A GRAPHICS PACKAGE FOR SIMULATING THE DATA OF RANGE FINDERS

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Abstract: A graphics package for generating the range data of 3-D objects is described. The simulating data generated by this package can be used for 3-D object recognition or related research. It is a useful tool for someone who wants to work on range data of 3-D objects, but does not have a good range finder.

Key Words: 3-D range data, Geometrical modeling, Range finder type scanner, Simulating data.

I. Introduction

In our recent study, we needed a very large amount of range data to represent the images of objects from all possible viewing positions. A laser range finder type scanner [1] was used to obtain some of the needed data. However, there were two problems: firstly, the amount of data needed was too large and it was too difficult to set up an object at an angle that is accurate enough for our purpose with the equipment available to us; secondly, the noise and the possible errors of the scanner blurred the real picture of the behavior of the images. At this stage, it was difficult for us to determine whether certain behavior is a real character of the images or if it is caused by the noise or the error of the scanners. Thus, we have decided to use a graphics modeling package to generate simulating data for the preliminary investigation.

There are many geometrical modeling packages available, such as UNIBLOCK , ROMULUS, PROREN and COMPAC [2]. However, most of these are too general or too complicated for our purpose on most aspects, but are not accurate enough on some particular requirements. We have decided to write a package especially for our own purpose. Such a package will be quite simple and will have only the exact features that are needed. In the future, if so desired, this package can easily be included in the overall system to facilitate the recognition processing. It certainly will be a useful tool for someone who wants to work on range data of 3-D objects, but does not have a good range finder.

In the following sections, we will describe the features of this package and the principles on which it is based. This package has been used to generate 3-D range data for our study on the choice of features for characterizing the images of an object from all possible viewing positions, and the possibility of establishing a feasible recognition system based on this approach.

II. The Basic Assumptions

The range finder we are using is a laser range finder type scanner, described in ref. 1, which provides a two-dimensional image of Z(x,y) from a zero reference plane (x,y) orthogonal to the line of sight from the scanner. The graphics package will act in a manner similar to this scanner. We are assuming that:

1. The readings of X, Y and Z will be given in millimetres according to a fixed coordinate system.

2. A reading of Z will be taken at every 0.5 mm interval along both X and Y axes.

3. When transformations of rotations are applied to an object, the object always rotates along the X axis first and then rotates along the Y axis, unless specified otherwise.

4. In each viewing position, the object will be generated with the lowest point (may or may not be visible) just touching the reference plane and the image of the range data thus obtained is considered as the standard of this particular viewing position. Of