Ambiguities in Symmetric Objects at 5° calibration

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Abstract

This paper shows the ambiguities generated in Symmetric Objects by using 2D images at calibration of 5° angles. The goal of these results is to show the ambiguities in 3D graphical models of real objects mostly in Symmetric and present the work done based on Eigen values and Eigen vectors. The main contribution of the paper is that it describes a complete, end-to-end system explained in detail based upon symmetric and Asymmetric Objects. Based on a multi-images calibration, an algorithm is designed to extract the common features of the images. Furthermore, this can be extended to estimate robustly the initial Eigen values of the object to be modeled. This algorithm has a simpler visibility check. Besides, in order to construct the appearance, we use the application of images based rendering. The reconstruction results are shown on two type of objects.

Keywords— 3D object creation, Images based rendering, Eigen values and Eigen vectors

Introduction

During creation of 3D object, there are some distortions occurred in case of Symmetric object.The creation of 3D model directly from 2D images of objects. Our work is motivated by observing the workflow of traditional CAD, where design usually proceeds in many phases and two cases of objects. First load data set of an object which is in 2D in MATLAB, often from front, side except top and bottom view and then uses these images as a reference in constructing a 3D model on a computer. While most of the creative designing occurs in 2D, the process of translating those 2D images into a 3D model is tedious, and often takes some time. The 3D position for every element of the model must be specified, and when referring to images, the user must be constantly translating a desired change in a 2D view to the sequence of 3D operations that will produce that change.

Here we take two type of objects: Symmetric and Asymmetric Objects to show and clarify the our results.

The core idea is to focus on 2D object silhouettes. The user specifies a part by drawing its silhouettes in two or more orthogonal views and a 3D shape that matches those silhouettes is automatically generated and displayed. A user can focus on iterating the 2D images, allowing for fast experimentation and modelling[1].

With the help of an algorithmic standpoint, we show that using silhouettes dramatically simplifies the computation of one of the most challenging features in CAD-CAM[1] and MAYA : Eigen values and Eigen vectors. We also enable the creation of smooth shapes that approximate the least variation- of-curvature surfaces that match their input silhouettes[1] with the extraction of common features.

After loading the data set there is a task to normalize the images to calculate the mean image .Normalization is necessary to reduce the artifacts occurred due to light, after normalization calculate Eigen values if the Eigen value is zero then it can be eliminated because it will plot directly which it find that's why we can ignore it. When all the Eigen values are calculated then it will be sort in ascending order and calculate Eigen vectors which will detect the direction after that calculate the Euclidean distance. After extracting all the values reconstruct the wireframe model.

Due to shape of objects, the results are varies at same degree calibration. Our technique is based upon the extraction of common features that's why ambiguities are occurred in Symmetric Object.

Related work

In this section, we give a brief overview of the previously proposed methods for create a 3D model by using various techniques and methods with the help of Image based Rendering. During 3D reconstruction solutions, the problem can be simplified by using controlled imaging environments around the object, and background surface and lighting are selected to reduce the specularities on the acquired image. A setup consisting of a rotary table with a fixed camera is generally used in order to obtain a controlled camera motion around the object[1]

The camera has to be calibrated in such a setup to obtain the internal and external parameters defining the physical properties of the camera and the camera imaging positions with respect to the rotary table turn angles. Due to acquisition setup, the rotation axis and distance from the camera centre to this rotation axis remain the same during the turns of the table. Based on this idea a vision-based geometrical calibration algorithm have been developed for the rotary table. One of the advantages of this algorithm is that it is more robust than the single image calibration methods[1]

It can compute very easily the distance between the rotation axis of the table with respect to the camera centre which in fact facilitates the calculation of the bounding box. The initial estimation of the bounding box is not an essential step but leads to more efficient computations in the subsequent steps. Keeping the number of voxels constant, the size of the bounding box affects the resolution of the final model: smaller the box, less the quantization effects. There are many disadvantages of the silhouette-based reconstruction algorithm. In this context, they have implemented an algorithm which removes the dis advantages using photoconsistency[1]

In another approach sketch-based modelling is designed by drawing their 2D silhouettes from different views .Complex models can be constructed by assembling them out of parts defined by their silhouettes, which can be combined using CSG operations. Algorithm is used to compute CSG solids that have special properties of silhouette cylinders to convert the 3D CSG problem into one that can be handled entirely with 2D operations, making implementation simpler and more robust. In this designer first sketches an object in 2D, often from front, side, and top views, and then uses these sketches as a reference in constructing a 3D model on a computer. It takes the most time[2]

The user specifies a part by drawing its silhouettes in two or more orthographic views, and a 3D shape that matches those silhouettes is automatically generated and displayed. silhouettes dramatically simplifies the computation of one of the most challenging features in CAD-CAM: Boolean operations, Constructive Solid Geometry (CSG). Basically target is for modeling of man-made objects, as they typically can be decomposed into axis-aligned subparts. Organic models are not well suited to this approach[2]

In another approach, user consider 3D-shape descriptors generated by using functions on a sphere. The descriptors are engaged for retrieving polygonal mesh models. Model can be Created either by using the Principle Component Analysis (PCA) or defining features in which the invariance exists. firstly, they define a new rotation invariant feature vector based on functions on concentric spheres. secondly, we compare the two approaches for achieving rotation invariance as well as options to use a single function or several functions on concentric spheres to generate feature vectors[3]
This algorithms consist of three steps : normalization, feature extraction, and similarity search. During the normalization, a 3D-object is translated, rotated, scaled, and flipped into a canonical position and orientation[3]

PROPOSED ALGORITHM

In our approach, a 3D model is created out of parts. Each part is specified by two silhouettes from front, side views. As the user creates and refines the silhouettes of a part, the corresponding 3D model is automatically generated and displayed.

our interface makes associations between parts and silhouettes explicit by only allowing the MATLAB to match silhouettes for the currently selected part. One image is match with another image, extract the common features from both of the images [1].

After extracting the common features calculate the mean image, and from the mean image the need to calculate the Eigen values and the Eigen vectors which gives us the directions and then sort all Eigen values in the ascending order then we need to calculate Euclidean distance to create a 3D model.
In this method, we use real objects that having same degree angles : 5° difference around 360°.To construct a 3D model we have many steps of algorithm:

Step 1: At the very first level load data set in MATLAB®.

Step 2: Taking first two images and get normalized that images.
Show the deviation with the assumed mean and comparative image of mean,find out standard deviation and then normalize the image.

Step 3: consider first two images and calculate the mean image from them.
Find out the mean with the help of extracting image pixel by pixel then find out column wise mean, after getting mean image, reshape that mean image in the form of (m*n)

Step 4: After getting the mean image let to assume the standard and deviation values which are used to calculate the Eigen values.

Step 5: Sorting the Eigen values in ascending order so that it will plot easily .Eliminate those values whose Eigen value is zero, it will plot directly which it find, it can be ignored it.

Step 6: After sorting Eigen values next task is to calculate Eigen vectors which detect the direction.

Step 7: Calculate weight and Euclidean distance. Which is nearest to mean image that is the weight which is also called as Euclidean distance. Euclidean distance is find out to create an 3D object.

Step 8: Reconstruct the wireframe model using Eigen vectors.

Results

To clarify the concept of 3D generation at 5° calibration,we have taken two types of images to show the resut.it will not same for all the objects.

Case 1: Asymmetric Objects

Fig 1

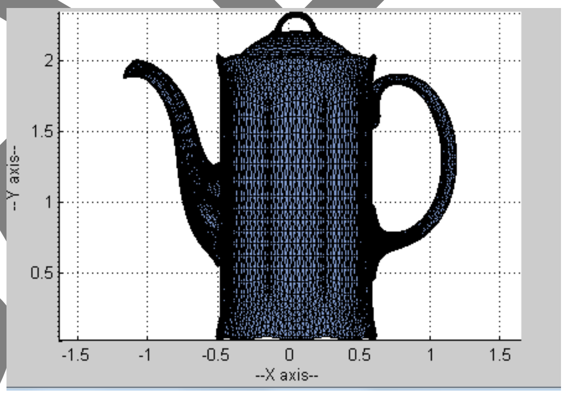


Fig 1.1

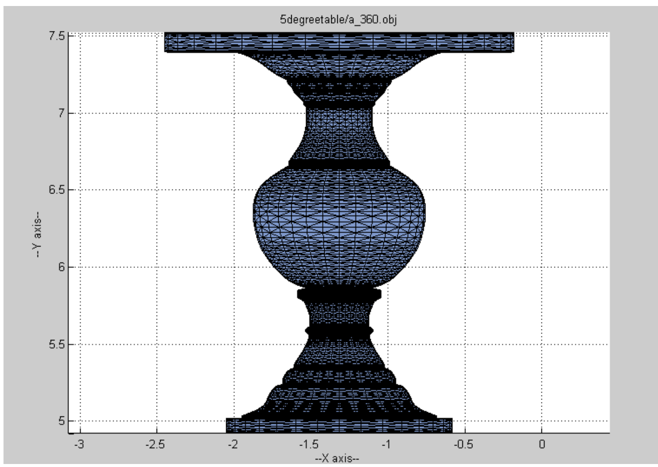
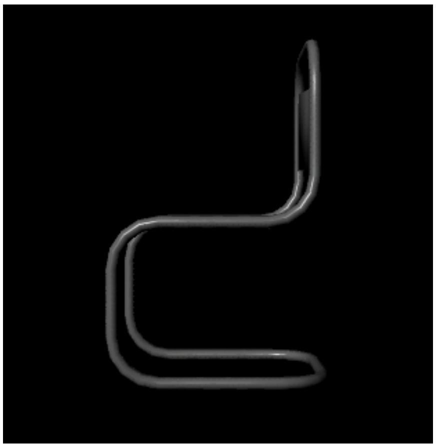


Fig 2

Fig 2.1



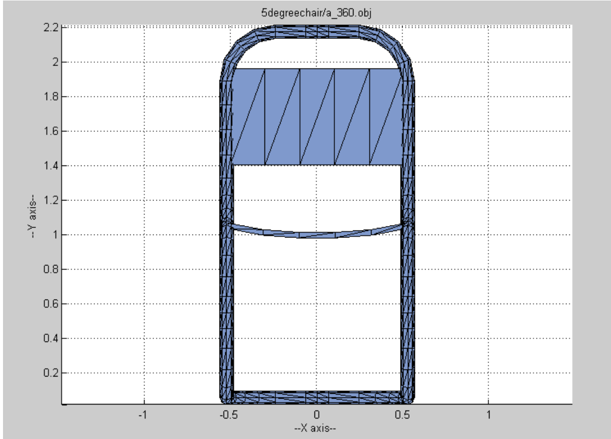
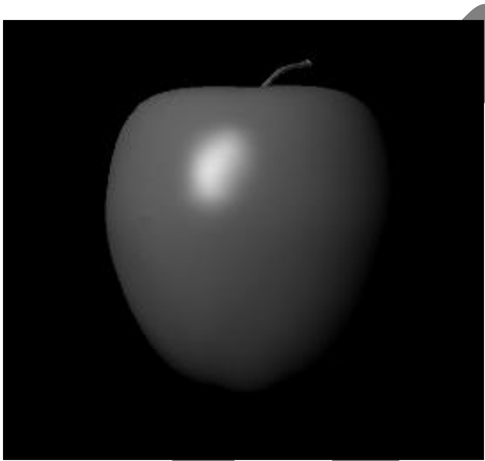


Fig 3

Fig 3.1

Case 2: Symmetric Objects



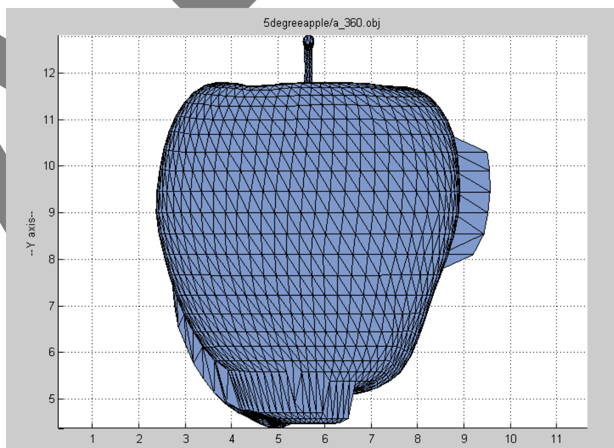


Fig 4

Fig 4.1

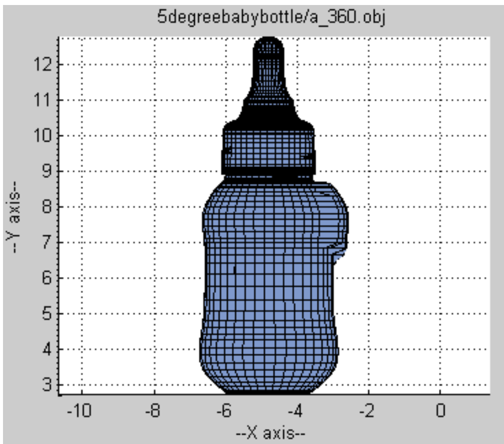
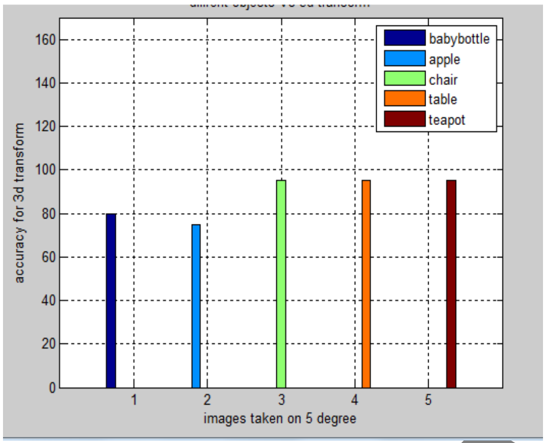


Fig 5

Fig 5.1

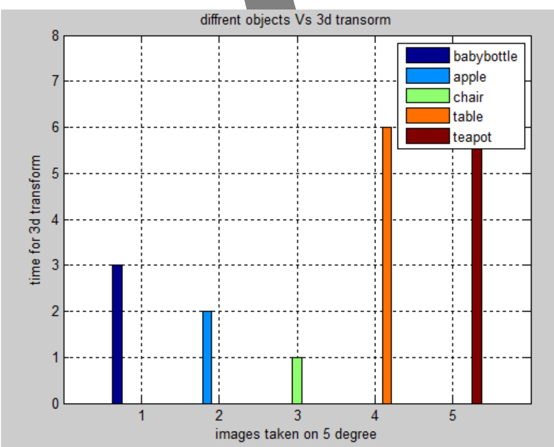
These results are used to differentiate the both of the objects.

Accuracy graph:



We have tried five real object having 5° angle images to convert 3D model and take different results for transform .Table, Chair and Teaport images have good results as compared to other images.

Time graph:



Time taken for Asymmetric objects are more due to complex shapes as compared to Symmetric objects due to simpler objects.

Conclusion:

Here, we have two type of objects Symmetric and Asymmetric objects. The distortions are occurred in Symmetric objects but Asymmetric objects results are extremely fine .Distortions are occurred due to their simpler shapes ,when it rotats from 0° to 360°, it will give the same view at every angela,no variation is occurred that’s why where the feature matches,it will plot that edge.

But in case of Asymmetric objects,shapes are complex and combinations of sub hulls that's why it will plot separately that sub hulls,the results are extremely good.

Future work:

According to conclusion, In case of Symmetric objects, we can try the less degree calibration images to improve the results.

References

[1] Alec Rivers et al," 3D Modeling with Silhouettes" SIGGRAPH 2010

[2] Adem Yasar Mulayim et al," Silhouette- based 3D Model Reconstruction from Multiple Images " IEEE 2003

[3] Andrew E. Johnson et al," Using Spin-Images for Efficient Object Recognition in Cluttered 3-D Scenes" IEEE 1998.

[4] Stefanos Zafeiriou et al," Blind Robust Watermarking Schemes for Copyright Protection of 3D Mesh Objects" IEEE 2005.

[5] Dejan V. Vrani ," An Improvement of Rotation Invariant 3D-Shape Descriptor based on Functions on Concentric Spheres" IEEE 2003

[6] Lior Shapira et al ," Consistent mesh partitioning and skeletonisation using the shape diameter function" IEEE 2008

[7] A.A.Johnson et al ," Advanced mesh generation and update methods for 3D flow simulations" IEEE 1998.

[8] J.C.Carr et al," Reconstruction and Representation of 3D Objects with Radial Basis Functions" ACM SIGGRAPH 2001

[9] Matthew A.Turk et al," Face Recognition using Eigenfaces" IEEE 1998

[10] Alex Pentland et al," View based and modular Eigenspaces for face recognition " IEEE 1994

[11] Takeo Igarashi et al," Teddy : A sketching interface for 3D Freeform Design " ACM SIGGRAPH 1999

[12] Yi Huo et al," Motion Vector based Image Rendering Algorithm" CISP 2010