ABSTRACT
3D modeling of a real scene stands for constructing a virtual representation of the scene, generally simplified that can be used or modified at our will. Constructing such a 3D model by hand is a laborious and time consuming task, and automating the whole process has attracted growing interest in the computer vision field. In particular, the task of registering (i.e. aligning) different parts of the scene (called range images) acquired from different viewpoints is of crucial importance when constructing 3D models.

We propose a system for image registration using photometry and albedo.

Keywords- Range Images, Image Registration, Albedo, ICP, SURF, BRDF.

1. INTRODUCTION
Image registration is the process of shaping the point-by-point association between two images of a view. By registering two images, the combination of multimodality information becomes possible, the depth map of the view can be determined, changes in the view can be detected, and objects can be recognized. Basic terminologies [1] related to image registration are reference image, sensed image, and transformation function that maps the sensed image to the reference image. It is determined using the coordinates of a number of corresponding points in the images.

2D Image registration is the process of overlay two or more images of the same scene taken at different times, from different viewpoints, and/or by different sensors [2]. It geometrically aligns two images—the reference and sensed images.

Image registration is a critical step in all image analysis tasks in which the final information is gained from the combination of various data sources like in image fusion, change detection, and multichannel image restoration.

This registration is required in remote sensing, weather forecasting, developing super-resolution images, integrating information into geographic information systems (GIS), in medical science (combine computer tomography (CT) and NMR data to obtain more complete information about the patient, monitor tumor growth, treatment confirmation...
comparison of the patient’s data with anatomical atlases). At present image registration is a newly research topic of digital image processing and machine vision on which researchers do their work.

An example [1] of 2-D image registration is shown in Fig. 1.1. Figure 1.1a (source image) shows a Landsat multispectral scanner (MSS) image and Fig. 1.1b (sensed image) shows a Landsat thematic mapper (TM) image of the same area. By resampling the sensed image to the geometry of the reference image, the image shown in Fig. 1.1c is obtained. Figure 1.1d shows overlaying of the resample sensed image and the reference image.

Range images for image registration are divided into four main groups according to the manner of the image acquisition [2]. Various viewpoints, Images of the same view are acquired from different viewpoints. Different times, Images of the same scene are acquired at different times. Different sensors, Images of the same scene are acquired by different sensors. Scene to model registration, Images of a scene and a model of the scene are registered. The model can be a computer representation of the scene, for instance maps or digital elevation models (DEM) in GIS, another scene with similar content (another patient), ‘average’ specimen, etc.

Among all of our whole senses, vision plays the most important role in our daily life. Our visual perception helps us understanding, interacting and moving into our environment. The objective of 3D vision [3] is to simulate the human visual perception. 3D models give a geometric understanding of the scene. [4] [5] The 3D modeling procedure of factual objects has attracted growing interest during the past decade for applications in augmented reality, cinema, computer games or medicine. Because creating the detailed 3D model of a real object using some modeling software very time taking.[6] This process can be divided in five steps: [5] (1) data acquisition, (2) reconstruction of 3D images, (3) 3D registration, (4) merging and (5) inverse rendering.

Now we convert 2D images into 3D images, this process is divided into two main steps: (1) 3D reconstruction. (2) 3D modeling.

Many studies have been proposed that allow accurate 3D registration of range images.
range images) acquired from different viewpoints is of crucial importance when constructing 3D models.

2. RELATED WORK

In general we use the following techniques for image registration: [7] [8] [9] [10] Image Registration using geometric features, align overlap range images using geometry is the most popular approach for 3D registration and has been widely studied over the past decades. When we use geometry to guide the registration process, feature descriptors of images are used to identify key-point correspondences, it allow evaluation of the transformation.

Image Registration using textural information, by using the textural information, we denote the information derived from the appearance of the object’s textured surface. This can be the color reflected by the object surface towards the scanning viewpoint, the chromaticity or the intensity. For example, the popular SIFT method uses differences of Gaussians in the intensity image to identify key-points and define scale-invariant descriptor.

Registration using photometric features, the recent advances and breakthroughs in understanding and modeling image formation ([11 12, 13]) bring new possibilities for 3D registration using photometry. Photometry gives the relationship between geometry, reflectance properties and incident illumination. Registering using photometry is still an unsolved problem. Therefore, it necessary to propose another method.

3. PROPOSED METHOD

In my project I have done the photometry registration using ALBEDO. The albedo is a famous reflectance attribute that depends only on the object material (for the diffuse reflection, the albedo of a point represents how much light is reflected by it when illuminated by a point light source facing its normal). It is a photometric feature useful for matching and comparing similarity of points at the surface of an object. Albedo [14] derived from Latin albedo "whiteness" (or reflected sunlight) in turn from albus "white," is the diffuse reflectivity or reflecting power of a surface. It is the ratio of reflected radiation from the surface to incident radiation upon it.

It has been shown that for many applications involving terrestrial albedo, the albedo at a particular solar zenith angle \( \theta_i \) can reasonably be approximated by the proportionate sum of two terms: the directional-hemispherical reflectance at that solar zenith angle, \( \tilde{\alpha}(\theta_i) \), and the bi-hemispherical reflectance, \( \tilde{\alpha} \) the proportion concerned being defined as the proportion of diffuse illumination \( \tilde{D} \).

Albedo \( \alpha \) can then be given as:

\[
\alpha = (1 - \tilde{D})\tilde{\alpha}(\theta_i) + D\tilde{\alpha} \quad \text{(i)}
\]

The correlation between geometric albedo, absolute magnitude and diameter is:

\[
A = \left( \frac{1329 \times 10^{-H/5}}{D} \right)^2 \quad \text{(ii)}
\]

where \( A \) is the astronomical albedo, \( D \) is the diameter in kilometers, and \( H \) is the absolute magnitude. Fig.2 shows the process of photometry for the objects.
Proposed Model

My proposed model is following:

1. Range image 1
2. Range image 2

Pre-processing

Feature extraction using albedo

Compute the speed map

Growing adaptive region

Computing the similar score

Define the list of matches

Eliminating incorrect matches

Estimating transformation

4. Experiment & Results

We evaluated our method using synthetic and real data and compared it with ICPA and ICP using both chromaticity and geometric features (which we call ICP-CG). This comparative study is thus useful for determining the effectiveness of different methods of registering overlapping range images of Lambertian surfaces devoid of salient geometric features.

We have two range images of hands then we do the preprocessing by using smoothing filtering. Now we extract the feature of these two images by using albedo. Now we take the speed map between images, now we grow our image region. Now we find the similar score between images for finding the total list of matches in images after this step we eliminate the incorrect matches from our images. At last by using transformation function we find out actual image registration using albedo for hand images.
According to references [17, 7, 19] the result of albedo of Lambert objects are given below in table no.1, 2, 3.

### Table 1

<table>
<thead>
<tr>
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<th>ICPA</th>
<th>ICP-CG</th>
<th>SURF</th>
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<td>1.14</td>
<td>1.20</td>
<td>16.02</td>
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<tr>
<td>Time</td>
<td>9.8mn</td>
<td>9.7mn</td>
<td>0.0mn</td>
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<td>6.56</td>
<td>2.96</td>
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<tr>
<td>Time</td>
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<td>41.1mn</td>
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### Table 3

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<td>4.03</td>
<td>23.25</td>
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<tr>
<td>Time</td>
<td>7.7mn</td>
<td>7.4mn</td>
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Proposed method is compare with existing approaches. The result of proposed method represent in table no.4 which shows that proposed method is better than existing approaches in the case of hand. Author confident that same conclusions will be finding with box & candy.

### Table 4

<table>
<thead>
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<th>SURF</th>
<th>Proposed method</th>
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5. CONCLUSION

Paper addressed the use of photometry for accurately registering pairs of range images. Authors proposed a methods using albedo for Lambertian objects under simple illumination. Proposed research made significant advances in using photometry for registering pairs of overlapping range images. Finally, proposed research achieved a better result compare than ICPA, ICP-CG and SURF in case of hands.

6. FUTURE WORK

In future registration using photometry play an important role. Real time execution will be mandatory for registration techniques. It is possible to retrieve both the different illuminations and albedo. Authors define a strong and stable photometric metric, suitable for optimization. We develop the real-time 3D sensor, registering multiple range images simultaneously becomes of great interest.

7. REFERENCES

[1] 2D and 3D Image Registration by A.Ardeshir Goshtasby.


