to for exploring around nature's turf. A halfway reproduction of the scene will demonstrate helpful in giving a finer visualization of that scene for nearly examining nature's domain and subsequently give the client a feeling of "vicinity" without really always being in the scene. In the previous years, there has been fast improvement in 3-D applications, including 3-D TV and film, virtual reality, 3-D city, and 3-D item recovery. In any case, contrasted and the improvements of 3-D applications, 3-D assets are still restricted. Generally, 3-D models are either caught by 3-D Polaroids or planned by originators utilizing machine supported configuration devices. The previous requires cautious alignment and sweeps protests under strict conditions, and the recent is physically concentrated.

II. AN OVERVIEW OF THE METHOD

The whole project is divided into the following 3 steps:

1. Image Registration
2. 3-D Surface Generation
3. 3-D Visualization & Frame Generation

We have 2 static picture of every scene. Commonly, one is called base or reference picture and the other which is to be analyzed is known as information or input picture. The directions of base picture is thought to be geometrically right. The objective of picture enrolment methodology to bring info picture into the arrangement of base picture & resample them on a typical space. In the next step, points of depth is calculated where area is equivalent to the area of base picture and depth is equal to the horizontal difference between the input & base image. The registered picture is then wrap over this depth field and at long last the reproduced scene with profundity discernment is pivoted and casings are spared to make a motion picture which indicates distinctive perspectives of scene that are not shot.

A. IDEA OF IMAGE REGISTRATION

Image registration is the procedure of adjusting two or more pictures to make gimmicks adjust precisely. An image transform is used to align images & resample them on a common space. Picture Registration is a standout amongst the most paramount picture preparing provision of geometric change. Geometric conversion characterizes the mapping around the pixel area in a input picture to the new pixel area in a yield picture. Picture registration strategy is utilized to adjust two or more pictures of same scene or at the end of the day it could be said that distinctive set of information is changed into one direction framework in picture enlistment. Picture enlistment calculation could be considered: intensity based and characteristic or feature based. The rule of picture enlistment is to evacuate the bending of picture by some former of pixel data. The pixels of mutilated picture is moved to redress position by applying spatial change. The former data of pixel is gotten from base picture of same scene taken from diverse perspective. The provision of spatial

conversion on info picture $I(x,y)$ to another picture $J(x,y)$ where each pixel (x,y) is assessed from chose spatial change comparison:

$$\begin{aligned}x &= F_x(x,y) \\ y &= F_y(x,y)\end{aligned}$$

F_x & F_y are the functions which are given by the selected type of transformation. The transformation may be projective, affine, polynomial etc. Normally, one picture, called the base picture or reference image(fixed picture), is viewed as the reference to which alternate pictures, called info images(moving pictures), are compared. The objective of picture enlistment procedure is to efficiently place separate pictures in a typical casing of reference so that the data they hold might be ideally coordinated.

Terminologies:

Reference or source image: An image which is considered as a reference for other input images.

Input image: also called target, sensed or moving image.

Transformation Function: used to resample target image to the geometry of reference image.

Control points: used to determine transformation parameter.

Features: It can be points, lines or corners.

Image Registration calculation could be characterized as per after models:

1).Transformation models:

1.*Linear Transformation:* It incorporates rotation, scaling, translation & other affine transform.

2.*Elastic or non-rigid Transformation:* Capable of generally twisting the target picture to adjust to the reference picture.

2). Spatial Vs Frequency Domain Methods:

1.*Spatial Method:* It work in picture area.. Match intensity patterns or features in images.

2.*Frequency Method:* It finds the change parameter for enrollment of picture while working in transform domain.

3). Single Vs Multi modality Method:

1.*Single Modality:* Single has a tendency to enroll pictures in same modality procured by same scanner.

2.*Multi Modality:* It It has a tendency to enroll pictures gained by distinctive scanner sort.

Algorithm for Image Registration

Input : Base image & Input Image

Output : Registered or Aligned image

1. Read the base into a variable base.
2. Read the input image one by one and extract second slice from it and save into an image sequence array.
3. Select features which are identified in base & input image.
4. Save the sets of control points selected in the input image and the base image in a text file input_# & base_# respectively.
5. Pass the points along with the type of transformation we want to cp2tform function. It will return the geometric transformation structure in tform.
6. Save the transformation matrix in tform_# text file.
7. Perform spatial transformation.
8. Pass input picture with tform to imtransform function.

The accuracy of registration depends heavily on the characteristics of input image & similarity between them. In this paper we have collected 4 fish embryo data set, base image with its ground truth image. Our all the registered images are compared to ground truth image. Ground truth image is a solution that is known to be correct. Therefore, by applying spatial transformation to input image a registered image is obtained. We have computed Similarity using Euclidian distance(0.127368), Coorelation coefficient(0.646570) and Mean Squared Error(32.149621) of our registered image with the ground truth image and concludes that our registered image is similar to ground truth image and there is a strong relationship between the images.

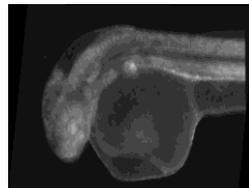
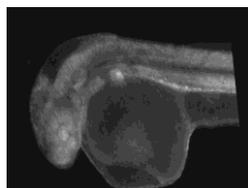
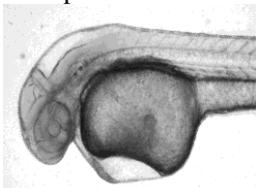


Figure-1 (a) reference image

(b) input image

(c) registered image

(d) registered image with a semi-transparent version of base image.

Table 1: Control points & Transformation Matrix of input & base image is :

Input image points		Base image points		Transformation Matrix
356.15	315.27	350.14	299.24	
422.27	225.11	432.29	199.06	1.08619 -0.0484569 0
402.23	148.97	422.27	138.95	-0.122656 0.972944 0
233.93	285.22	215.89	273.2	1.62785 7.20047 1
251.96	122.92	255.97	104.89	
107.7	132.94	99.681	124.93	
161.79	245.14	153.78	241.14	
171.81	62.812	183.83	70.827	

B. 3-D SURFACE GENERATION

When a spatial change is secured, we can move ahead to recreate the picture.

$X = f(x,y)$

$Y = g(x,y)$; where (x,y) is the direction of a pixel on unique picture and (X,Y) is the direction of a pixel on changed picture.

In advanced pictures, the discrete picture components, or pixels, are confined to lie on a testing network, taken to be the whole number cross section. The yield pixels, now characterized to lie on the yield inspecting matrix, are passed through the mapping capacity producing another framework used to resample the information. This new resampling matrix, not at all like the info inspecting lattice, does not for the most part correspond with the whole number cross section. Rather, the positions of the lattice focuses may undertake any of the nonstop values relegated by the mapping capacity. Since the discrete information is characterized just at number positions, an addition stage is acquainted with fit a constant surface through the information tests. The nonstop surface may then be tested at discretionary positions. This addition stage is known as picture reproduction. The correctness of introduction has huge effect on the nature of the yield picture. Therefore, numerous insertion capacities have been examined from the perspectives of both computational productivity and estimate quality. Famous insertion capacities incorporate cubic convolution, bilinear, and nearest neighbor. They can precisely recreate second-, first-, and zero-degree polynomials, separately. More expensive and accurate methods include Biharmonic interpolation which is used for surface only. 'v4' uses a full matrix composed of ALL of the interpoint distance.

Algorithm for 3-D Surface Generation

Input : Selected Control points of input & base image and Registered image
 Output : 3-D mask

Step 1: Initialize two zeros arrays fp1 & fp2 to the size of input image points.
 Step 2: For i=1 to no. of files in specified directory

- 2.1 Read input_#.txt file in array fp1.
- 2.2 Read base_#.txt file in array fp2.
- 2.3 Calculate points for depth where area is equivalent to the area of base picture and depth is equivalent to the level relocation between input and base picture control focuses.
 $depth = [fp2(:,2), fp2(:,1), (fp2(:,1) - fp1(:,1))];$
- 2.4 Generate a uniformly spaced grid from the base picture.
- 2.5 Interpolate the values of function at uniformly spaced points, based on the values of function at original data points.
- 2.6 Wrap our registered image over this depth field or 3-D mask.

C. 3-D VISUALIZATION & FRAME GENERATION

The perspective is the specific introduction that we select to show our diagram or graphical scene. The term review alludes to the procedure of showing a graphical scene from different bearings, zooming in or out, changing the viewpoint and angle proportion, flying by, etc. For the most part, survey is connected to 3-D charts or models, in spite of the fact that we may need to modify the perspective degree of 2-D perspectives to attain particular extents or make a diagram fit as a fiddle. MATLAB survey is made out of two essential territories: Positioning the perspective to situate the scene & Setting the angle degree and relative hub scaling to control the state of the articles being shown.. For 3-D , first we need to set Polaroid position, camera target and Polaroid perspective plot mode. Polaroid position sets the position of the Polaroid in the current tomahawks to the specified worth. Define the position as a three-component vector holding the x-, y-, and z-directions of the wanted area in the information units of the tomahawks. Polaroid Target details the area in the

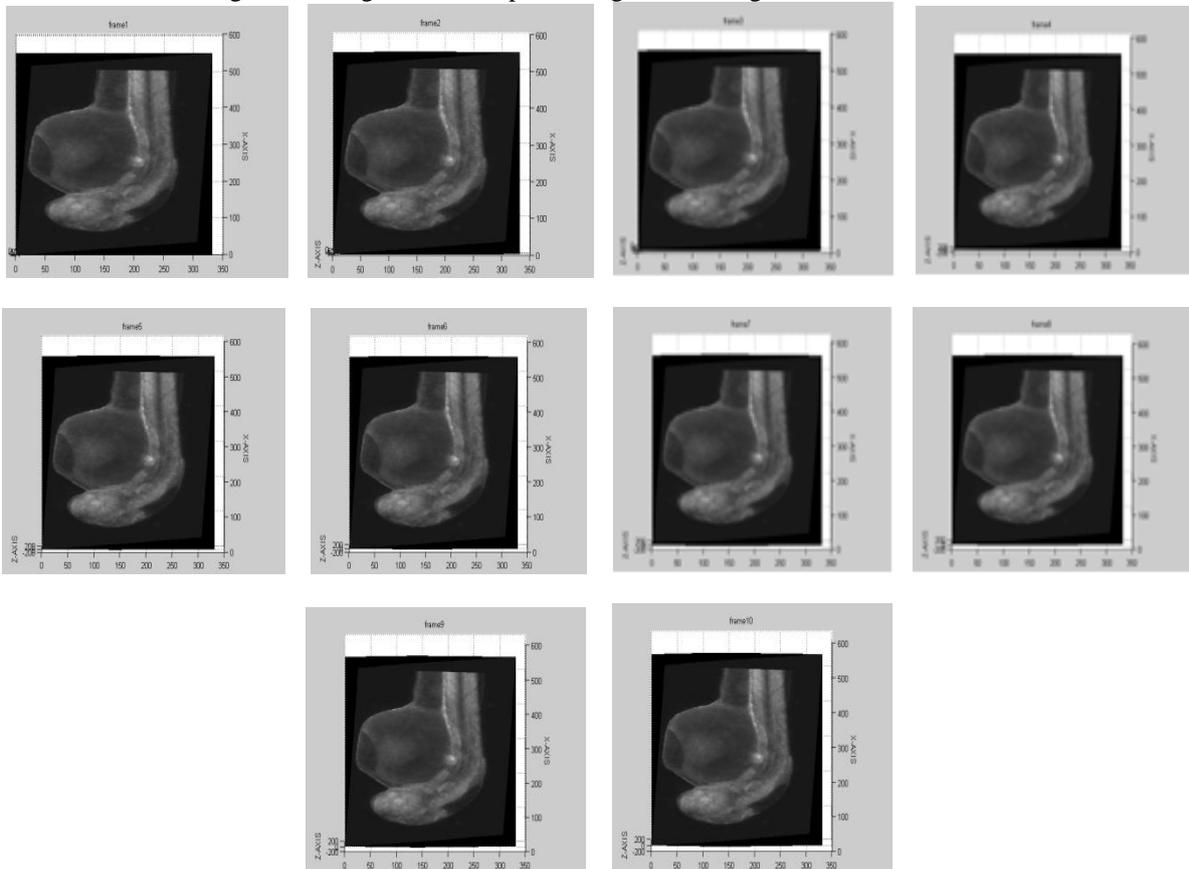
tomahawks that the Polaroid focuses to. The CameraTarget and the CameraPosition characterize the vector (the perspective hub) along which the Polaroid looks. Polaroid ViewAngleMode is situated to auto which set CameraViewAngle to the base point to catch the whole scene. CameraUpVector[x, y, z] tomahawks coordinates Camera revolution. This property determines the pivot of the Polaroid around the review hub characterized by the CameraTarget and the CameraPosition properties. Define CameraUpVector as a three-component exhibit holding the x, y, and z segments of the vector. CameraUpVector is [0 0 1] characterizes the positive z-hub as the up course. Presently evenly move the Polaroid position in front of 3-D surface and appraisal distinctive perspectives that were not shot. To catch a picture and to gather an exhibit of film casings use for loop and frame2im(f) capacity changes over the film outline F into the filed picture X and spare the edges into a specified index.

Algorithm for 3-D Visualization & Frame Generation

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Step 1: Set CameraTargetMode of current axis handle to 'manual' while the CameraViewAngleMode to 'auto'
Step 2: Initialize camera distance cam_dist=500
        % To record Movie
Step 3: For j=1 to 10
        % Set camera position
        3.1: campos([320+sin((j/2)*pi/180)*cam_dist,240, -1*cos((j/2)*pi/180)*cam_dist])
        3.2: Set CameraUpVector to [0 0 1],CameraTarget to [320 240 0],and
            CameraViewAngle to 'auto' of current axis handle.
        %Capture Movie Frame
        3.3:F(j) = getframe(gcf);
    end loop
Step 4:movie(F)
Step 5:Set the path of destination folder where the frames of movie will
        Save.
Step 6: For p=1 to 10
        6.1:frame = frame2im(F(p));
        6.2:imwrite(frame,sprintf('frame_%d.tif',p))
    end loop
    
```

Depth mask overlaid on registered image to show depth on registered image:



III. Conclusion

The 3-D scene is recreated utilizing registered image from two static pictures of every scene. For the set of pictures that are taken from free hand a feature cuts were handled which demonstrates the picture examined from right to left. The feature cuts give a feeling of profundity in the picture. The synthesis of the picture "hung" on the evaluated profundity surface of the scene and the formation of edges by gradually seeing the profundity improved picture surface gives the eye a false recognition of profundity. By moving the Polaroid along a way by our recreated the earth, we could make short films that show up as though there were taken by a feature Polaroid moving around in the nature's turf!

Throughout the reproduction of the 3d scene we experienced occurrences where twisting between reproduced casings was pervasive. This issue was created by the impediment of characteristics in one picture that were available in the second, for this situation no comparing picture focuses could be picked. Twisting was likewise watched where a characteristic was spoke to by a more diminutive number of pixels in one picture than in the other picture so that there was nobody-to-one correspondence. To incompletely assuage this issue more comparing focuses were picked around the range of the characteristic where less pixel data was accessible.

Favorable element of this calculation is that if a speedy 3d remaking is wanted very little computational is fundamental and the profundity exactness of the reproduced scene might be gigantically enhanced essentially by selecting additionally comparing picture focuses. No Polaroid adjustment is essential and no inherent or outward Polaroid parameters need to be resolved..

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